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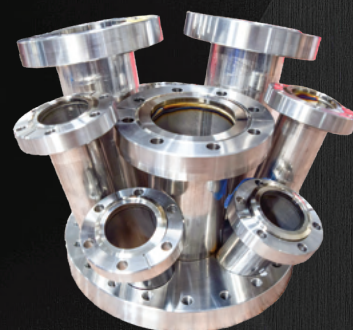
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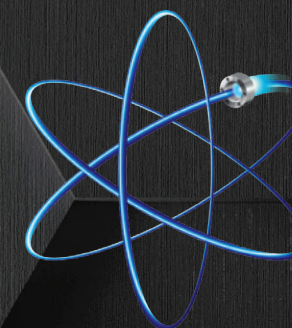


MDC PRECISION

ENABLING SCIENCE TO CHANGE THE WORLD

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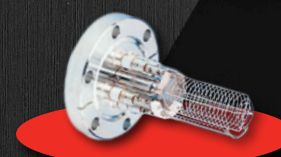
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COMPONENTS



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CHAMBERS



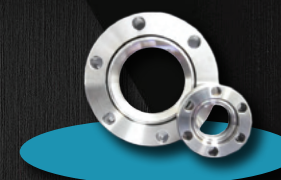
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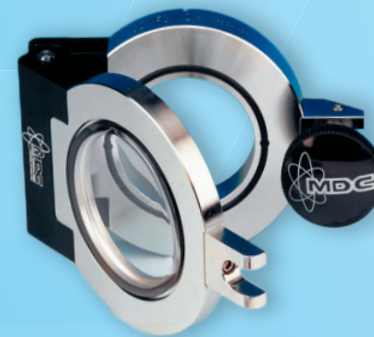
Vacuum, Ceramic-to-Metal Seal, and Gas Delivery Solutions

Since 1975, MDC has been a world leader in delivering the performance, precision and purity to meet the most stringent technology and manufacturing requirements of customers in the research, semiconductor, aerospace, life sciences, industrial, food processing and energy sectors. MDC Precision's state-of-the-art factories are located in Hayward, California, Sarasota, Florida, Milton Keynes, United Kingdom, and Pflugerville, Texas. We are also expanding our operations in Asia with a new factory in Viet Nam to support our global customer base.

MDC's comprehensive product portfolio includes:

- Vacuum components: flanges, fittings, valves, roughing hardware, vacuum measurement, motion and manipulation instruments, system safety components, vacuum pumps and vacuum chambers, including special magnetically shielded Mu-metal vacuum chambers and custom ultra-high vacuum / UHV chambers
- High purity, Ultra-high purity (UHP) and hygienic materials fabrication
- Electrical and optical ceramic-to-metal sealing products for harsh environmental connector applications, including: coaxial / electrical / liquid / multipin / RF power / thermocouple feedthroughs, vacuum breaks and viewports
- End-to-end custom engineering design and contract manufacturing services

MDC provides high quality, genuine parts that are critical in enabling our customers to innovate the science and technologies that change the world.

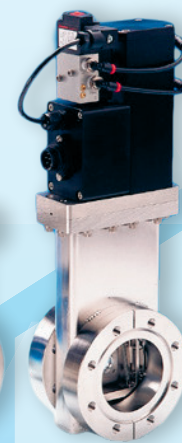


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Flanges & Fittings



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Del-Seal™ CF metal seal flanges

Features

- Del-Seal™ CF metal seal flange
- Conflat® compatible
- Genderless mating
- Rotatable and non-rotatable
- Tapped or clearance bolt holes
- Wire Seal flanges used for tubes larger than 14 inches diameter
- Double Sided flanges
- Reducing flanges
- Hybrid Adapters interconnect dissimilar flange systems

MDC established its standing in the vacuum components world after becoming one of the first licensed manufacturers of Varian's patented Conflat® metal-seal flange, known today to most MDC customers as the Del-Seal™ CF metal-seal flange.

Del-Seal™ CF Metal Seal Flanges

The reliable sealing performance of MDC's Del-Seal™ CF flanges is a result of a unique seal design and geometry which "captures" a metal gasket material. When a flat OFE copper gasket is pressed between the conical sealing edges of two Del-Seal™ CF flanges, a lateral cold flow of the gasket material occurs. This cold flow is limited by a vertical flange wall or capture groove that is concentric to the sealing knife edge. Further material flow away from the seal area is severely limited and high interface pressures are developed. These pressures cause gasket material to fill minor surface imperfections and produce a highly reliable seal. At high temperatures, the "capturing" geometry maintains high pressures despite softening of the gaskets. Del-Seal™ CF flanges can be baked to 450°C and cooled to -200°C and are suitable for vacuum service levels of 1×10^{-13} Torr. They are ideally suited for the rigorous demands of ultrahigh vacuum environments and capable of maintaining seal integrity through high temperature excursions. Del-Seal™ CF flanges are 100% compatible with the equivalent Varian Conflat® metal seal flanges.

Del-Seal™ CF flanges are classified as genderless flanges, since the seal geometries on both mating flanges are identical. They are available in both rotatable and nonrotatable geometries with clearance or threaded bolt holes, and for standard tube sizes from .250 to 14.0 inches in diameter.

MDC discourages resealing a Del-Seal™ CF flange with a previously used metal gasket and strongly recommends the installation of a new metal gasket every time a flange is fastened. When flange fasteners are tightened to their specified sealing torques a gap will remain between the mating flanges, this is normal and desirable. Tightening the flanges metal-to-metal is not necessary to achieve a UHV hermetic seal.

OFE copper, which stands for "Oxygen Free Electronic or Electrolytic grade Copper", is the metal gasket material of choice for most UHV sealing applications. For special applications which preclude the use of pure copper, various metal gasket materials including nickel, aluminum and silver plated copper are also available.

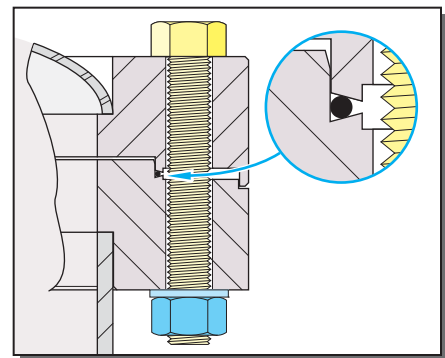
MDC can also provide specialized elastomer gaskets made of fluorocarbon-based fluoroelastomer (FKM / FPM) material. These can be used within existing UHV systems fitted with MDC Del-Seal™ CF flanges and allow frequent and repeated assembly and disassembly. These elastomer gaskets have rectangular cross sections and fit within the standard knife edge seal geometry of a Del-Seal™ CF metal seal flange. Note that the use of elastomer gasket seals in metal seal flanges will reduce the system's minimum and maximum temperatures and its vacuum ratings to -20°C, 150°C and 1×10^{-8} Torr, respectively. The torque required to make a leak tight seal with an elastomer gasket will be reduced to 7-10 lb-ft.

Wire Seal Flanges

MDC Wire Seal Flanges provide a convenient method of metal-sealing large diameter vacuum chambers. These metal seal flanges pick up where the Del-Seal™ CF flanges leave off. They are available for tube sizes



Male and female wire seal flange set



Wire seal flange geometry

from 10 to 24 inch diameter, and only in a nonrotatable geometry. Because of their size, blank wire seal flanges are of significant weight. For applications restricted by weight limitations MDC offers blank wire-seal flanges with a dished-head construction which greatly reduces the flange's overall weight.

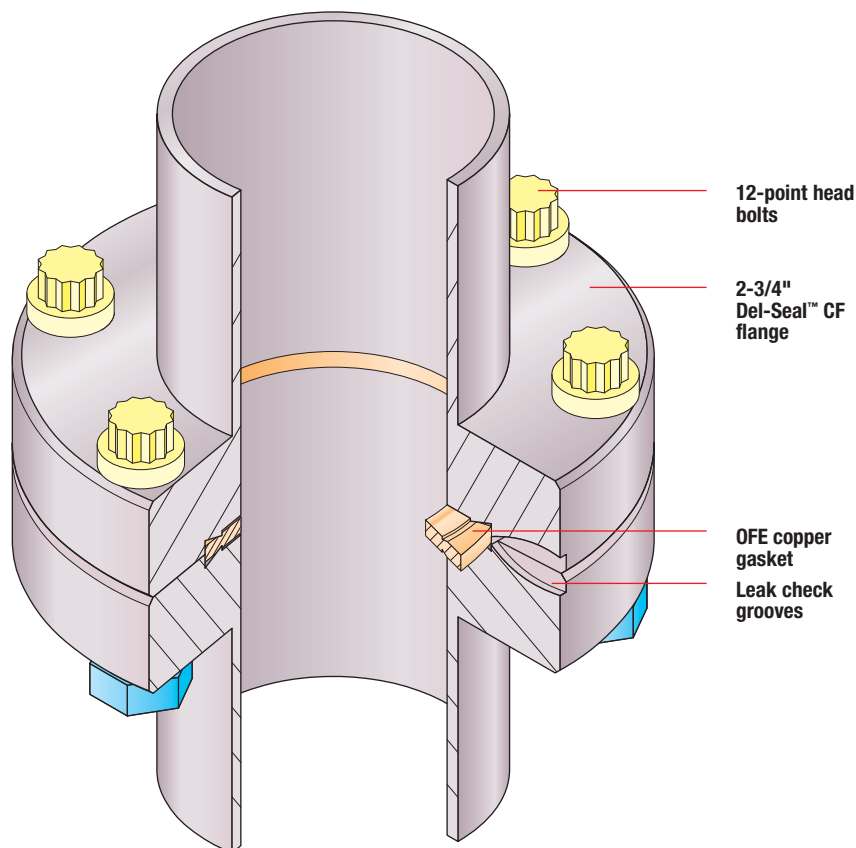
An .080 inch cross-section diameter OFE copper wire gasket is compressed between male and female mating flanges. The beveled geometry of the sealing surfaces confine the flow of the crushed gasket material, causing it to fill minor imperfections in the seal area. See the wire seal flange cross-section diagram at the bottom of the previous page. Applications for the use of wire-seal flanges include bell jars, vacuum furnaces and a variety of other ultrahigh vacuum enclosures. As with Del-Seal™ CF flanges, these too can be used with elastomer gaskets for high vacuum applications.

Del-Seal™ CF Fittings

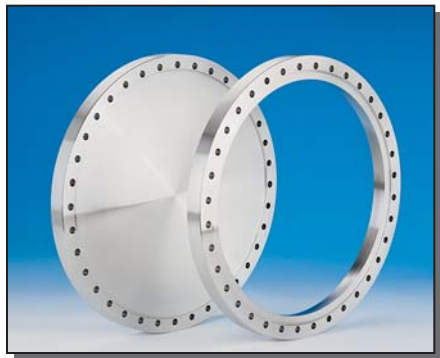
MDC Del-Seal™ CF fittings such as nipples, half nipples, reducer nipples, flexible nipples, elbows with 45° and 90° configurations, tees, reducer tees, crosses with four-, five- and six-way configurations, six-way cubes and multiport flange assemblies comprise the industry's largest selection of Del-Seal™ CF fitted vacuum components. If we do not have the product you seek, custom versions of most of these components can be quoted upon request.

All dimensions in this catalog are given in inches unless specified otherwise.

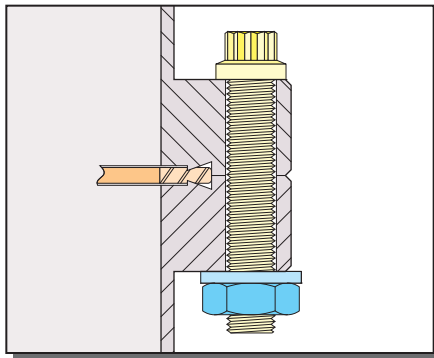
Del-Seal™ CF Metal Seal Flange
Mated Cross Section



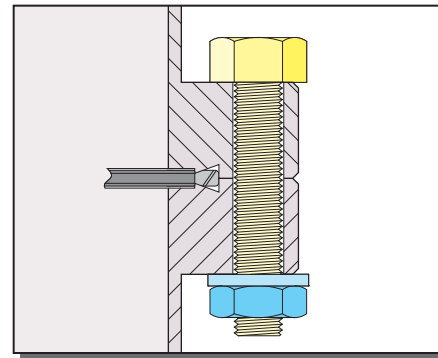
Intermediate hardware may be required for joining components.
These have been omitted for clarity.



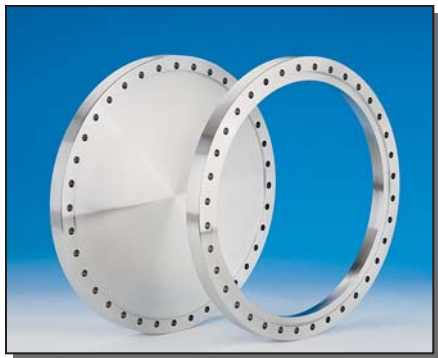
Del-Seal™ CF metal seal flange pair



Del-Seal™ CF metal gasket geometry
12 point head bolt set shown



Del-Seal™ CF elastomer gasket geometry
Hex head bolt set shown



Del-Seal™ CF metal seal flange

- Flange installation
- Nonrotatable & rotatable flanges

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper or FKM / FPM fluoroelastomer
Bolts	300ss and silver plated
Alternate material 18-8 SS bolts are	

Fastening

Bolt head type	Hexagonal, socket or 12-point head	
Nut Type	Hexagonal or two hole plate nuts	
Bolt Size	Fractional Size	Torque
.160-32 UNC	8-32	7 lb-ft
.250-28 UNF	1/4-28	12 lb-ft
.312-24 UNF	5/16-24	15 lb-ft
.375-24 UNF	3/8-24	26 lb-ft
.500-20 UNF	1/2-20	33 lb-ft
.625-18 UNF	5/8-18	33 lb-ft
Elastomer seal, all sizes		7-10 lb-ft

Vacuum Range

Del-Seal™ CF or Wire Seal	1x10 ⁻¹³ Torr
Elastomer seal	1x10 ⁻⁸ Torr

Temperature Range

Del-Seal™ CF or Wire Seal	-200°C to 450°C
Elastomer seal	Sustained: -20°C to 150°C
	Intermittent: 200°C

Standard specifications are for OFE copper metal seals; optional elastomer sealing specifications are stated for gaskets made of fluorocarbon-based fluoroelastomer (FKM / FPM)

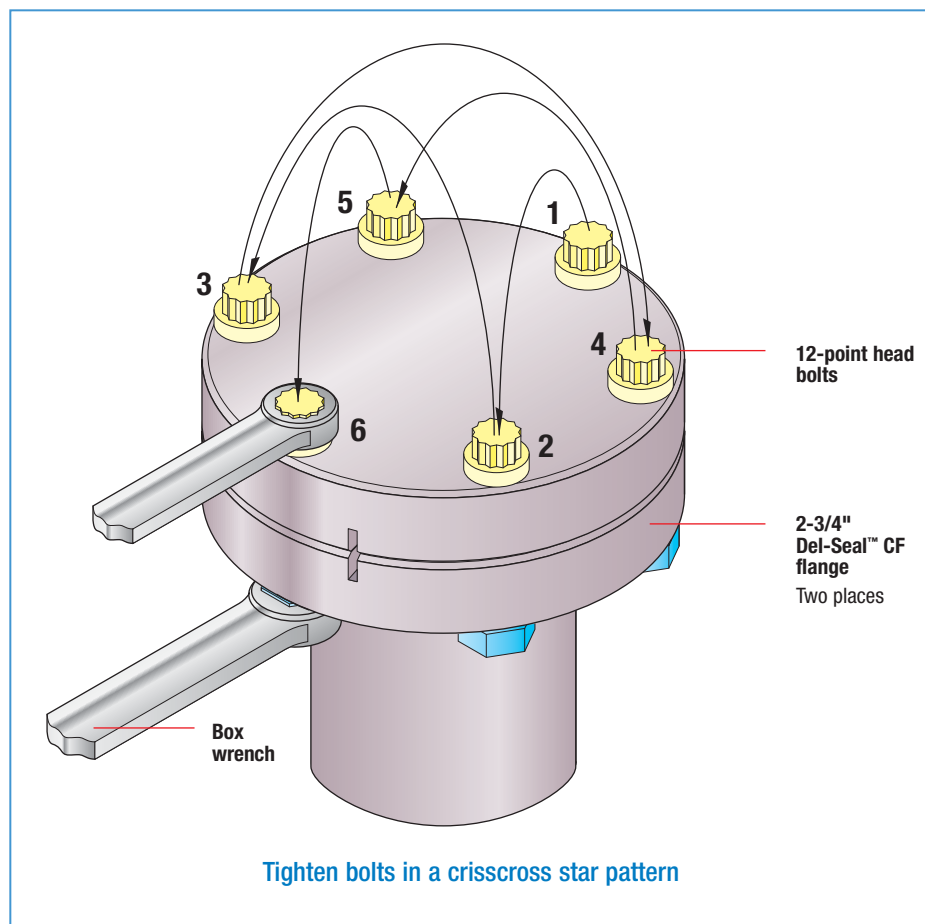
Flange Installation

Using clean lint free gloves, place an MDC pre-cleaned OFE copper gasket against the knife edge seal of one of two standard Del-Seal™ CF flanges, preferably the flange most likely to hold and support the gasket from falling. With the gasket in place arrange mating flange with the desired bolt hole orientation. If flanges are fitted with leak test grooves, these should be aligned. With flanges aligned, insert proper size bolt and hand tighten. Washers are typically used on the nut side of the fastener assembly. Repeat this procedure with the remaining bolts. Silver plated bolts or anti-seize thread lubricants are recommended for the fastening of all stainless steel hardware. This is especially true with tapped hole or blind-tapped hole mating Del-Seal™ CF flanges which will see high temperatures. Even at room temperatures, galling of non-lubricated stainless steel fasteners can lead to seizing and possible loss of a component. After hand tightening all bolts, support bolt and turn nut using two closed-end box wrenches. The tightening process must be

done gradually in 1/4 to 1/2 turn increments in a alternating crisscross pattern. Continue this incremental tightening until the desired torque ratings have been achieved. Tightening bolts in this fashion will insure a reliable seal with even gasket compression and deformation.

Nonrotatable and Rotatable Flanges

Nonrotatable and rotatable flanges are typically used in combination for bolt alignment purposes. Nonrotatable flanges are often referred to as fixed flanges. A nonrotatable flange is constructed of a single machined piece. Once nonrotatable flanges are welded in place their fastening bolt holes are fixed in position. The industry standard for positioning fixed flange bolt holes is to have bolt holes straddle a vertical centerline. Flanges fitted with leak test grooves are welded so that the groove is positioned on that vertical centerline. A rotatable flange is constructed of two concentric or coaxial components, these are referred to as the receiver and the insert. The receiver, or outer ring, contains the fastening bolt holes while the insert is the blank or bored center piece



that contains the sealing knife edge and to which a mating tube is typically welded. The term “rotatable” pertains to the flange’s outer ring or receiver prior to the insertion of fasteners. The receiver is rotatable for the purpose of aligning bolt holes with fixed, nonrotatable mating flanges. Once the holes have been aligned and fasteners inserted, the flange is no longer rotatable. Fastening two rotatable flanges is not only difficult but also increases the possibility for damage to one or both of the mating flange knife edge seals. Caution should be exercised when fastening two rotatable flanges.

Del-Seal™ CF metal seal flanges are fitted with either clearance or threaded fastening bolt holes. Clearance holes are commonly referred to as through holes and threaded holes are commonly referred to as tapped holes. Tapped holes provide threads through the entire thickness of a flange. Exceptions to this include reducer flanges and cubes which are fitted with blind tapped holes. Blind tapped holes are drilled only part way through a flange and do not break through. Blind tapped holes are typically used where drilling through a component is not possible or desirable, like the direct tapping of a

chamber wall, where breaking through would provide a leak path through the vacuum walls.

All dimensions in this catalog are given in inches unless specified otherwise.



Wire Seal OFE Copper-seal flanges

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Del-Seal™ CF double sided flanges

page 56



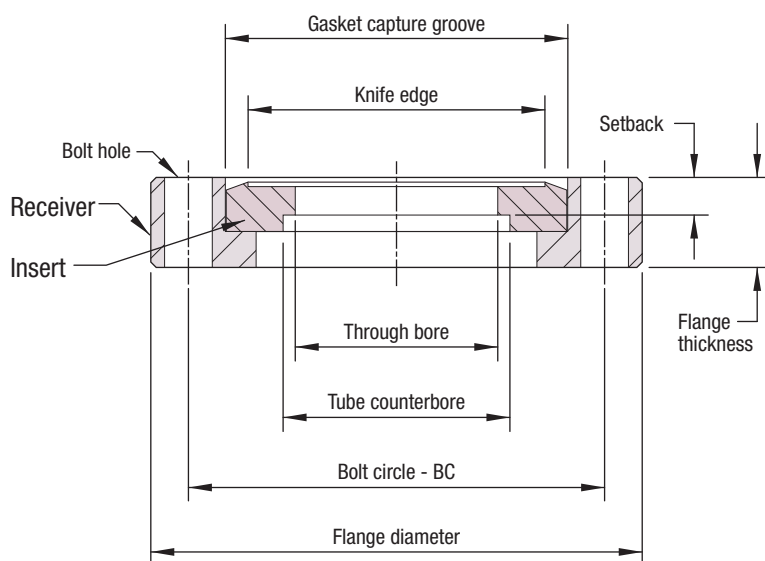
Hybrid adapters

page 148



Del-Seal™ CF fittings

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Del-Seal™ CF Flange Parts Identification
Rotatable Flange Example



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Socket head screws
Nut Type	Hexagonal or two hole plate nuts
Size	.160-32 UNC
Torque	7 lb-ft

Vacuum Range 1×10^{-13} Torr

Temperature Range -200°C to 450°C

Weight .25 lb

Dimensions 1.33 OD x .625 ID maximum

See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

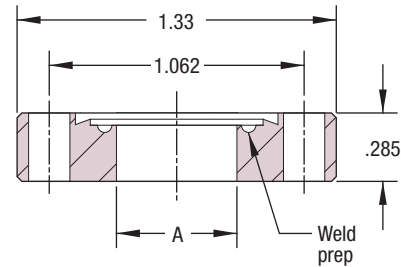


Figure 2

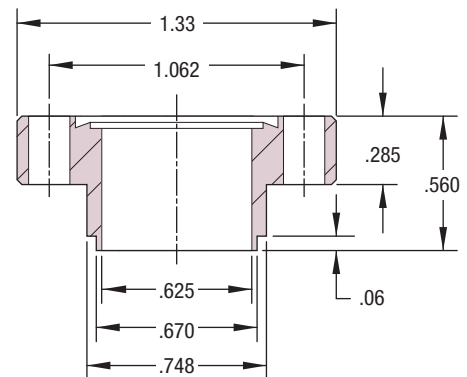


Figure 3

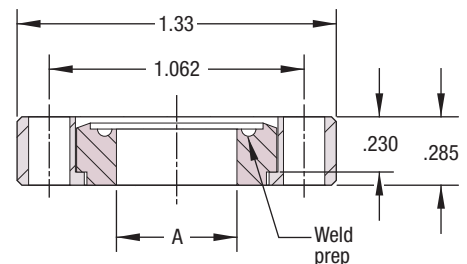
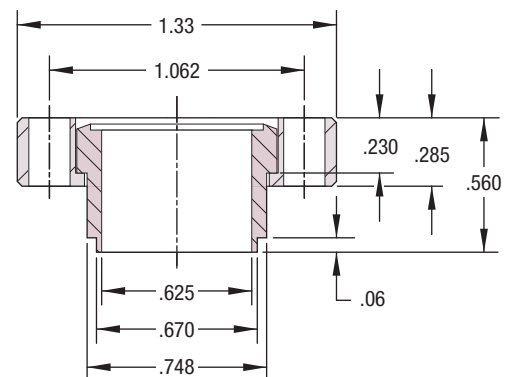
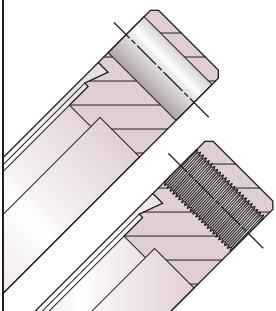


Figure 4



- Through hole flanges have 6 bolt holes drilled .172" diameter
- Tapped flanges have 6 bolt holes threaded 8-32
- Weld preps shown for small diameter, thin wall tube sizes

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	1/4	F133000	110000
1/4	CLEARANCE	1	.252	1/4	F133025	110001
3/8	CLEARANCE	1	.377	1/4	F133038	110002
1/2	CLEARANCE	1	.502	1/4	F133050	110003
3/4	CLEARANCE	2	.625	1/4	F133075	110004
BLANK	TAPPED	1	-	1/4	F133000T	130000
1/4	TAPPED	1	.252	1/4	F133025T	130001
3/8	TAPPED	1	.377	1/4	F133038T	130002
1/2	TAPPED	1	.502	1/4	F133050T	130003
3/4	TAPPED	2	.625	1/4	F133075T	130004

Hardware



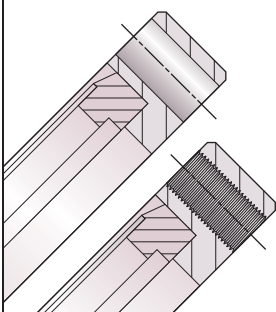
- Bolt Sets for clearance hole flanges include screws and nuts
- Bolt sets for tapped flanges include screws only

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 0.64 I.D.	-	-	10	1/4	GK-075	191000
GASKET, VFKM / FPM, 0.62 I.D.	-	-	5	1/4	GK-075V	191001
SOCKET HEAD SCREW	C	3/4	25	1/4	BA-075	190001
SOCKET HEAD SCREW	T	1/2	25	1/4	BA-050	190000
SOCKET HEAD SCREW	CUBE	1/2	36	1/2	BA-056	190155
SOCKET HEAD SCREW/PLATE NUT	C	3/4	24 / 12	1/4	BA-075-PN	190094
SOCKET HEAD, SILVER PLATED ²	C	3/4	25	1/4	BA-075-SP	190037
SOCKET HEAD, SILVER PLATED ²	T	1/2	25	1/4	BA-050-SP	190055
BALL WRENCH, HEX DRIVER, 8-32	-	-	1	1/4	WRENCH	540000
PLATE NUTS, 8-32	C	-	24	1/4	PN-133	190069
FLANGE COVER, PLASTIC	-	-	6	1/4	FC133	192020

¹ C = Clearance holes, T = Tapped holes, CUBE = Tapped holes on CU075-6

² Silver plated screws only; nuts not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	1/4	F133000R	100000
1/4	CLEARANCE	3	.252	1/4	F133025R	100001
3/8	CLEARANCE	3	.377	1/4	F133038R	100002
1/2	CLEARANCE	3	.502	1/4	F133050R	100003
3/4	CLEARANCE	4	.625	1/4	F133075R	100004
BLANK	TAPPED	3	-	1/4	F133000RT	120000
1/4	TAPPED	3	.252	1/4	F133025RT	120001
3/8	TAPPED	3	.377	1/4	F133038RT	120002
1/2	TAPPED	3	.502	1/4	F133050RT	120003
3/4	TAPPED	4	.625	1/4	F133075RT	120004



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets, metal / elastomer	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal or 12-point head
Nut Type	Hexagonal
Size	.250-28 UNF
Torque	12 lb-ft

Vacuum Range 1×10^{-13} Torr

Temperature Range -200°C to 450°C

Weight .50 lb

Dimensions 2.11 OD x .875 ID maximum

See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

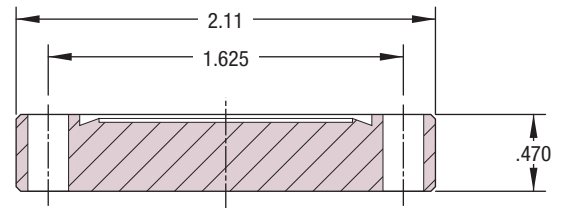


Figure 2

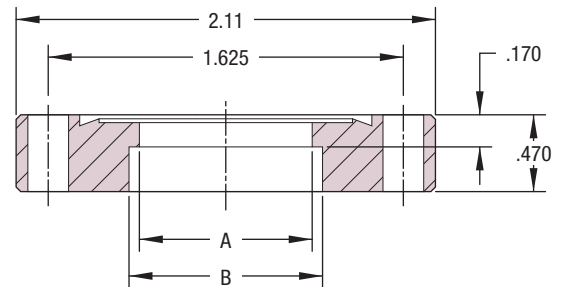


Figure 3

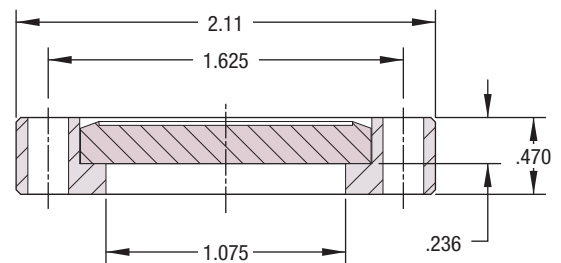
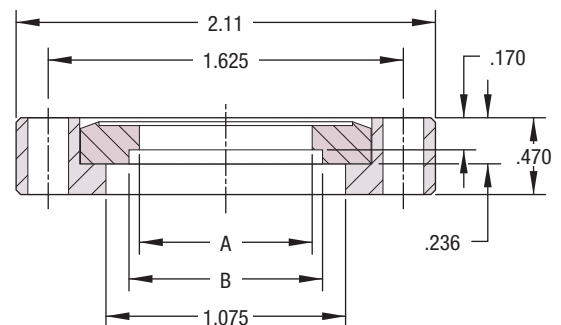
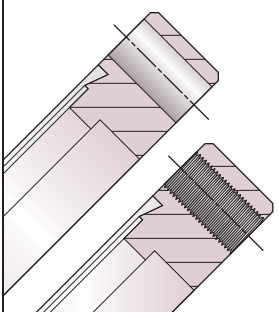


Figure 4



- Through hole flanges have 4 bolt holes drilled .265" diameter
- Tapped flanges have 4 bolt holes threaded .250-28

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	1/2	F218000	110005
3/4	CLEARANCE	2	.690	.760	1/2	F218075	110006
1	CLEARANCE	2	.875	1.010	1/2	F218100	110007
BLANK	TAPPED	1	-	-	1/2	F218000T	130005
3/4	TAPPED	2	.690	.760	1/2	F218075T	130006
1	TAPPED	2	.875	1.010	1/2	F218100T	130007

Hardware



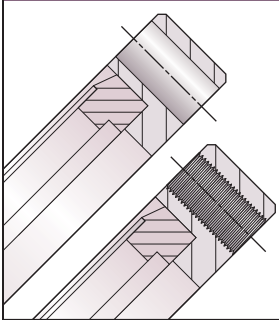
- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 1.00 I.D.	-	-	10	1/4	GK-100	191002
GASKET, VFKM / FPM, 1.02 I.D.	-	-	5	1/4	GK-100V	191003
HEX HEAD BOLT	C	1-1/4	25	1	BA-150	190004
HEX HEAD BOLT	T	7/8	25	1	BA-085	190002
12-PT BOLT	C	1-1/4	25	1	BA-150-12	190040
12-PT BOLT	T	7/8	25	1	BA-085-12	190041
12-PT BOLT, SILVER PLATED ²	C	1-1/4	25	1	BA-150-12-SP	190061
12-PT BOLT, SILVER PLATED ²	T	7/8	25	1	BA-085-12-SP	190057
12-PT BOX WRENCH, 1/4" x 5/16"	-	-	1	1/4	WRENCH	540001

¹ C = Clearance holes, T = Tapped holes

² Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	1/2	F218000R	100005
3/4	CLEARANCE	4	.690	.760	1/2	F218075R	100006
1	CLEARANCE	4	.875	1.010	1/2	F218100R	100007
BLANK	TAPPED	3	-	-	1/2	F218000RT	120005
3/4	TAPPED	4	.690	.760	1/2	F218075RT	120006
1	TAPPED	4	.875	1.010	1/2	F218100RT	120007



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal or 12-point head
Nut Type	Hexagonal or two hole plate nuts
Size	.250-28 UNF
Torque	12 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
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Weight	1 lb maximum
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Dimensions	2.73 OD x .1.375 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

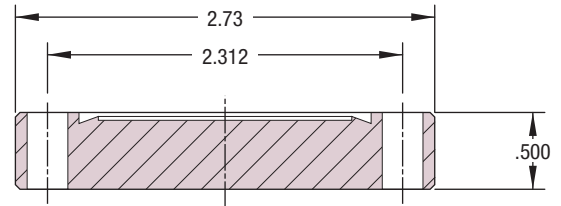


Figure 2

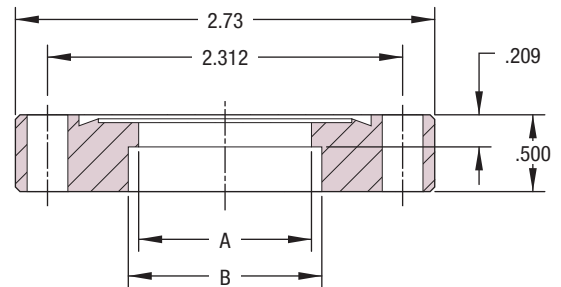


Figure 3

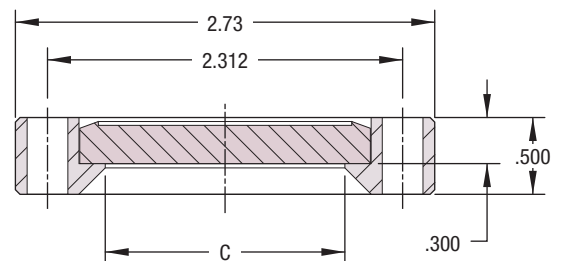
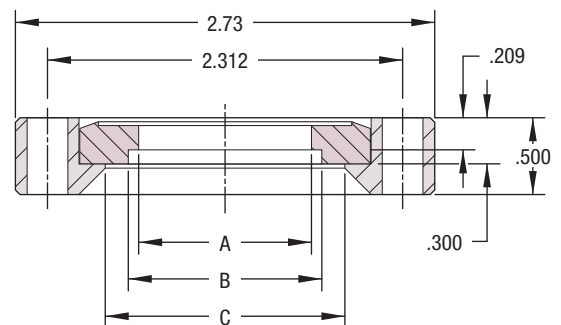
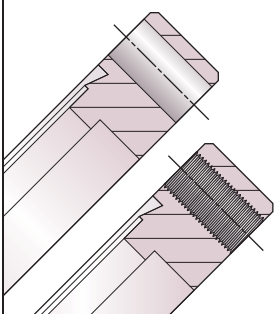


Figure 4



- Through hole flanges have 6 bolt holes drilled .265" diameter
- Tapped flanges have 6 bolt holes threaded .250-28

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	C	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	-	1	F275000	110008
1/4	CLEARANCE	2	-	.252	-	3/4	F275025	110009
1/2	CLEARANCE	2	-	.502	-	3/4	F275050	110010
3/4	CLEARANCE	2	.690	.760	-	3/4	F275075	110011
1	CLEARANCE	2	.875	1.010	-	3/4	F275100	110012
1-1/4	CLEARANCE	2	1.125	1.255	-	3/4	F275125	110013
1-1/2	CLEARANCE	2	1.375	1.510	-	3/4	F275150	110014
1-3/4	CLEARANCE	2	1.625	1.760	-	3/4	F275175	110052
BLANK	TAPPED	1	-	-	-	1	F275000T	130008
1/4	TAPPED	2	-	.252	-	3/4	F275025T	130009
1/2	TAPPED	2	-	.502	-	3/4	F275050T	130010
3/4	TAPPED	2	.690	.760	-	3/4	F275075T	130011
1	TAPPED	2	.875	1.010	-	3/4	F275100T	130012
1-1/4	TAPPED	2	1.125	1.255	-	3/4	F275125T	130013
1-1/2	TAPPED	2	1.375	1.510	-	3/4	F275150T	130014
1-3/4	TAPPED	2	1.625	1.760	-	3/4	F275175T	130094

Hardware

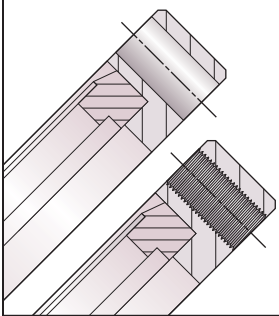


- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 1.45 I.D.	-	-	10	1/4	GK-150	191004
GASKET, COPPER, 1.53 I.D.	-	-	10	1/4	GK-175	191147
GASKET, COPPER, BLANK	-	-	10	1	GK-150S	191006
GASKET, FKM / FPM, 1.68 I.D.	-	-	5	1/4	GK-150V	191005
HEX HEAD BOLT	C	1-1/4	25	1	BA-150	190004
HEX HEAD BOLT	T	7/8	25	1	BA-085	190002
HEX HEAD BOLT / PLATE NUT	C	1-1/4	24 / 12	1	BA-150-PN	190093
12-PT BOLT	C	1-1/4	25	1	BA-150-12	190040
12-PT BOLT	T	7/8	25	1	BA-085-12	190041
12-PT BOLT	CUBE	7/8	36	1-1/2	BA-156-12	190156
12-PT BOLT, SILVER PLATED ²	C	1-1/4	25	1	BA-150-12-SP	190061
12-PT BOLT, SILVER PLATED ²	T	7/8	25	1	BA-085-12-SP	190057
12-PT BOLT / PLATE NUT	C	1-1/4	24 / 12	1	BA-150-12-PN	190049
12-PT BOX WRENCH, 1/4" x 5/16"	-	-	1	1/4	WRENCH	540001
PLATE NUTS, .250-28	C	-	24	1/4	PN-275	190070
FLANGE COVER, PLASTIC	-	-	6	1/4	FC275	192022

¹ C = Clearance holes, T = Tapped holes, CUBE = Tapped holes on CU150-6 ² Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	C	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	1.56	1	F275000R	100008
1/4	CLEARANCE	4	-	.252	1.56	3/4	F275025R	100009
1/2	CLEARANCE	4	-	.502	1.56	3/4	F275050R	100010
3/4	CLEARANCE	4	.690	.760	1.56	3/4	F275075R	100011
1	CLEARANCE	4	.875	1.010	1.56	3/4	F275100R	100012
1-1/4	CLEARANCE	4	1.125	1.255	1.56	3/4	F275125R	100013
1-1/2	CLEARANCE	4	1.375	1.510	1.56	3/4	F275150R	100014
1-3/4	CLEARANCE	4	1.625	1.760	1.78	3/4	F275175R	100043
BLANK	TAPPED	3	-	-	1.56	1	F275000RT	120008
1/4	TAPPED	4	-	.252	1.56	3/4	F275025RT	120009
1/2	TAPPED	4	-	.502	1.56	3/4	F275050RT	120010
3/4	TAPPED	4	.690	.760	1.56	3/4	F275075RT	120011
1	TAPPED	4	.875	1.010	1.56	3/4	F275100RT	120012
1-1/4	TAPPED	4	1.125	1.255	1.56	3/4	F275125RT	120013
1-1/2	TAPPED	4	1.375	1.510	1.56	3/4	F275150RT	120014
1-3/4	TAPPED	4	1.625	1.760	1.78	3/4	F275175RT	120093



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal or 12-point head
Nut Type	Hexagonal or two hole plate nuts
Size	.312-24 UNF
Torque	15 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
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Weight	1.5 lb maximum
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Dimensions	3.37 OD x 1.875 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

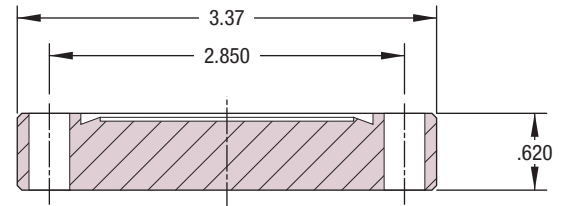


Figure 2

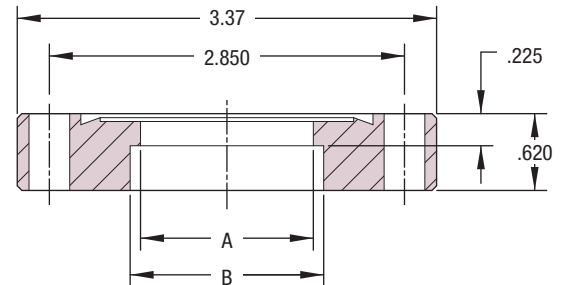


Figure 3

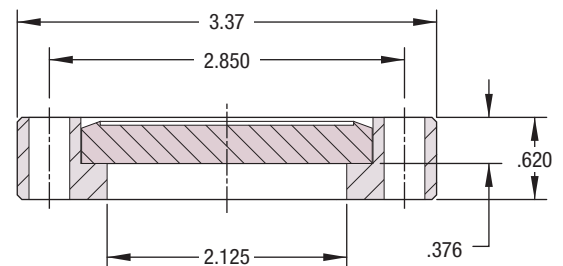
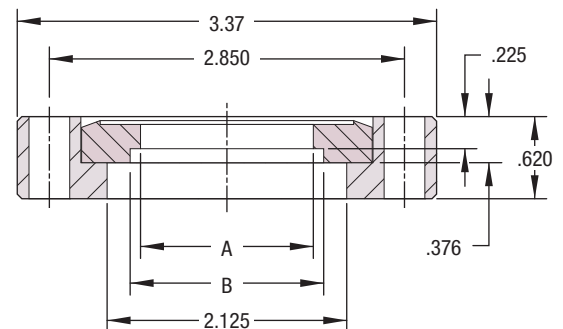
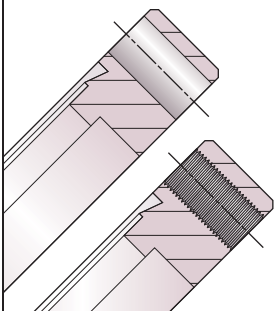


Figure 4



- Through hole flanges have 8 bolt holes drilled .332" diameter
- Tapped flanges have 8 bolt holes threaded .312-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	1-1/2	F338000	110015
1-1/2	CLEARANCE	2	1.375	1.510	1	F338150	110016
2	CLEARANCE	2	1.875	2.010	1	F338200	110017
BLANK	TAPPED	1	-	-	1-1/2	F338000T	130015
1-1/2	TAPPED	2	1.375	1.510	1	F338150T	130016
2	TAPPED	2	1.875	2.010	1	F338200T	130017

Hardware

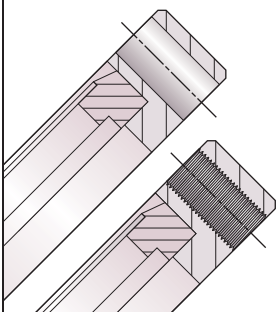


- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 2.01 I.D.	-	-	10	1/2	GK-200	191007
GASKET, FKM / FPM, 2.19 I.D.	-	-	1	1/4	GK-200V	191008
HEX HEAD BOLT	C	1-3/4	25	2	BA-180	190006
HEX HEAD BOLT	T	1-1/4	25	2	BA-125	190003
HEX HEAD BOLT / PLATE NUT	C	1-3/4	32 / 16	2	BA-180-PN	190095
12-PT BOLT	C	1-3/4	25	2	BA-180-12	190043
12-PT BOLT	T	1-1/4	25	2	BA-125-12	190044
12-PT BOLT	CUBE	1	48	3	BA-206-12	190157
12-PT BOLT, SILVER PLATED ²	C	1-3/4	25	2	BA-180-12-SP	190062
12-PT BOLT, SILVER PLATED ²	T	1-1/4	25	2	BA-125-12-SP	190058
12-PT BOLT / PLATE NUT	C	1-3/4	32 / 16	2	BA-180-12-PN	190050
12-PT BOX WRENCH, 1/4" x 5/16"	-	-	1	1/4	WRENCH	540001
PLATE NUTS, .312-24	C	-	24	1/4	PN-338	190071
FLANGE COVER, PLASTIC	-	-	6	1/4	FC338	192023

¹ C = Clearance holes, T = Tapped holes, CUBE = Tapped holes on CU200-6 ² Silver plated bolts only; nuts and washers not silver plated

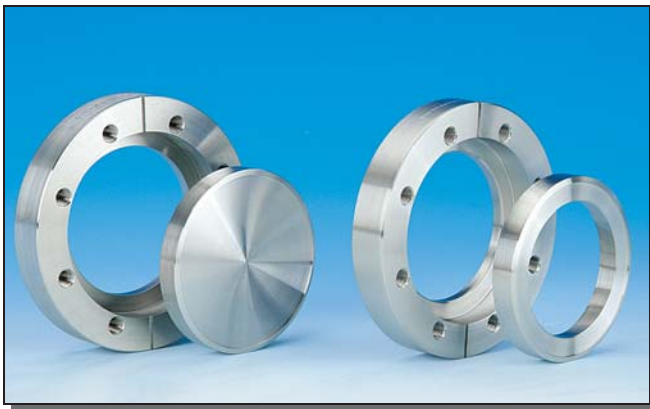
Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	1-1/2	F338000R	100015
1-1/2	CLEARANCE	4	1.375	1.510	1	F338150R	100016
2	CLEARANCE	4	1.875	2.010	1	F338200R	100017
BLANK	TAPPED	3	-	-	1-1/2	F338000RT	120015
1-1/2	TAPPED	4	1.375	1.510	1	F338150RT	120016
2	TAPPED	4	1.875	2.010	1	F338200RT	120017



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal or 12-point head
Nut Type	Hexagonal or two hole plate nuts
Size	.312-24 UNF
Torque	15 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
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Weight	3 lb maximum
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Dimensions	4.47 OD x 2.510 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

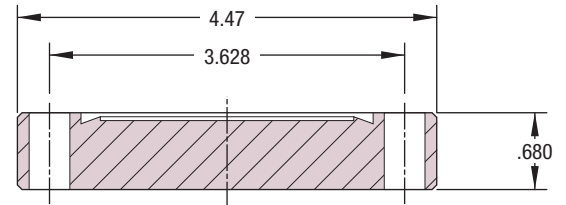


Figure 2

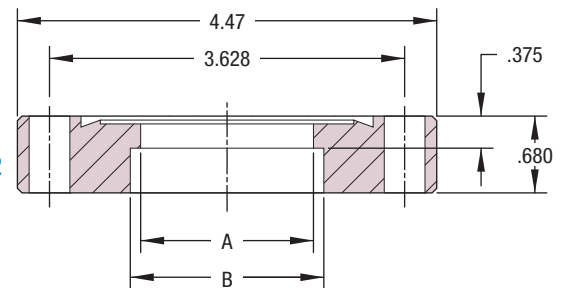


Figure 3

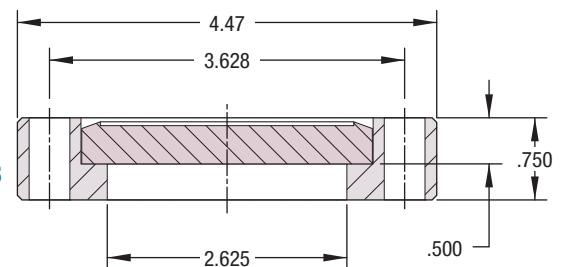
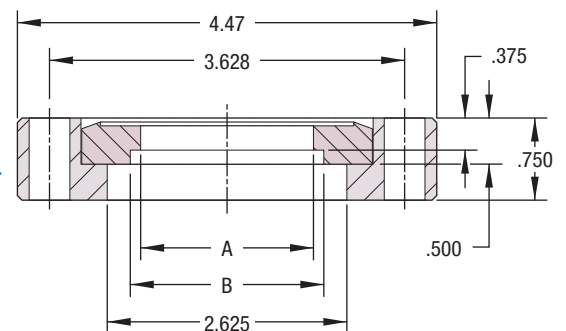
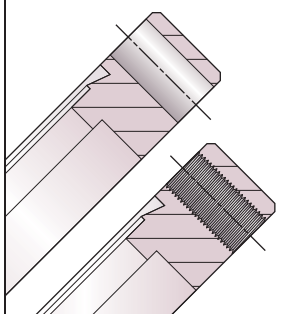


Figure 4



- Through hole flanges have 8 bolt holes drilled .332" diameter
- Tapped flanges have 8 bolt holes threaded .312-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	3	F450000	110018
1-1/2	CLEARANCE	2	1.375	1.510	2-1/2	F450150	110019
2	CLEARANCE	2	1.875	2.010	2	F450200	110020
2-1/2	CLEARANCE	2	2.375	2.510	2	F450250	110021
BLANK	TAPPED	1	-	-	3	F450000T	130018
1-1/2	TAPPED	2	1.375	1.510	2-1/2	F450150T	130019
2	TAPPED	2	1.875	2.010	2	F450200T	130020
2-1/2	TAPPED	2	2.375	2.510	2	F450250T	130021

Hardware

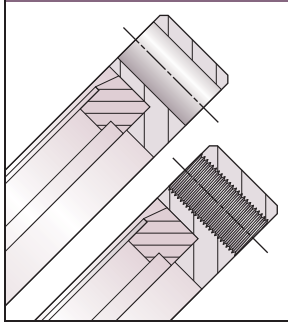


- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 2.51 I.D.	-	-	10	1/2	GK-250	191009
GASKET, FKM / FPM, 3.02 I.D.	-	-	1	1/4	GK-250V	191010
HEX HEAD BOLT	C	2	25	2	BA-200	190007
HEX HEAD BOLT	T	1-1/4	25	2	BA-125	190003
HEX HEAD BOLT / PLATE NUT	C	2	32 / 16	2	BA-200-PN	190096
12-PT BOLT	C	2	25	2	BA-200-12	190045
12-PT BOLT	T	1-1/4	25	2	BA-125-12	190044
12-PT BOLT	CUBE	1-1/8	48	4	BA-256-12	190158
12-PT BOLT, SILVER PLATED ²	C	2	25	2	BA-200-12-SP	190063
12-PT BOLT, SILVER PLATED ²	T	1-1/4	25	2	BA-125-12-SP	190058
12-PT BOLT / PLATE NUT	C	2	32 / 16	2	BA-200-12-PN	190051
12-PT BOX WRENCH, 1/4" x 5/16"	-	-	1	1/4	WRENCH	540001
PLATE NUTS, .312-24	C	-	24	1/4	PN-450	190072
FLANGE COVER, PLASTIC	-	-	6	1/4	FC450	192024

¹ C = Clearance holes, T = Tapped holes, CUBE = Tapped holes on CU250-6 ² Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	3	F450000R	100018
1-1/2	CLEARANCE	4	1.375	1.510	2-1/2	F450150R	100019
2	CLEARANCE	4	1.875	2.010	2	F450200R	100020
2-1/2	CLEARANCE	4	2.375	2.510	2	F450250R	100021
BLANK	TAPPED	3	-	-	3	F450000RT	120018
1-1/2	TAPPED	4	1.375	1.510	2-1/2	F450150RT	120019
2	TAPPED	4	1.875	2.010	2	F450200RT	120020
2-1/2	TAPPED	4	2.375	2.510	2	F450250RT	120021



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal or 12-point head
Nut Type	Hexagonal or two hole plate nuts
Size	.312-24 UNF
Torque	15 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
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Weight	3.5 lb maximum
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Dimensions	4.62 OD x 2.875 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

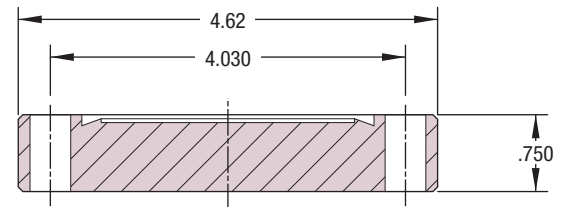


Figure 2

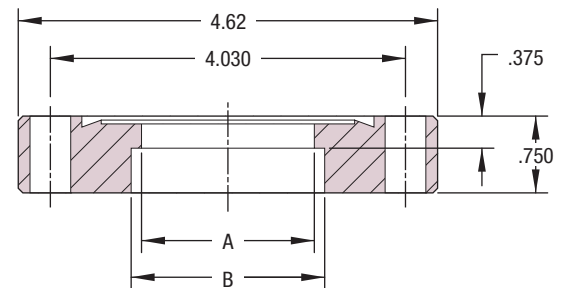


Figure 3

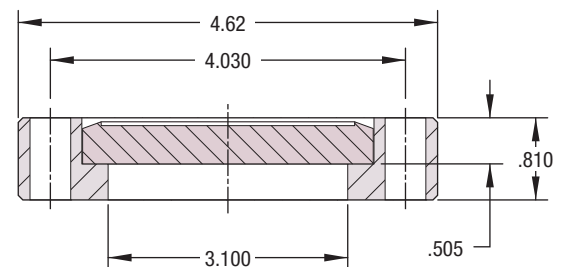
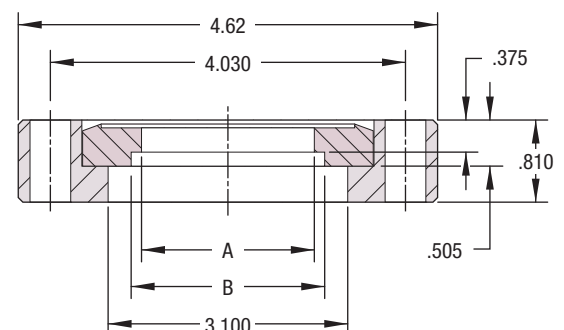
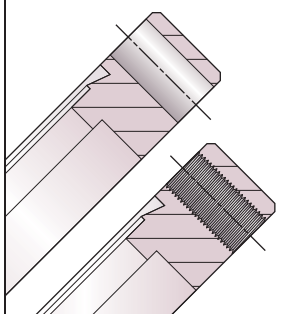


Figure 4



- Through hole flanges have 10 bolt holes drilled .332" diameter
- Tapped flanges have 10 bolt holes threaded .312-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	3-1/2	F458000	110022
2-1/2	CLEARANCE	2	2.375	2.510	2-1/2	F458250	110023
3	CLEARANCE	2	2.875	3.010	2	F458300	110024
BLANK	TAPPED	1	-	-	3-1/2	F458000T	130022
2-1/2	TAPPED	2	2.375	2.510	2-1/2	F458250T	130023
3	TAPPED	2	2.875	3.010	2	F458300T	130024

Hardware

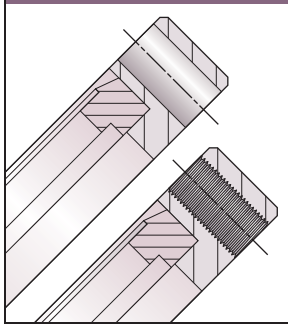


- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	FLANGE ² GEOMETRY	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 3.01 I.D.	-	-	-	10	1	GK-300	191011
GASKET, FKM / FPM, 3.36 I.D.	-	-	-	1	1/4	GK-300V	191012
HEX HEAD BOLT	C	NR	2	25	2	BA-200	190007
HEX HEAD BOLT	C	R	2-1/4	25	2	BA-300	190008
HEX HEAD BOLT	T	BOTH	1-1/4	25	2	BA-125	190003
HEX HEAD BOLT/PLATE NUT	C	BOTH	2-1/4	40/20	2	BA-462-PN	190182
12-PT BOLT	C	NR	2	25	2	BA-200-12	190045
12-PT BOLT	C	R	2-1/4	25	2	BA-300-12	190046
12-PT BOLT	T	BOTH	1-1/4	25	2	BA-125-12	190044
12-PT BOLT, SILVER PLATED ³	C	NR	2	25	2	BA-200-12-SP	190063
12-PT BOLT, SILVER PLATED ³	C	R	2-1/4	25	2	BA-300-12-SP	190064
12-PT BOLT, SILVER PLATED ³	T	BOTH	1-1/4	25	2	BA-125-12-SP	190058
12-PT BOLT/PLATE NUT	C	BOTH	2-1/4	40/20	2	BA-462-12-PN	190184
12-PT BOX WRENCH, 1/4" x 5/16"	-	-	-	1	1/4	WRENCH	540001
PLATE NUTS, .312-24	C	BOTH	-	24	1/4	PN462	190180
FLANGE COVER, PLASTIC	-	-	-	6	1/2	FC458	192025

¹ C = Clearance holes, T = Tapped holes ² NR = Nonrotatable, R = Rotatable ³ Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	3-1/2	F458000R	100022
2-1/2	CLEARANCE	4	2.375	2.510	2-1/2	F458250R	100023
3	CLEARANCE	4	2.875	3.010	2	F458300R	100024
BLANK	TAPPED	3	-	-	3-1/2	F458000RT	120022
2-1/2	TAPPED	4	2.375	2.510	2-1/2	F458250RT	120023
3	TAPPED	4	2.875	3.010	2	F458300RT	120024



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal or 12-point head
Nut Type	Hexagonal or two hole plate nuts
Size	.312-24 UNF
Torque	15 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
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Weight	5.5 lb maximum
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Dimensions	5.97 OD x 3.810 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

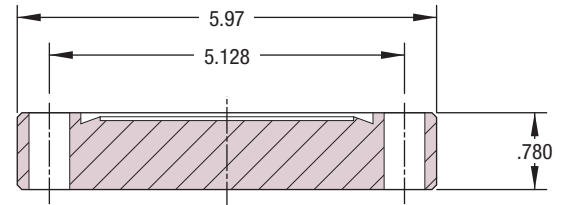


Figure 2

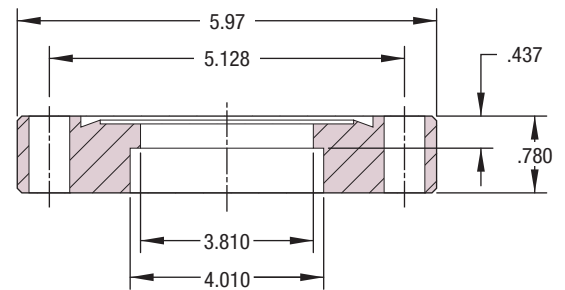


Figure 3

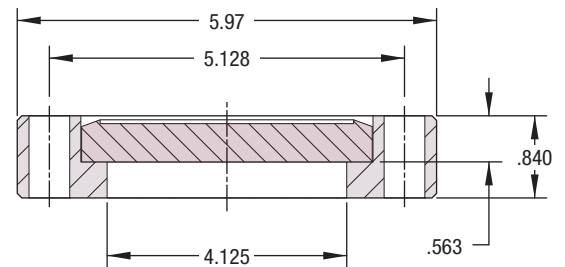
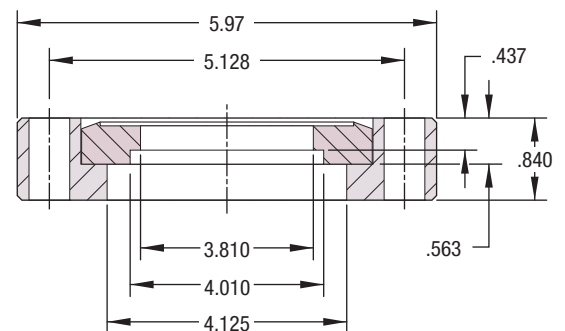
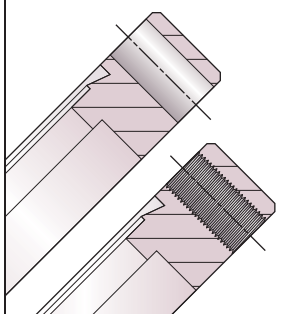


Figure 4



- Through hole flanges have 16 bolt holes drilled .332" diameter
- Tapped flanges have 16 bolt holes threaded .312-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	5-1/2	F600000	110025
4	CLEARANCE	2	3.810	4.010	3-1/2	F600400	110026
BLANK	TAPPED	1	-	-	5-1/2	F600000T	130025
4	TAPPED	2	3.810	4.010	3-1/2	F600400T	130026

Hardware



- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

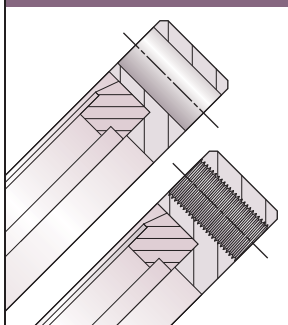
DESCRIPTION	BOLT ¹ HOLE	FLANGE ² GEOMETRY	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 4.01 I.D.	-	-	-	10	1-1/2	GK-400	191013
GASKET, FKM / FPM, 4.51 I.D.	-	-	-	1	1/4	GK-400V	191014
HEX HEAD BOLT	C	NR	2	25	2	BA-200	190007
HEX HEAD BOLT	C	R	2-1/4	25	2	BA-300	190008
HEX HEAD BOLT	T	BOTH	1-1/4	25	2	BA-125	190003
HEX HEAD BOLT / PLATE NUT	C	BOTH	2-1/4	32 / 16	2	BA-301-PN	190097
12-PT BOLT	C	NR	2	25	2	BA-200-12	190045
12-PT BOLT	C	R	2-1/4	25	2	BA-300-12	190046
12-PT BOLT	T	BOTH	1-1/4	25	2	BA-125-12	190044
12-PT BOLT	CUBE	NR	1-1/4	96	8	BA-406-12	190159
12-PT BOLT, SILVER PLATED ³	C	NR	2	25	2	BA-200-12-SP	190063
12-PT BOLT, SILVER PLATED ³	C	R	2-1/4	25	2	BA-300-12-SP	190064
12-PT BOLT, SILVER PLATED ³	T	BOTH	1-1/4	25	2	BA-125-12-SP	190058
12-PT BOLT / PLATE NUT	C	BOTH	2-1/4	32 / 16	2	BA-301-12-PN	190053
12-PT BOX WRENCH, 1/4" x 5/16"	-	-	-	1	1/4	WRENCH	540001
PLATE NUTS, .312-24	C	BOTH	-	24	1/4	PN-600	190073
FLANGE COVER, PLASTIC	-	-	-	6	1/2	FC600	192026

¹ C = Clearance holes, T = Tapped holes, CUBE = Tapped holes on CU400-6

² NR = Nonrotatable, R = Rotatable

³ Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	5-1/2	F600000R	100025
4	CLEARANCE	4	3.810	4.010	3-1/2	F600400R	100026
BLANK	TAPPED	3	-	-	5-1/2	F600000RT	120025
4	TAPPED	4	3.810	4.010	3-1/2	F600400RT	120026



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal or 12-point head
Nut Type	Hexagonal
Size	.312-24 UNF
Torque	15 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
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Weight	8 lb maximum
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Dimensions	6.75 OD x 4.870 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

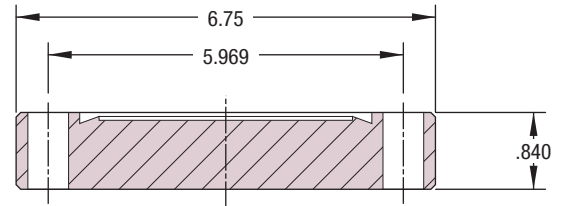


Figure 2

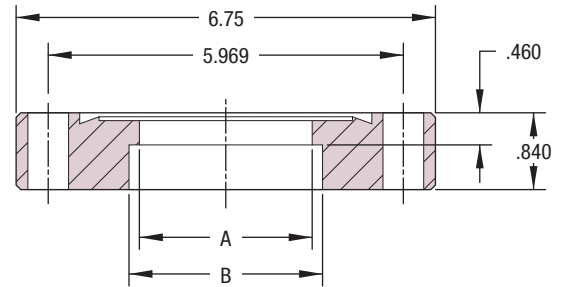


Figure 3

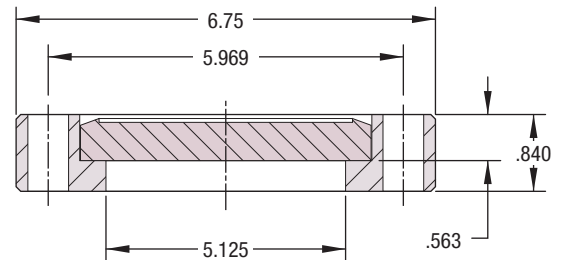
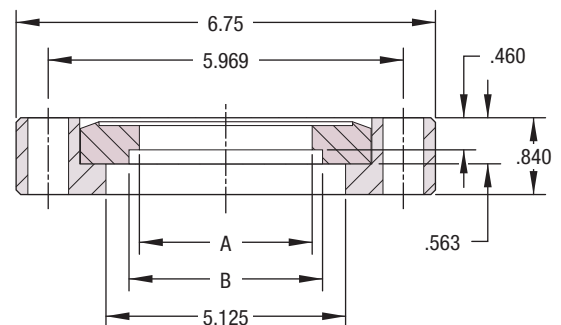
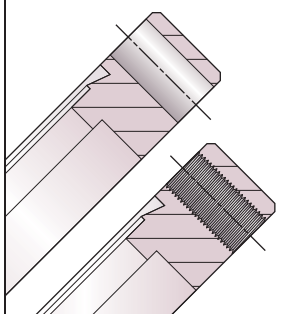


Figure 4



- Through hole flanges have 18 bolt holes drilled .332" diameter
- Tapped flanges have 18 bolt holes threaded .312-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	8	F675000	110027
4	CLEARANCE	2	3.810	4.010	5	F675400	110028
5	CLEARANCE	2	4.870	5.010	3-1/2	F675500	110029
BLANK	TAPPED	1	-	-	8	F675000T	130027
4	TAPPED	2	3.810	4.010	5	F675400T	130028
5	TAPPED	2	4.870	5.010	3-1/2	F675500T	130029

Hardware



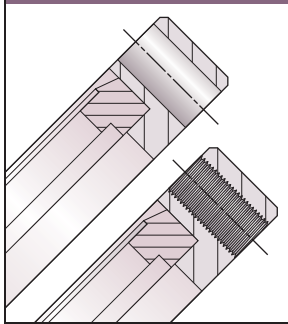
- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 5.01 I.D.	-	-	10	1-1/2	GK-500	191015
GASKET, FKM / FPM, 5.34 I.D.	-	-	1	1/4	GK-500V	191016
HEX HEAD BOLT	C	2-1/4	25	2	BA-300	190008
HEX HEAD BOLT	T	1-1/4	25	2	BA-125	190003
12-PT BOLT	C	2-1/4	25	2	BA-300-12	190046
12-PT BOLT	T	1-1/4	25	2	BA-125-12	190044
12-PT BOLT, SILVER PLATED ²	C	2-1/4	25	2	BA-300-12-SP	190064
12-PT BOLT, SILVER PLATED ²	T	1-1/4	25	2	BA-125-12-SP	190058
12-PT BOX WRENCH, 1/4" x 5/16"	-	-	1	1/4	WRENCH	540001

¹ C = Clearance holes, T = Tapped holes

² Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	8	F675000R	100027
4	CLEARANCE	4	3.810	4.010	5	F675400R	100028
5	CLEARANCE	4	4.870	5.010	3-1/2	F675500R	100029
BLANK	TAPPED	3	-	-	8	F675000RT	120027
4	TAPPED	4	3.810	4.010	5	F675400RT	120028
5	TAPPED	4	4.870	5.010	3-1/2	F675500RT	120029



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal or 12-point head
Nut Type	Hexagonal or two hole plate nuts
Size	.312-24 UNF
Torque	15 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
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Weight	12 lb maximum
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Dimensions	7.97 OD x 5.812 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

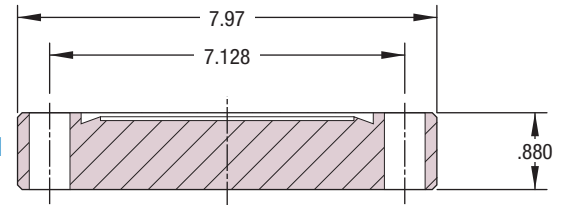


Figure 2

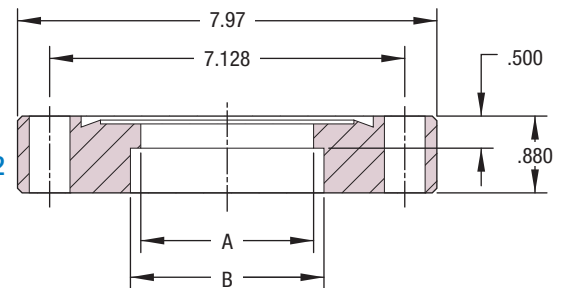


Figure 3

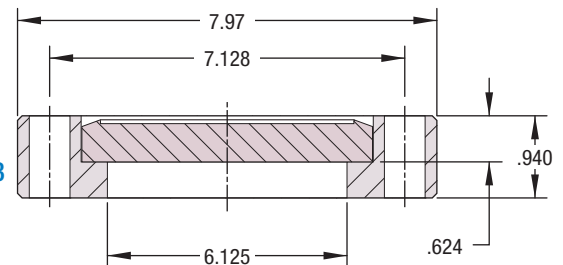
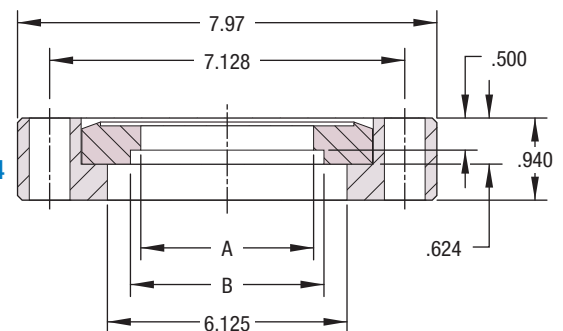
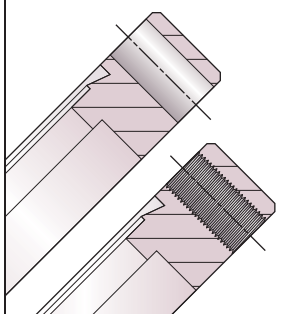


Figure 4



- Through hole flanges have 20 bolt holes drilled .332" diameter
- Tapped flanges have 20 bolt holes threaded .312-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	12	F800000	110030
6	CLEARANCE	2	5.812	6.020	5-1/2	F800600	110031
BLANK	TAPPED	1	-	-	12	F800000T	130030
6	TAPPED	2	5.812	6.020	5-1/2	F800600T	130031

Hardware

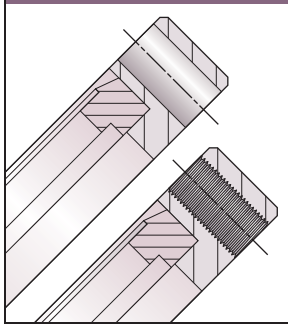


- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 6.01 I.D.	-	-	10	2	GK-600	191017
GASKET, FKM / FPM, 6.51 I.D.	-	-	1	1/4	GK-600V	191018
HEX HEAD BOLT	C	2-1/4	25	2	BA-300	190008
HEX HEAD BOLT	T	1-3/4	25	2	BA-600	190010
HEX HEAD BOLT / PLATE NUT	C	2-1/4	40 / 20	2	BA-300-PN	190098
12-PT BOLT	C	2-1/4	25	2	BA-300-12	190046
12-PT BOLT	T	1-3/4	25	2	BA-600-12	190047
12-PT BOLT	CUBE	1-1/4	120	10	BA-606-12	190160
12-PT BOLT, SILVER PLATED ²	C	2-1/4	25	2	BA-300-12-SP	190064
12-PT BOLT, SILVER PLATED ²	T	1-3/4	25	2	BA-600-12-SP	190059
12-PT BOLT / PLATE NUT	C	2-1/4	40 / 20	2	BA-300-12-PN	190052
12-PT BOX WRENCH, 1/4" x 5/16"	-	-	1	1/4	WRENCH	540001
PLATE NUTS, .312-24	C	-	24	1/4	PN-800	190074
FLANGE COVER, PLASTIC	-	-	1	1/4	FC800	192007

¹ C = Clearance holes, T = Tapped holes, CUBE = Tapped holes on CU600-6 ² Silver plated bolts only; nuts and washers not silver plated

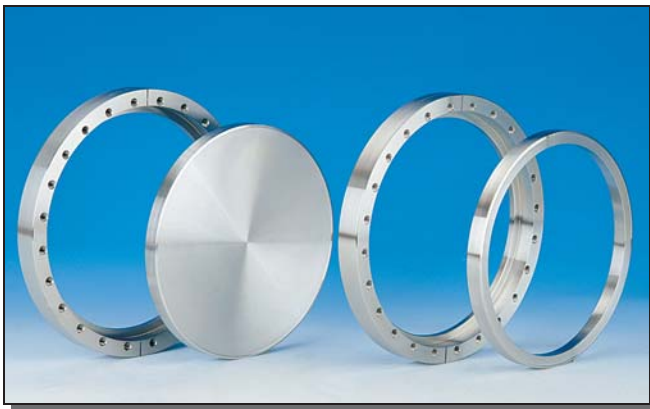
Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	12	F800000R	100030
6	CLEARANCE	4	5.812	6.020	5-1/2	F800600R	100031
BLANK	TAPPED	3	-	-	12	F800000RT	120030
6	TAPPED	4	5.812	6.020	5-1/2	F800600RT	120031



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal or 12-point head
Nut Type	Hexagonal
Size	.312-24 UNF
Torque	15 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
--------------------------	-----------------

Weight	20 lb maximum
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Dimensions	9.97 OD x 7.812 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

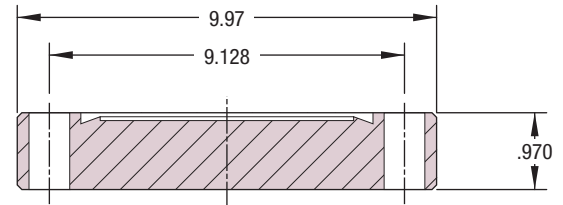


Figure 2

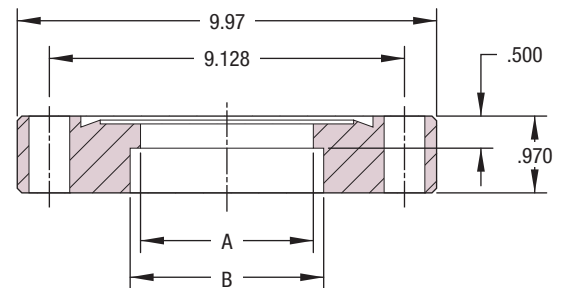


Figure 3

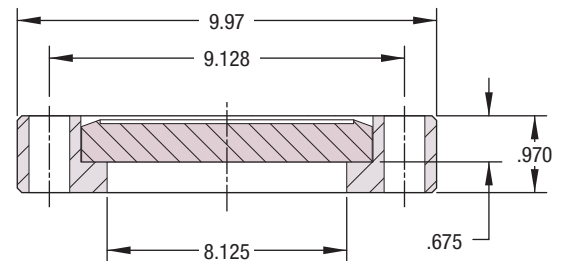
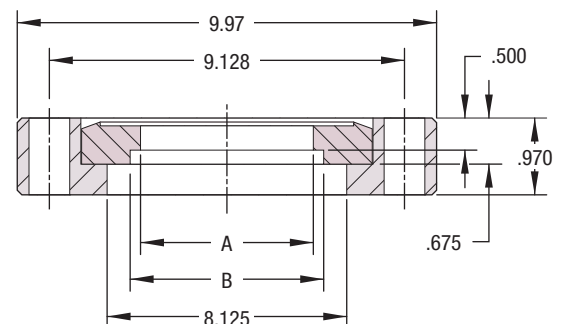
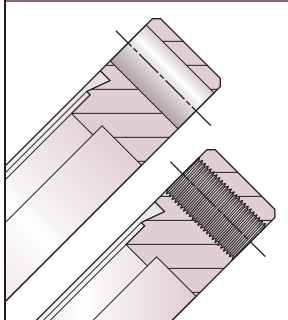


Figure 4



- Through hole flanges have 24 bolt holes drilled .332" diameter
- Tapped flanges have 24 bolt holes threaded .312-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	20	F1000000	110032
8	CLEARANCE	2	7.812	8.020	7-1/2	F1000800	110033
BLANK	TAPPED	1	-	-	20	F1000000T	130032
8	TAPPED	2	7.812	8.020	7-1/2	F1000800T	130033

Hardware

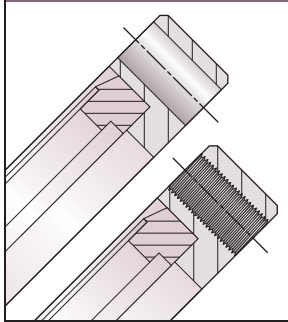


- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 8.00 I.D.	-	-	10	3	GK-800	191019
GASKET, FKM / FPM, 8.47 I.D.	-	-	1	1/4	GK-800V	191020
HEX HEAD BOLT	C	2-1/2	25	2	BA-800	190011
HEX HEAD BOLT	T	1-3/4	25	2	BA-600	190010
12-PT BOLT	C	2-1/2	25	2	BA-800-12	190048
12-PT BOLT	T	1-3/4	25	2	BA-600-12	190047
12-PT BOLT	CUBE	1-1/4	144	12	BA-806-12	190161
12-PT BOLT, SILVER PLATED ²	C	2-1/2	25	2	BA-800-12-SP	190067
12-PT BOLT, SILVER PLATED ²	T	1-3/4	25	2	BA-600-12-SP	190059
12-PT BOX WRENCH, 1/4" x 5/16"	-	-	1	1/4	WRENCH	540001
FLANGE COVER, PLASTIC	-	-	1	1/2	FC1000	192008

¹ C = Clearance holes, T = Tapped holes, CUBE = Tapped holes on CU800-6 ² Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	20	F1000000R	100032
8	CLEARANCE	4	7.812	8.020	7-1/2	F1000800R	100033
BLANK	TAPPED	3	-	-	20	F1000000RT	120032
8	TAPPED	4	7.812	8.020	7-1/2	F1000800RT	120033



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper gaskets
- Tapped or clearance bolt holes
- Varian and Balzers compatible design

Specifications

Material	
Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated
Fastening	
Bolt Type	Hexagonal head
Nut Type	Hexagonal
Size	.312-24 UNF
Torque	15 lb-ft
Vacuum Range	1×10^{-13} Torr
Temperature Range	-200°C to 450°C
Weight	40 lb maximum
Dimensions	12.00 OD x 10.00 ID maximum

ULTRAHIGH VACUUM SERIES

Figure 1

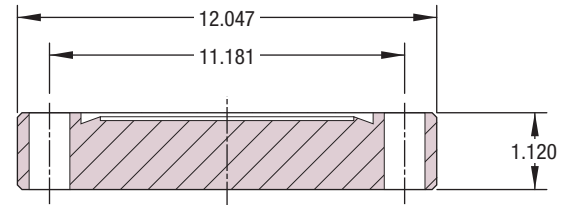


Figure 2

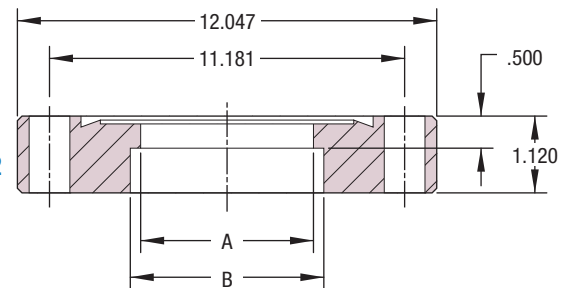


Figure 3

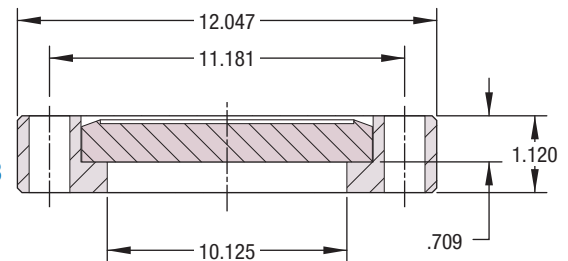
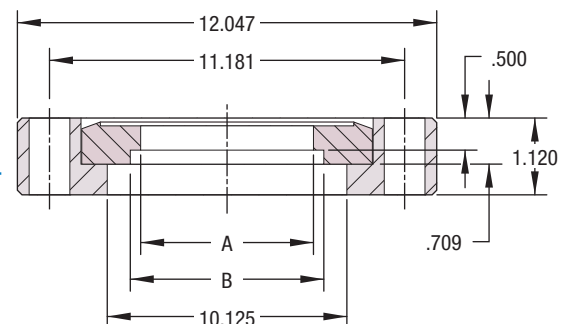
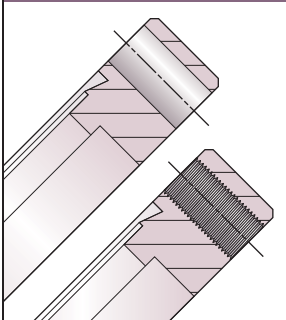


Figure 4



- Through hole flanges have 32 bolt holes drilled .332" diameter
- Tapped flanges have 32 bolt holes threaded .312-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	34	F1200000	110058
10	CLEARANCE	2	9.750	10.020	10	F12001000	110059
BLANK	TAPPED	1	-	-	34	F1200000T	130092
10	TAPPED	2	9.750	10.020	10	F12001000T	130093

Hardware



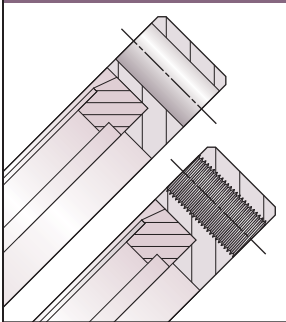
- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 10.00 I.D.	-	-	10	2	GK-1200	191094
GASKET, COPPER, 10.00 I.D.	-	-	1	1/4	GK-1200I	191070
HEX HEAD BOLT	C	3	32	1-1/2	BA-1200	190162
HEX HEAD BOLT	T	2	32	1-1/2	BA-1201	190163
HEX HEAD BOLT, SILVER PLATED ²	C	3	32	1-1/2	BA-1200-SP	190164
HEX HEAD BOLT, SILVER PLATED ²	T	2	32	1-1/2	BA-1201-SP	190165

¹ C = Clearance holes, T = Tapped holes

² Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	33	F1200000R	100058
10	CLEARANCE	4	9.750	10.020	9	F12001000R	100059
BLANK	TAPPED	3	-	-	33	F1200000RT	120091
10	TAPPED	4	9.750	10.020	9	F12001000RT	120092



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal head
Nut Type	Hexagonal
Size	.375-24 UNF
Torque	26 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
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Weight	41 lb maximum
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Dimensions	13.25 OD x 10.500 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

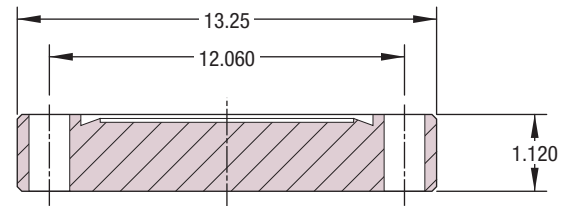


Figure 2

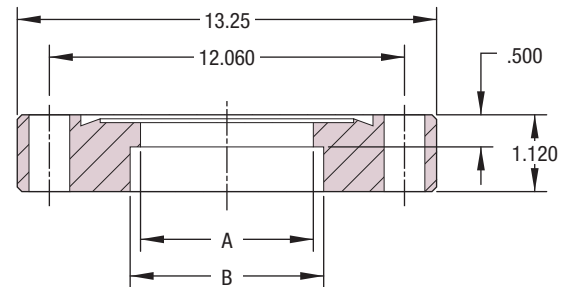


Figure 3

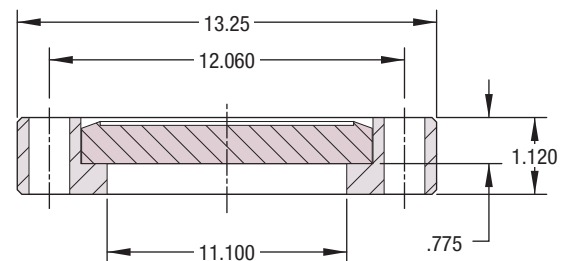
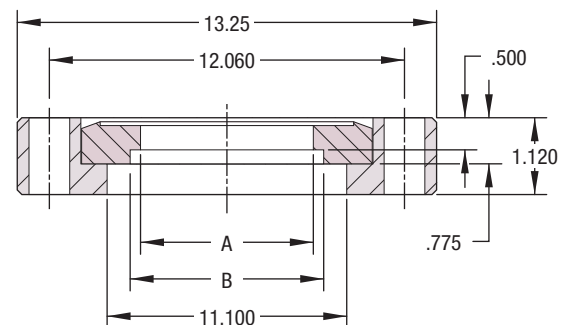
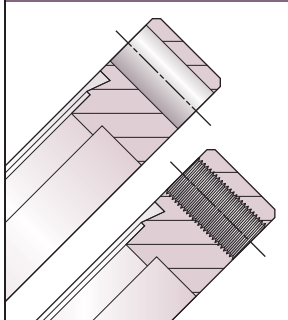


Figure 4



- Through hole flanges have 30 bolt holes drilled .390" diameter
- Tapped flanges have 30 bolt holes threaded .375-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	41	F1325000	110034
10	CLEARANCE	2	9.750	10.020	18	F13251000	110035
10-3/4	CLEARANCE	2	10.500	10.765	14	F13251075	110036
BLANK	TAPPED	1	-	-	41	F1325000T	130034
10	TAPPED	2	9.750	10.020	18	F13251000T	130035
10-3/4	TAPPED	2	10.500	10.765	14	F13251075T	130036

Hardware



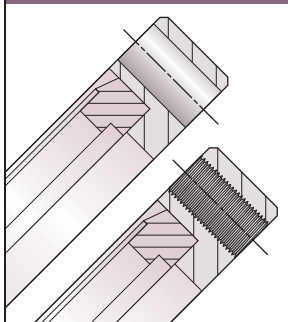
- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 10.87 I.D.	-	-	10	3-1/2	GK-1325	191021
GASKET, COPPER, 10.87 I.D.	-	-	1	1/4	GK-1325I	191022
GASKET, FKM / FPM, 11.36 I.D.	-	-	1	1/4	GK-1325V	191023
HEX HEAD BOLT	C	3	30	4	BA-1000	190012
HEX HEAD BOLT	T	2	30	2	BA-1001	190013
HEX HEAD BOLT, SILVER PLATED ²	C	3	30	4	BA-1000-SP	190060
HEX HEAD BOLT, SILVER PLATED ²	T	2	30	2	BA-1001-SP	190065

¹ C = Clearance holes, T = Tapped holes

² Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	41	F1325000R	100034
10	CLEARANCE	4	9.750	10.020	18	F13251000R	100035
10-3/4	CLEARANCE	4	10.500	10.765	14	F13251075R	100036
BLANK	TAPPED	3	-	-	41	F1325000RT	120034
10	TAPPED	4	9.750	10.020	18	F13251000RT	120035
10-3/4	TAPPED	4	10.500	10.765	14	F13251075RT	120036



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal head
Nut Type	Hexagonal
Size	.375-24 UNF
Torque	26 lb-ft

Vacuum Range	1×10^{-13} Torr
---------------------	--------------------------

Temperature Range	-200°C to 450°C
--------------------------	-----------------

Weight	46 lb maximum
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Dimensions	14.00 OD x 11.750 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

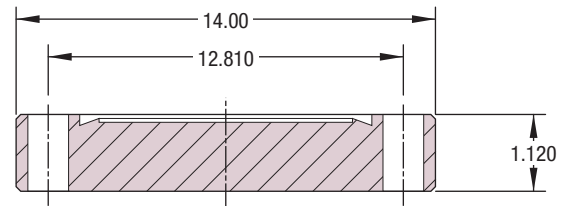


Figure 2

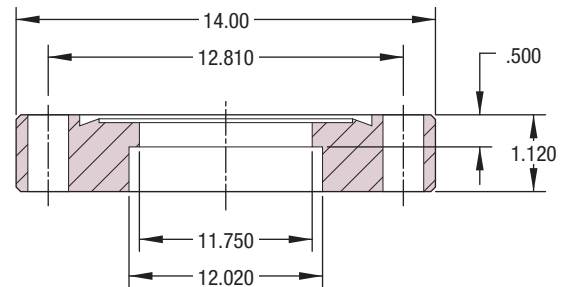


Figure 3

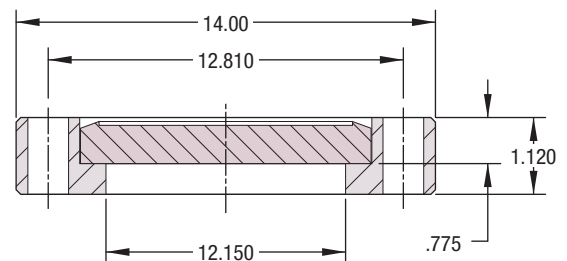
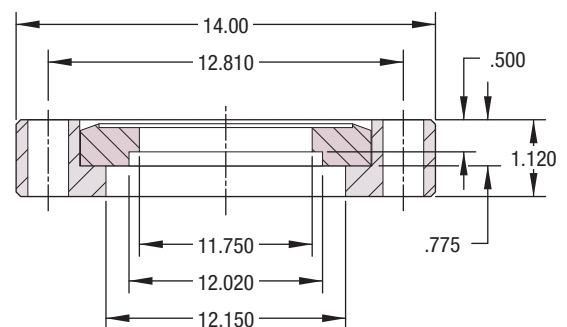
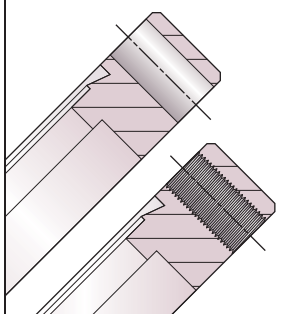


Figure 4



- Through hole flanges have 30 bolt holes drilled .390" diameter
- Tapped flanges have 30 bolt holes threaded .375-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	46	F1400000	110037
12	CLEARANCE	2	11.750	12.020	13	F14001200	110038
BLANK	TAPPED	1	-	-	46	F1400000T	130037
12	TAPPED	2	11.750	12.020	13	F14001200T	130038

Hardware



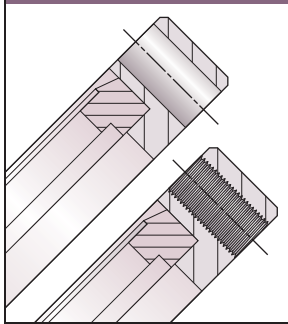
- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT ¹ HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 11.52 I.D.	-	-	10	4	GK-1400	191024
GASKET, COPPER, 11.52 I.D.	-	-	1	1	GK-1400I	191025
GASKET, FKM/FPM, 12.11 I.D.	-	-	1	1/4	GK-1400V	191026
HEX HEAD BOLT	C	3	30	4	BA-1000	190012
HEX HEAD BOLT	T	2	30	2	BA-1001	190013
HEX HEAD BOLT, SILVER PLATED ²	C	3	30	4	BA-1000-SP	190060
HEX HEAD BOLT, SILVER PLATED ²	T	2	30	2	BA-1001-SP	190065

¹ C = Clearance holes, T = Tapped holes

² Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	46	F1400000R	100037
12	CLEARANCE	4	11.750	12.020	13	F14001200R	100038
BLANK	TAPPED	3	-	-	46	F1400000RT	120037
12	TAPPED	4	11.750	12.020	13	F14001200RT	120038



Nonrotatable



Rotatable

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Tapped or clearance bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets, metal / elastomer	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal head
Nut Type	Hexagonal
Size	.375-24 UNF
Torque	26 lb-ft

Vacuum Range	1×10^{-13} Torr
---------------------	--------------------------

Temperature Range	-200°C to 450°C
--------------------------	-----------------

Weight	64 lb maximum
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Dimensions	16.50 OD x 13.750 ID maximum
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1

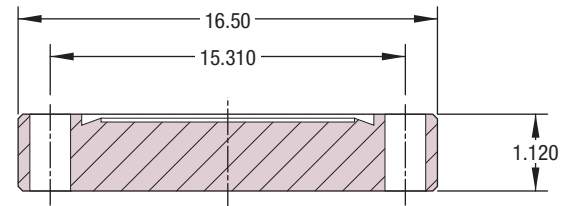


Figure 2

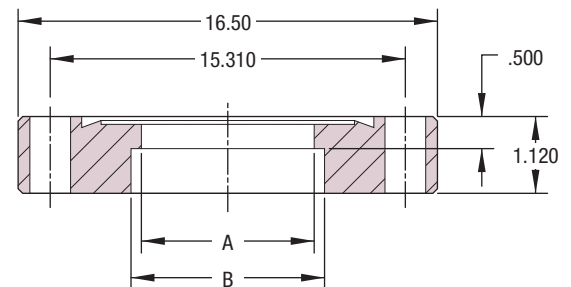


Figure 3

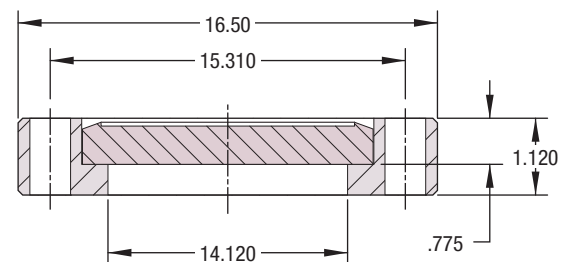
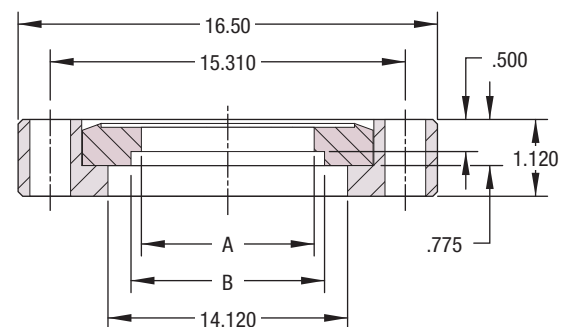
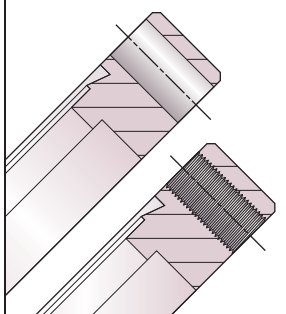


Figure 4



- Through hole flanges have 36 bolt holes drilled .390" diameter
- Tapped flanges have 36 bolt holes threaded .375-24

Nonrotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	1	-	-	64	F1650000	110039
14	CLEARANCE	2	13.750	14.020	18	F16501400	110040
BLANK	TAPPED	1	-	-	64	F1650000T	130039
14	TAPPED	2	13.750	14.020	18	F16501400T	130040

Hardware



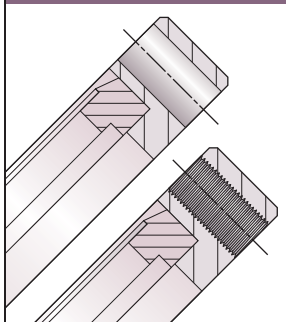
- Bolt Sets for clearance hole flanges include bolts, flat washers and nuts
- Bolt sets for tapped flanges include bolts and flat washers

DESCRIPTION	BOLT HOLE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
GASKET, COPPER, 14.11 I.D.	-	-	10	5	GK-1650	191027
GASKET, COPPER, 14.11 I.D.	-	-	1	1	GK-1650I	191028
GASKET, FKM / FPM, 14.60 I.D.	-	-	1	1	GK-1650V	191029
HEX HEAD BOLT	C	3	36	5	BA-1650	190015
HEX HEAD BOLT	T	2	36	3	BA-1002	190014
HEX HEAD BOLT, SILVER PLATED ²	C	3	36	5	BA-1650-SP	190068
HEX HEAD BOLT, SILVER PLATED ²	T	2	36	3	BA-1002-SP	190066

¹ C = Clearance holes, T = Tapped holes

² Silver plated bolts only; nuts and washers not silver plated

Rotatable



ID NOMINAL	BOLT HOLE	FIGURE	A	B	WT LB	REFERENCE	PART NUMBER
BLANK	CLEARANCE	3	-	-	64	F1650000R	100039
14	CLEARANCE	4	13.750	14.020	18	F16501400R	100040
BLANK	TAPPED	3	-	-	64	F1650000RT	120039
14	TAPPED	4	13.750	14.020	18	F16501400RT	120040



ULTRAHIGH VACUUM SERIES

Description

Del-Seal™ CF Double Sided Flanges are designed to be inserted between two flanges of the same size. This provides a simple method for adding thermocouple gauge tubes or up-to-air valves to a system with virtually no change in conductance and pumping speed. Refer to Section 3.4 for special purpose double sided flanges which are supplied with accessories attached. Additional applications include viewport shutters, butterfly valves and spacers. All Del-Seal™ CF Double Sided Flanges are made of 304ss material. Each assembly requires two gaskets and longer length bolts. MDC does not recommend stacking more than one double sided flange in a single assembly.

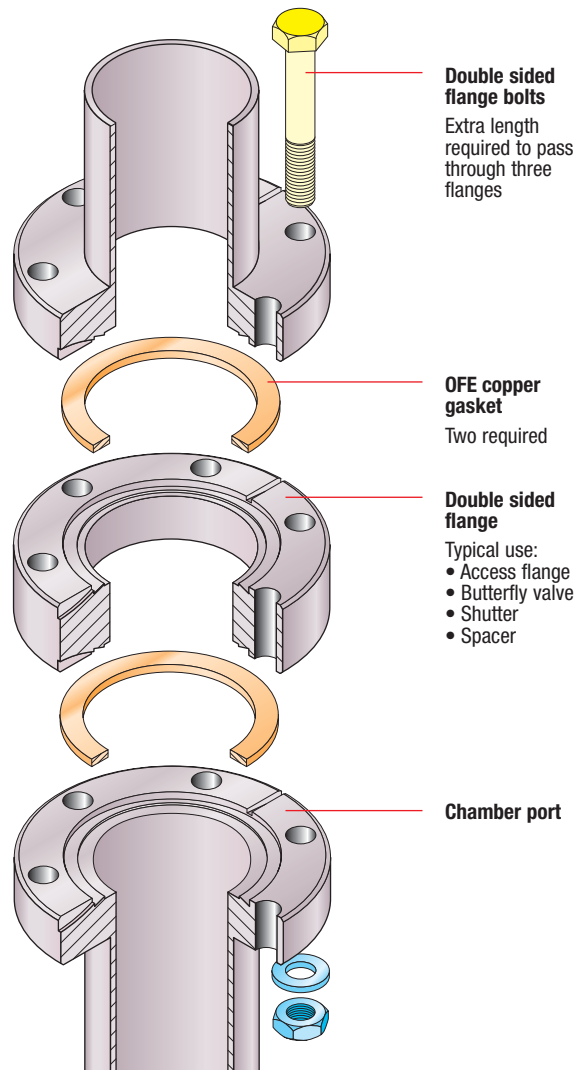
Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Nonrotatable geometry
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Clearance bolt holes on most flanges
- Conflat® compatible design

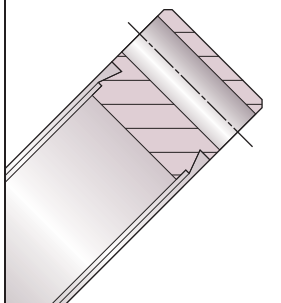
Specifications

Material	
Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated
Fastening	
Bolt Type	Hexagonal or socket head
Nut Type	Hexagonal
Size / Torque	8-32 UNC / 7 lb-ft .250-28 UNF / 12 lb-ft .312-24 UNF / 15 lb-ft .375-24 UNF / 26 lb-ft
Vacuum Range	1×10^{-13} Torr
Temperature Range	-200°C to 450°C
Weight and Dimensions	See table
See page 26 for elastomer specifications	

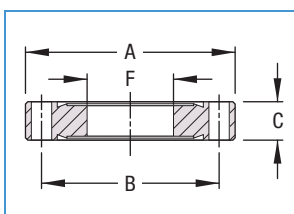
Double Sided Assembly



1-1/3" to 2-3/4"



- Bolt holes are clearance holes unless thread size is stated
- See Section 3.4 for double sided flanges with accessories attached



NOMINAL SIZE	A	B	C	F	NO. HOLES	HOLE SIZE	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	1.062	.285	BLANK	6	.172	1/2	FD-133000	140000
1-1/3	1.33	1.062	.285	.250	6	.172	1/2	FD-133025	140001
1-1/3	1.33	1.062	.285	.380	6	.172	1/2	FD-133037	140002
1-1/3	1.33	1.062	.285	.500	6	.172	1/2	FD-133050	140003

Leak check groove applied to one side only

2-1/8	2.11	1.625	.470	BLANK	4	.265	3/4	FD-218000	140004
2-1/8	2.11	1.625	.470	.750	4	.265	3/4	FD-218075	140005
2-1/8	2.11	1.625	.470	1.000	4	.265	3/4	FD-218100	140006

2-3/4	2.73	2.312	.750	BLANK	6	.265	3/4	FD-275000	140007
2-3/4	2.73	2.312	1.000	BLANK	6	.265	3/4	FD-275000-1	140043
2-3/4	2.73	2.312	.750	.250	6	.265	3/4	FD-275025	140008
2-3/4	2.73	2.312	.750	.500	6	.265	3/4	FD-275050	140009
2-3/4	2.73	2.312	.750	.750	6	.265	3/4	FD-275075	140010
2-3/4	2.73	2.312	.750	1.000	6	.265	3/4	FD-275100	140011
2-3/4	2.73	2.312	.750	1.250	6	.265	3/4	FD-275125	140012
2-3/4	2.73	2.312	.750	1.500	6	.265	3/4	FD-275150	140013
2-3/4	2.73	2.312	1.000	1.500	6	.265	3/4	FD-275150-1	140014

With tapped mounting holes				Thread					
2-3/4	2.73	2.312	.750	1.500	6	.250-28	3/4	FD-275150T	140041
2-3/4	2.73	2.312	1.000	1.500	6	.250-28	3/4	FD-275150T-1	140042

With NPT tapped radial holes				NPT	Thread				
2-3/4	2.73	2.312	.750	1.500	1	1/8-27	3/4	FD-275150-1H	420001
2-3/4	2.73	2.312	.750	1.500	2	1/8-27	3/4	FD-275150-2H	420002

Larger size flanges are found on the following two pages

Hardware

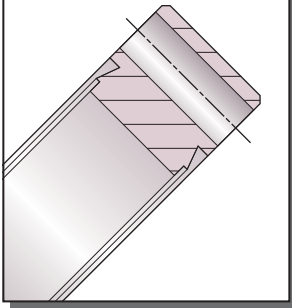


- Bolt Sets for clearance hole flanges include bolts, nuts and flat washers.

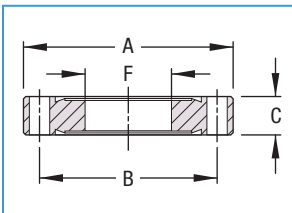
NOMINAL SIZE	HARDWARE DESCRIPTION	BOLT THREAD	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
1-1/3	GASKET, COPPER	-	-	10	1/4	GK-075	191000
1-1/3	GASKET, FKM / FPM	-	-	5	1/4	GK-075V	191001
1-1/3	SOCKET HEAD BOLT	8-32	1-1/4	6	1/4	BA-133D	190111
2-1/8	GASKET, COPPER	-	-	10	1/4	GK-100	191002
2-1/8	GASKET, FKM / FPM	-	-	5	1/4	GK-100V	191003
2-1/8	HEX HEAD BOLT	.250-28	2	4	1/4	BA-218D	190112
2-3/4	GASKET, COPPER	-	-	10	1/2	GK-150	191004
2-3/4	GASKET, COPPER BLANK	-	-	10	1/2	GK-150S	191006
2-3/4	GASKET, FKM / FPM	-	-	5	1/4	GK-150V	191005
2-3/4	HEX HEAD BOLT	.250-28	2-1/4	6	1	BA-275D	190113

Continued on next two pages

3-3/8" to 6-3/4"



- Bolt holes are clearance holes unless thread size is stated



NOMINAL SIZE	A	B	C	F	NO. HOLES	HOLE SIZE	WT LB	REFERENCE	PART NUMBER
3-3/8	3.37	2.850	.620	BLANK	8	.332	1-1/2	FD-338000	140015
3-3/8	3.37	2.850	.620	1.500	8	.332	1	FD-338150	140016
3-3/8	3.37	2.850	.620	2.000	8	.332	1	FD-338200	140017
4-1/2	4.47	3.628	.680	BLANK	8	.332	3	FD-450000	140018
4-1/2	4.47	3.628	.680	1.500	8	.332	2-1/2	FD-450150	140019
4-1/2	4.47	3.628	.680	2.000	8	.332	2	FD-450200	140020
4-1/2	4.47	3.628	.680	2.500	8	.332	2	FD-450250	140021
4-5/8	4.62	4.030	.750	BLANK	10	.332	3-1/2	FD-458000	140022
4-5/8	4.62	4.030	.750	2.500	10	.332	2-1/2	FD-458250	140023
4-5/8	4.62	4.030	.750	3.000	10	.332	2	FD-458300	140024
6	5.97	5.128	.780	BLANK	16	.332	5-1/2	FD-600000	140025
6	5.97	5.128	.780	4.000	16	.332	3-1/2	FD-600400	140026
6-3/4	6.75	5.969	.840	BLANK	18	.332	8	FD-675000	140027
6-3/4	6.75	5.969	.840	4.000	18	.332	5	FD-675400	140028
6-3/4	6.75	5.969	.840	5.000	18	.332	3-1/2	FD-675500	140029

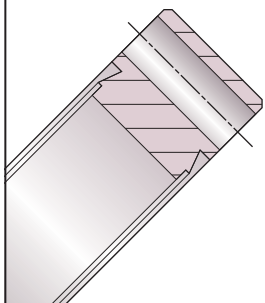
Hardware



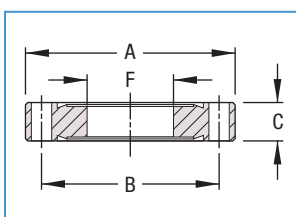
- Bolt Sets for clearance hole flanges include bolts, nuts and flat washers

NOMINAL SIZE	HARDWARE DESCRIPTION	BOLT THREAD	LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
3-3/8	GASKET, COPPER	-	-	10	1/2	GK-200	191007
3-3/8	GASKET, FKM / FPM	-	-	1	1/4	GK-200V	191008
3-3/8	HEX HEAD BOLT	.312-24	2-1/4	8	3/4	BA-338D	190114
4-1/2	GASKET, COPPER	-	-	10	1	GK-250	191009
4-1/2	GASKET, FKM / FPM	-	-	1	1/4	GK-250V	191010
4-1/2	HEX HEAD BOLT	.312-24	2-1/2	8	3/4	BA-450D	190115
4-5/8	GASKET, COPPER	-	-	10	1	GK-300	191011
4-5/8	GASKET, FKM / FPM	-	-	1	1/4	GK-300V	191012
4-5/8	HEX HEAD BOLT	.312-24	2-3/4	10	1	BA-458D	190116
6	GASKET, COPPER	-	-	10	1-1/2	GK-400	191013
6	GASKET, FKM / FPM	-	-	1	1/4	GK-400V	191014
6	HEX HEAD BOLT	.312-24	2-3/4	16	2	BA-600D	190117
6-3/4	GASKET, COPPER	-	-	10	1-1/2	GK-500	191015
6-3/4	GASKET, FKM / FPM	-	-	1	1/4	GK-500V	191016
6-3/4	HEX HEAD BOLT	.312-24	3	18	2-1/2	BA-675D	190118

8" to 16-1/2"



- Bolt holes are clearance holes unless thread size is stated



NOMINAL SIZE	A	B	C	F	NO. HOLES	HOLE SIZE	WT LB	REFERENCE	PART NUMBER
8	7.97	7.128	.870	BLANK	20	.332	12	FD-800000	140030
8	7.97	7.128	.870	6.000	20	.332	5-1/2	FD-800600	140031
10	9.97	9.128	.970	BLANK	24	.332	20	FD-1000000	140032
10	9.97	9.128	.970	8.000	24	.332	7-1/2	FD-1000800	140033
13-1/4	13.25	12.060	1.120	BLANK	30	.390	41	FD-1325000	140034
13-1/4	13.25	12.060	1.120	10.000	30	.390	18	FD-13251000	140035
13-1/4	13.25	12.060	1.120	10.750	30	.390	14-1/2	FD-13251075	140036
14	14.00	12.810	1.120	BLANK	30	.390	46	FD-14000000	140037
14	14.00	12.810	1.120	12.000	30	.390	13	FD-14001200	140038
16-1/2	16.50	15.310	1.120	BLANK	36	.390	64	FD-1650000	140039
16-1/2	16.50	15.310	1.120	14.000	36	.390	18-1/2	FD-16501400	140040

Hardware



- Bolt Sets for clearance hole flanges include bolts, nuts and flat washers

NOMINAL SIZE	HARDWARE DESCRIPTION	BOLT THREAD	LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
8	GASKET, COPPER	-	-	10	2	GK-600	191017
8	GASKET, FKM / FPM	-	-	1	1/4	GK-600V	191018
8	HEX HEAD BOLT	.312-24	3-1/4	20	3	BA-800D	190119
10	GASKET, COPPER	-	-	10	2-1/2	GK-800	191019
10	GASKET, FKM / FPM	-	-	1	1/4	GK-800V	191020
10	HEX HEAD BOLT	.312-24	3-1/2	24	3	BA-1000D	190120
13-1/4	GASKET, COPPER	-	-	10	3-1/2	GK-1325	191021
13-1/4	GASKET, COPPER	-	-	1	1/4	GK-1325I	191022
13-1/4	GASKET, FKM / FPM	-	-	1	1/4	GK-1325V	191023
13-1/4	HEX HEAD BOLT	.375-24	4	30	3-1/2	BA-1001D	190121
14	GASKET, COPPER	-	-	10	4	GK-1400	191024
14	GASKET, COPPER	-	-	1	1/4	GK-1400I	191025
14	GASKET, FKM / FPM	-	-	1	1/4	GK-1400V	191026
	HEX HEAD BOLT	.375-24	4	30	3-1/2	BA-1001D	190121
16-1/2	GASKET, COPPER	-	-	10	5	GK-1650	191027
16-1/2	GASKET, COPPER	-	-	1	1/4	GK-1650I	191028
16-1/2	GASKET, FKM / FPM	-	-	1	1/4	GK-1650V	191029
16-1/2	HEX HEAD BOLT	.375-24	4	36	4	BA-1650D	190122



Del-Seal to Del-Seal Zero Length Reducers

For ASA TO Del-Seal Adapters, see page 151

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Nonrotatable geometry
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Clearance and blind-tapped bolt holes
- Conflat® compatible design

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal or socket head
Nut Type	Hexagonal
Size / Torque	.160-32 UNC / 7 lb-ft
	.250-28 UNF / 12 lb-ft
	.312-24 UNF / 15 lb-ft
	.375-24 UNF / 26 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
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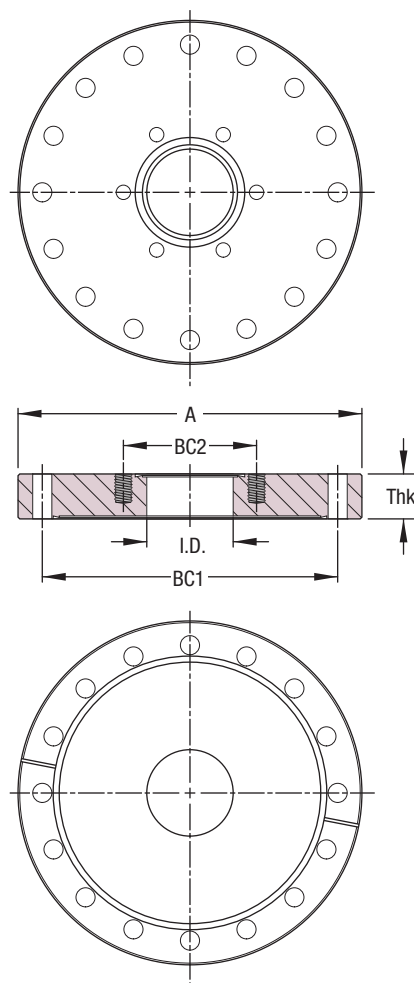
Weight and Dimensions	See table
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Description

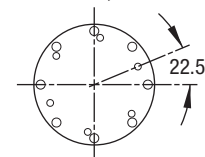
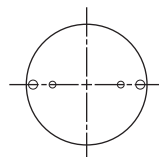
Zero length reducers are used for a change in size of flanges within the Del-Seal™ CF family. “Zero length” means the total thickness of a unit is the thickness of one flange only. Non-zero-length reducers, on page 65, may have straight or conical sections between flanges. Hybrid adapters are used for a change in method of sealing, such as Del-Seal™ CF to ISO, and are found in Section 1.5, page 148.



Orientation of Bolt Hole Centerlines

Four holes will be aligned on one centerline...

...except on Reference 338x275T¹, below.



¹ Flanges referenced with a T indicate tapped holes on the larger flange as well as on the smaller flange

Del-Seal™ CF Flanges

Zero Length Reducers

Section 1.1

MAIN FLANGE	REDUCER FLANGE	A	I.D.	THK	BC1	TAPPED HOLES BC2	THREAD	DEPTH	WT LB	REFERENCE	PART NUMBER
2-1/8	1-1/3	2.11	.62	.470	1.625 T ¹	1.062	8-32	1/4	1/2	218x133T	150000
2-3/4	1-1/3	2.73	.62	.500	2.312	1.062	8-32	1/4	3/4	275x133	150001
2-3/4	2-1/8	2.73	1.00	.500	2.312 T ¹	1.625	.250-28	5/16	1/2	275x218T	150002
3-3/8	1-1/3	2.73	.62	.620	2.850	1.062	8-32	3/8	1-1/2	338x133	150003
3-3/8	2-1/8	3.37	1.00	.620	2.850	1.625	.250-28	3/8	1-1/2	338x218	150004
3-3/8	2-3/4	3.37	1.50	.620	2.850 T ¹	2.312	.250-28	3/8	1	338x275T	150005
4-1/2	1-1/3	4.47	.62	.680	3.628	1.062	8-32	3/8	3	450x133	150006
4-1/2	2-1/8	4.47	1.00	.680	3.628	1.625	.250-28	1/2	3	450x218	150007
4-1/2	2-3/4	4.47	1.50	.680	3.628	2.312	.250-28	1/2	2-1/2	450x275	150008
4-1/2	3-3/8	4.47	2.00	.680	3.628 T ¹	2.850	.312-24	1/2	2-1/2	450x338T	150009
4-5/8	1-1/3	4.62	.62	.750	4.030	1.062	8-32	3/8	3-1/2	458x133	150010
4-5/8	2-1/8	4.62	1.00	.750	4.030	1.625	.250-28	1/2	3	458x218	150011
4-5/8	2-3/4	4.62	1.50	.750	4.030	2.312	.250-28	1/2	3	458x275	150012
4-5/8	3-3/8	4.62	2.00	.750	4.030	2.850	.312-24	1/2	2-1/2	458x338	150013
6	1-1/3	5.97	.62	.780	5.128	1.062	8-32	3/8	6	600x133	150014
6	2-1/8	5.97	1.00	.780	5.128	1.625	.250-28	1/2	5-1/2	600x218	150015
6	2-3/4	5.97	1.50	.780	5.128	2.312	.250-28	1/2	5-1/2	600x275	150016
6	3-3/8	5.97	2.00	.780	5.128	2.850	.312-24	1/2	5	600x338	150017
6	4-1/2	5.97	2.50	.780	5.128	3.628	.312-24	1/2	4-1/2	600x450	150018
6	4-5/8	5.97	3.00	.780	5.128	4.030	.312-24	1/2	4	600x458	150019
6-3/4	1-1/3	6.75	.62	.840	5.969	1.062	8-32	3/8	8	675x133	150020
6-3/4	2-1/8	6.75	1.00	.840	5.969	1.625	.250-28	1/2	8	675x218	150021
6-3/4	2-3/4	6.75	1.50	.840	5.969	2.312	.250-28	1/2	7-1/2	675x275	150022
6-3/4	3-3/8	6.75	2.00	.840	5.969	2.850	.312-24	1/2	7	675x338	150023
6-3/4	4-1/2	6.75	2.50	.840	5.969	3.628	.312-24	1/2	6-1/2	675x450	150024
6-3/4	4-5/8	6.75	3.00	.840	5.969	4.030	.312-24	1/2	6	675x458	150025
6-3/4	6	6.75	4.00	.840	5.969 T ¹	5.128	.312-24	1/2	5	675x600T	150026
8	1-1/3	7.97	.62	.880	7.128	1.062	8-32	3/8	12	800x133	150027
8	2-1/8	7.97	1.00	.880	7.128	1.625	.250-28	5/8	12	800x218	150028
8	2-3/4	7.97	1.50	.880	7.128	2.312	.250-28	5/8	11-1/2	800x275	150029
8	3-3/8	7.97	2.00	.880	7.128	2.850	.312-24	5/8	11	800x338	150030
8	4-1/2	7.97	2.50	.880	7.128	3.628	.312-24	5/8	10-1/2	800x450	150031
8	4-5/8	7.97	3.00	.880	7.128	4.030	.312-24	5/8	10	800x458	150032
8	6	7.97	4.00	.880	7.128	5.128	.312-24	5/8	8-1/2	800x600	150033
8	6-3/4	7.97	5.00	.880	7.128 T ¹	5.969	.312-24	5/8	7-1/2	800x675T	150034
10	1-1/3	9.97	.62	.970	9.128	1.062	8-32	3/8	20	1000x133	150035
10	2-1/8	9.97	1.00	.970	9.128	1.625	.250-28	5/8	20	1000x218	150036
10	2-3/4	9.97	1.50	.970	9.128	2.312	.250-28	5/8	20	1000x275	150037
10	3-3/8	9.97	2.00	.970	9.128	2.850	.312-24	5/8	20	1000x338	150038
10	4-1/2	9.97	2.50	.970	9.128	3.628	.312-24	5/8	18-1/2	1000x450	150039
10	4-5/8	9.97	3.00	.970	9.128	4.030	.312-24	5/8	18-1/2	1000x458	150040
10	6	9.97	4.00	.970	9.128	5.128	.312-24	5/8	17	1000x600	150041
10	6-3/4	9.97	5.00	.970	9.128	5.969	.312-24	5/8	17	1000x675	150042
10	8	9.97	6.00	.970	9.128	7.128	.312-24	5/8	15-1/2	1000x800	150043
13-1/4	1-1/3	13.25	.62	1.120	12.060	1.062	8-32	3/8	41	1325x133	150044
13-1/4	2-1/8	13.25	1.00	1.120	12.060	1.625	.250-28	3/4	41	1325x218	150045
13-1/4	2-3/4	13.25	1.50	1.120	12.060	2.312	.250-28	3/4	41	1325x275	150046
13-1/4	3-3/8	13.25	2.00	1.120	12.060	2.850	.312-24	3/4	40	1325x338	150047
13-1/4	4-1/2	13.25	2.50	1.120	12.060	3.628	.312-24	3/4	39	1325x450	150048
13-1/4	4-5/8	13.25	3.00	1.120	12.060	4.030	.312-24	3/4	39	1325x458	150049
13-1/4	6	13.25	4.00	1.120	12.060	5.128	.312-24	3/4	37	1325x600	150050
13-1/4	6-3/4	13.25	5.00	1.120	12.060	5.969	.312-24	3/4	37	1325x675	150051
13-1/4	8	13.25	6.00	1.120	12.060	7.128	.312-24	3/4	34	1325x800	150052
13-1/4	10	13.25	8.00	1.120	12.060	9.128	.312-24	3/4	30	1325x1000	150053



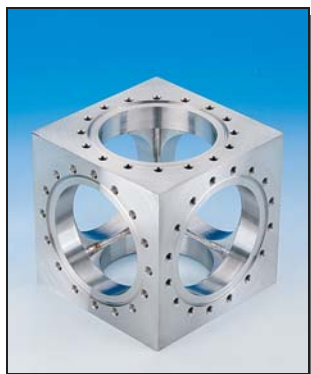
90° Del-Seal CF Elbows page 66



Del-Seal CF Reducing Cross page 71



Del-Seal CF 5-Way Cross page 72



Del-Seal CF 6-Way Cube page 73

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Rotatable and nonrotatable geometries
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Clearance bolt holes
- Conflat® compatible design
- Standard matte finish

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss and 300ss silver plated

Fastening

Bolt Type	Hexagonal, 12-point or socket head
Nut Type	Hexagonal or two hole plate nuts
Size / Torque	See individual flange specs, Section 1.1

Vacuum

Range	1×10^{-13} Torr
Leak Test	2×10^{-10} cc/sec of He

Temperature Range	-200°C to 450°C
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Weight and Dimensions	See table
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Description

MDC Del-Seal™ CF Tube Fittings are convenient “building-block” components. They offer great flexibility in the design and construction of high and ultrahigh vacuum systems. All fittings are fabricated from type 304 stainless steel drawn and welded vacuum tubing. To facilitate assembly alignment, a rotatable flange is supplied opposite a nonrotatable flange on each axis. Elbows are supplied with two rotatable flanges.

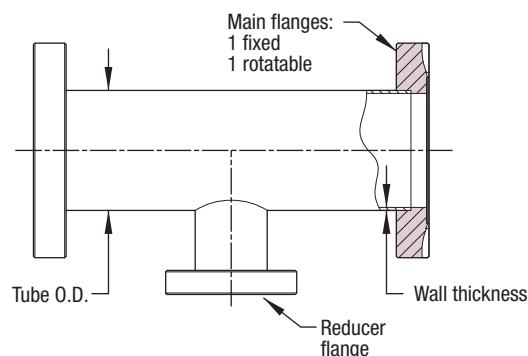
In general, reducers are used for a change in size of flanges within a single method of sealing, such as Del-Seal™ CF to Del-Seal™ CF. Reducers may be either zero length or include a section of tubing between flanges. Zero length Del-Seal™ CF reducers are on page 60.

Non-zero-length reducers are also called nipple reducers and have either a straight tube or a conical section between flanges. Nipple and conical reducers are on page 65.

In general, hybrid adapters provide a transition between two different methods of creating a vacuum seal, such as metal seal CF to elastomer seal ISO. Common configurations of Del-Seal™ CF to various other vacuum connections are listed in Section 1.5, Hybrid Adapters, beginning on page 148.

Reducing tees and crosses have a single main tube with main flanges and a smaller diameter reducer tube with a reducer flange or flanges.

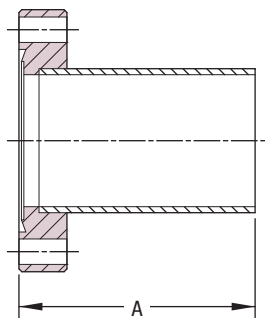
Fittings Parts Identification Tee Reducer Example



- Main flanges are on the larger tube
- Reducer flange is on the smaller tube
- In general, each axis includes one rotatable and one nonrotatable flange
- Tubes are specified by outer diameter (O.D.) and wall thickness

All dimensions in this catalog are given in inches unless specified otherwise.

Half Nipple

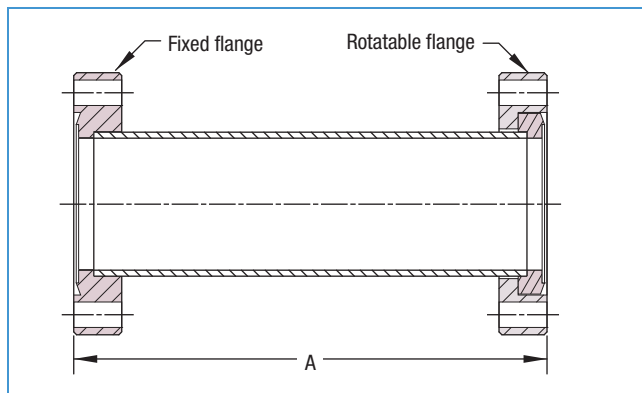


- Weldable fitting
- Full range of clearance or tapped holes, fixed or rotatable Del-Seal™ CF flange
- Custom lengths available

NOMINAL FLANGE	FLANGE O.D.	FLANGE CONFIG. ¹	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	NR	.75	.035	1.50	1/2	075-1	401000
1-1/3	1.33	T	.75	.035	1.50	1/2	075-1T	401021
1-1/3	1.33	R	.75	.035	1.50	1/2	075-1R	401020
1-1/3	1.33	RT	.75	.035	1.50	1/2	075-1RT	401027
2-1/8	2.11	NR	1.00	.065	2.04	1/2	100-1	401001
2-1/8	2.11	T	1.00	.065	2.04	1/2	100-1T	401030
2-1/8	2.11	R	1.00	.065	2.04	1/2	100-1R	401031
2-1/8	2.11	RT	1.00	.065	2.04	1/2	100-1RT	401032
2-3/4	2.73	NR	1.50	.065	2.46	1	150-1	401002
2-3/4	2.73	T	1.50	.065	2.46	1	150-1T	401023
2-3/4	2.73	R	1.50	.065	2.46	1	150-1R	401022
2-3/4	2.73	RT	1.50	.065	2.46	1	150-1RT	401028
3-3/8	3.37	NR	2.00	.065	3.21	1-1/2	200-1	401003
3-3/8	3.37	T	2.00	.065	3.21	1-1/2	200-1T	401033
3-3/8	3.37	R	2.00	.065	3.21	1-1/2	200-1R	401034
3-3/8	3.37	RT	2.00	.065	3.21	1-1/2	200-1RT	401035
4-1/2	4.47	NR	2.50	.065	4.12	3	250-1	401004
4-1/2	4.47	T	2.50	.065	4.12	3	250-1T	401025
4-1/2	4.47	R	2.50	.065	4.12	3	250-1R	401024
4-1/2	4.47	RT	2.50	.065	4.12	3	250-1RT	401029
4-5/8	4.62	NR	3.00	.065	3.53	3	300-1	401005
4-5/8	4.62	T	3.00	.065	3.53	3	300-1T	401036
4-5/8	4.62	R	3.00	.065	3.53	3	300-1R	401037
4-5/8	4.62	RT	3.00	.065	3.53	3	300-1RT	401038
6	5.97	NR	4.00	.083	5.31	4	400-1	401006
6	5.97	T	4.00	.083	5.31	4	400-1T	401039
6	5.97	R	4.00	.083	5.31	4	400-1R	401026
6	5.97	RT	4.00	.083	5.31	4	400-1RT	401040
6-3/4	6.75	NR	5.00	.083	4.93	5	500-1	401007
6-3/4	6.75	T	5.00	.083	4.93	5	500-1T	401041
6-3/4	6.75	R	5.00	.083	4.93	5	500-1R	401042
6-3/4	6.75	RT	5.00	.083	4.93	5	500-1RT	401043
8	7.97	NR	6.00	.120	6.56	7-1/2	600-1	401008
8	7.97	T	6.00	.120	6.56	7-1/2	600-1T	401044
8	7.97	R	6.00	.120	6.56	7-1/2	600-1R	401045
8	7.97	RT	6.00	.120	6.56	7-1/2	600-1RT	401046
10	9.97	NR	8.00	.120	8.00	11	800-1	401009
13-1/4	13.25	NR	10.00	.120	10.00	28	1000-1	401010

¹ NR = Non-Rotatable, T = Tapped holes, R = Rotatable, RT = Rotatable Tapped

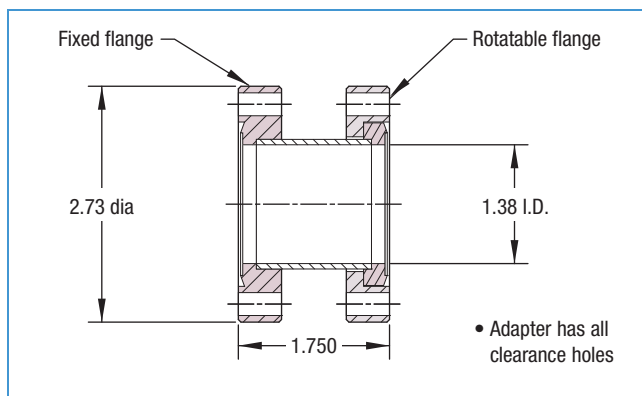
Nipple



- Coupling to mate two identical size Del-Seal™ CF flanges
- Includes one rotatable and one nonrotatable Del-Seal™ CF flanges
- Custom lengths available

NOMINAL FLANGE	FLANGE O.D.	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	.75	.035	3.00	1/2	075-2	402000
2-1/8	2.11	1.00	.065	4.08	1	100-2	402001
2-3/4	2.73	1.50	.065	4.93	1-1/2	150-2	402002
3-3/8	3.37	2.00	.065	6.45	2-1/2	200-2	402003
4-1/2	4.47	2.50	.065	8.25	3	250-2	402004
4-5/8	4.62	3.00	.065	7.08	5-1/2	300-2	402005
6	5.97	4.00	.083	10.62	9-1/2	400-2	402006
6-3/4	6.75	5.00	.083	9.87	11	500-2	402007
8	7.97	6.00	.120	13.12	16	600-2	402008
10	9.97	8.00	.120	16.00	27-1/2	800-2	402009
13-1/4	13.25	10.00	.120	20.00	58	1000-2	402010

Minimum Length

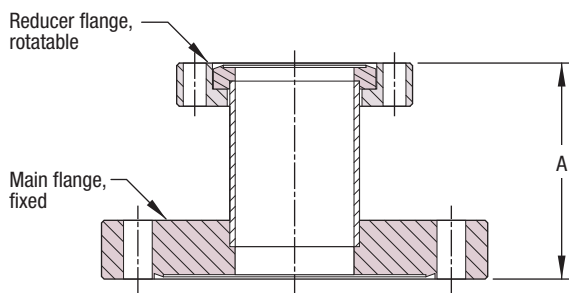


- Special nipple to mate two tapped flanges
- 2-3/4" Del-Seal™ CF flanged nipple mounts between two tapped flanges with minimum spacing
- Includes 12 each .250-28 threaded studs, nuts and washers

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
TAPPED FLANGE ADAPTER WITH MOUNTING HARDWARE	2	TFA-1	468008

The Tapped Flange Adapter is a nipple with a minimum length for mating two tapped flanges. Studs must be screwed into each tapped flange prior to installing the adapter. The Tapped Flange Adapter has clearance holes on each flange which slip over the studs. Nuts are then screwed onto the studs to complete the installation. Studs, nuts and washers are provided with the adapter.

Straight Tube

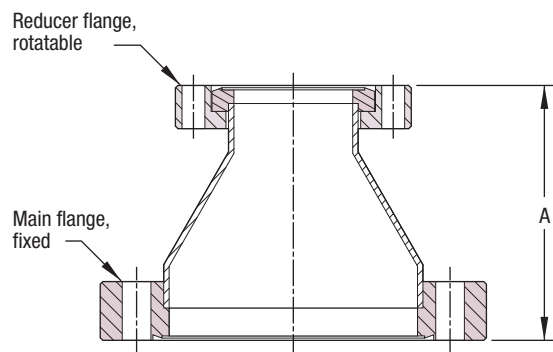


- For Del-Seal™ CF to Del-Seal™ CF connections of different size flanges
- Smaller flange is rotatable
- Zero-length reducers, see page 60
- Hybrid Adapters for Del-Seal™ CF to non-Del-Seal™ CF connections are found in Section 1.5

MAIN FLANGE NOM.	O.D.	REDUCER FLANGE NOM.	O.D.	TUBE O.D.	WALL	A	WT LB
2-3/4	2.73	1-1/3	1.33	.75	.035	2.50	1
3-3/8	3.37	2-3/4	2.73	1.50	.065	2.50	2-1/2
4-1/2	4.47	2-3/4	2.73	1.50	.065	2.50	3-1/2
6	5.97	2-3/4	2.73	1.50	.065	2.50	6
6	5.97	4-1/2	4.47	2.50	.065	2.50	7
8	7.97	2-3/4	2.73	1.50	.065	2.50	12
8	7.97	4-1/2	4.47	2.50	.065	2.50	14
8	7.97	6	5.97	4.00	.083	2.50	16

REFERENCE	PART NUMBER
F275075-1R	402011
F338150-1R	402012
F450150-1R	402013
F600150-1R	402014
F600250-1R	402015
F800150-1R	402016
F800250-1R	402017
F800400-1R	402018

Conical

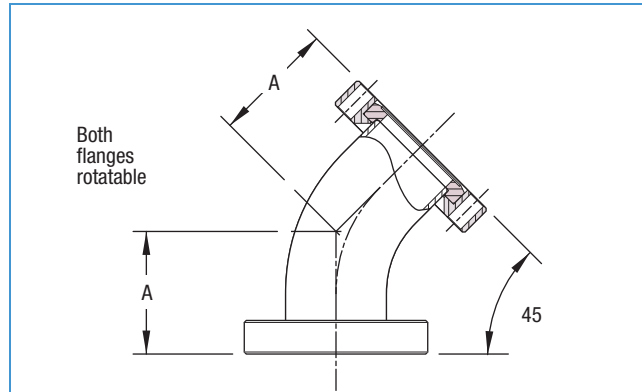
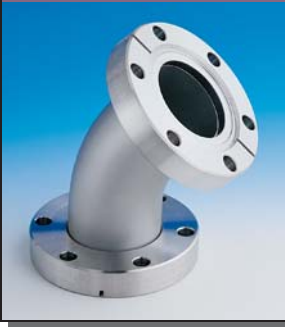


- For Del-Seal™ CF to Del-Seal™ CF connections of different size flanges
- Smaller flange is rotatable
- Zero-length reducers, see page 60
- Hybrid Adapters for Del-Seal™ CF to non-Del-Seal™ CF connections are found in Section 1.5

MAIN FLANGE NOM.	O.D.	REDUCER FLANGE NOM.	O.D.	CONICAL SECTION DIA.	WALL	A	WT LB
2-3/4	2.73	1-1/3	1.33	1.50 - .75	.065	3.08	1-1/2
2-3/4	2.73	2-1/8	2.11	1.50 - 1.00	.065	2.75	2
3-3/8	3.37	2-3/4	2.73	2.00 - 1.50	.065	2.80	3
4-1/2	4.47	2-3/4	2.73	2.50 - 1.50	.065	2.95	4
4-1/2	4.47	3-3/8	3.37	2.50 - 2.00	.065	2.97	5
4-5/8	4.62	2-3/4	2.73	3.00 - 1.50	.065	4.20	5
4-5/8	4.62	3-3/8	3.37	3.00 - 2.00	.065	4.22	6
4-5/8	4.62	4-1/2	4.47	3.00 - 2.50	.065	4.37	7
6	5.97	3-3/8	3.37	4.00 - 2.00	.065	4.28	8
6	5.97	4-1/2	4.47	4.00 - 2.50	.065	4.43	9
6	5.97	4-5/8	4.62	4.00 - 3.00	.065	4.43	10
8	7.97	6	5.97	6.00 - 4.00	.120	9.79	15

REFERENCE	PART NUMBER
FCR275-133	402030
FCR275-218	402041
FCR338-275	402031
FCR450-275	402032
FCR450-338	402033
FCR458-275	402034
FCR458-338	402035
FCR458-450	402036
FCR600-338	402037
FCR600-450	402038
FCR600-458	402039
FCR800-600	402040

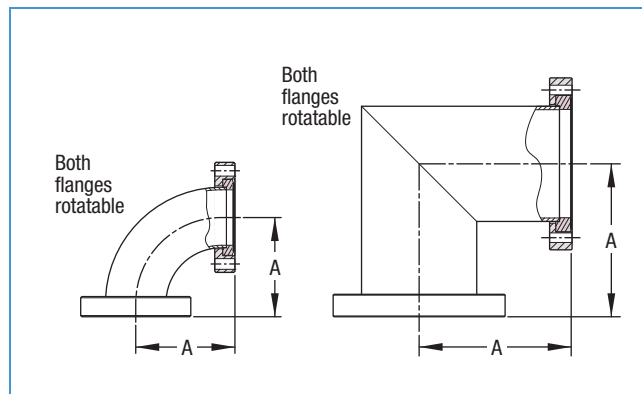
45° with Tangents



Radiussed tube

NOMINAL FLANGE	FLANGE O.D.	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	.75	.035	1.26	1/2	075-45L	403029
2-1/8	2.11	1.00	.065	1.36	1	100-45L	403030
2-3/4	2.73	1.50	.065	1.83	1-1/2	150-45L	403031
3-3/8	3.37	2.00	.065	2.54	3-1/2	200-45L	403032
4-1/2	4.47	2.50	.065	3.38	5	250-45L	403033
4-5/8	4.62	3.00	.065	4.06	6	300-45L	403034
6	5.97	4.00	.083	5.25	10	400-45L	403035

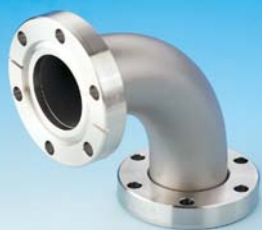
90 Degree



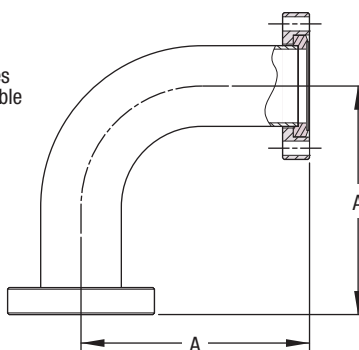
Radiussed or mitered tube

NOMINAL FLANGE	FLANGE O.D.	BEND TYPE	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	RADIUS	.75	.035	1.63	1/2	075-2L	403000
2-1/8	2.11	RADIUS	1.00	.065	1.67	1	100-2L	403036
2-3/4	2.73	RADIUS	1.50	.065	2.46	1-1/2	150-2L	403002
3-3/8	3.37	RADIUS	2.00	.065	3.23	3-1/2	200-2L	403003
4-1/2	4.47	RADIUS	2.50	.065	4.13	5	250-2L	403004
4-5/8	4.62	RADIUS	3.00	.065	4.88	5-1/2	300-2LR	403037
4-5/8	4.62	MITER	3.00	.120	3.53	6	300-2LM	403005
6	5.97	RADIUS	4.00	.083	6.44	11	400-2LR	403038
6	5.97	MITER	4.00	.120	5.31	11-1/2	400-2LM	403006
6-3/4	6.75	MITER	5.00	.120	4.93	11	500-2LM	403007
8	7.97	RADIUS	6.00	.109	9.50	19	600-2LR	403039
8	7.97	MITER	6.00	.120	6.56	19-1/2	600-2LM	403008
10	9.97	MITER	8.00	.120	8.00	27	800-2LM	403009
13-1/4	13.25	MITER	10.00	.120	10.00	56	1000-2LM	403010

90° with Tangents



Both
flanges
rotatable



Radiussed tube

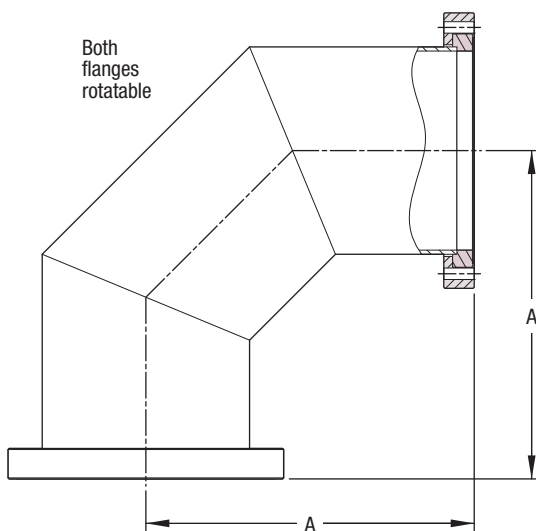
NOMINAL FLANGE	FLANGE O.D.	TUBE O.D.	TUBE WALL	A	WT LB
1-1/3	1.33	.75	.035	1.92	3/4
2-1/8	2.11	1.00	.065	2.23	1-1/2
2-3/4	2.73	1.50	.065	3.15	2-1/2
3-3/8	3.37	2.00	.065	4.29	3
4-1/2	4.47	2.50	.065	5.57	5
4-5/8	4.62	3.00	.065	6.69	6
6	5.97	4.00	.083	8.75	12

REFERENCE	PART NUMBER
075-2LL	403040
100-2LL	403041
150-2LL	403042
200-2LL	403043
250-2LL	403044
300-2LL	403045
400-2LL	403046

High Conductance



Both
flanges
rotatable

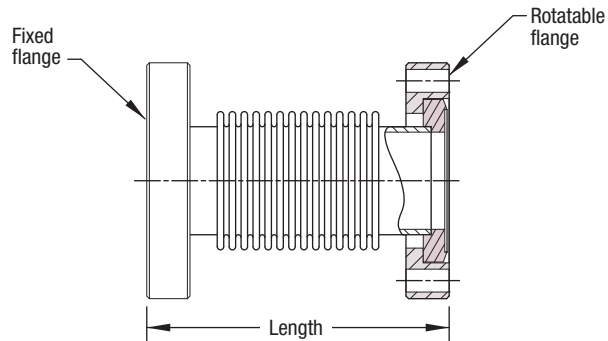


Mitered tube

NOMINAL FLANGE	FLANGE O.D.	TUBE O.D.	TUBE WALL	A	WT LB
8	7.97	6.00	.120	9.50	23
10	9.97	8.00	.120	12.50	31
13-1/4	13.25	10.00	.120	15.50	43

REFERENCE	PART NUMBER
600-2L-HC	403011
800-2L-HC	403012
1000-2L-HC	403013

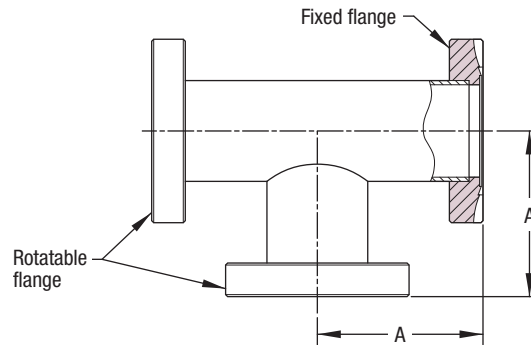
Flexible Coupling



- Used for short misalignment connections
- Also used in Gimbal Assemblies, *see page 441*

FLANGE NOM.	FLANGE O.D.	BELLOWS I.D.	WALL THK	FREE LENGTH	COMPR'D LENGTH	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	.50	.006	3.00	2.62	1/2	075-X	400000
1-1/3	1.33	.50	.006	10.00	-	1/2	075-X-10	400001
2-1/8	2.11	.75	.006	3.44	3.06	1	100-X	400002
2-3/4	2.73	1.25	.006	3.50	3.10	1	150-X	400003
3-3/8	3.37	1.62	.006	4.00	3.50	1-1/2	200-X	400004
4-1/2	4.47	2.00	.006	6.25	5.50	4	250-X	400005
4-5/8	4.62	2.50	.008	7.25	6.50	4	300-X	400006
6	5.97	3.50	.008	7.62	6.62	7	400-X	400007
6-3/4	6.75	4.00	.008	8.00	7.00	10	500-X	400008
8	7.97	5.50	.010	9.00	8.00	12	600-X	400009
10	9.97	7.50	.012	10.00	9.00	22	800-X	400010
13-1/4	13.25	10.00	.012	11.00	10.00	50	1000-X	400011

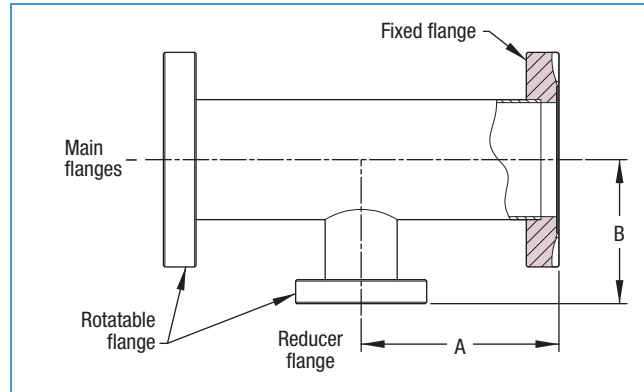
Tee



- Each axis has one rotatable flange

NOMINAL FLANGE	FLANGE O.D.	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	.75	.035	1.50	1/2	075-3	404000
2-1/8	2.11	1.00	.065	2.04	1-1/2	100-3	404001
2-3/4	2.73	1.50	.065	2.46	2	150-3	404002
3-3/8	3.37	2.00	.065	3.23	4	200-3	404003
4-1/2	4.47	2.50	.065	3.38	8	250-3	404038
4-5/8	4.62	3.00	.065	3.63	9	300-3	404039
6	5.97	4.00	.083	4.31	15	400-3	404040
6-3/4	6.75	5.00	.120	4.93	16	500-3	404007
8	7.97	6.00	.109	6.12	25	600-3	404041
10	9.97	8.00	.109	7.50	26	800-3	404042
13-1/4	13.25	10.00	.120	10.00	38	1000-3	404010

Reducing Tees



- Del-Seal™ CF to Del-Seal™ CF connections of different size flanges
- Each axis has one rotatable flange

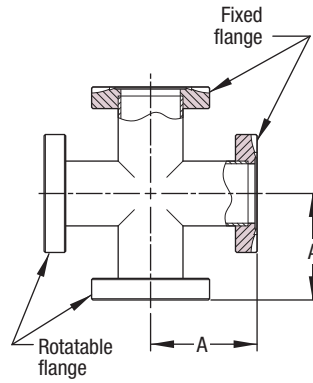
MAIN FLANGES				REDUCER FLANGE				WT LB
NOM.	TUBE	WALL	A	NOM.	TUBE	WALL	B	
2-1/8	1.00	.065	2.04	1-1/3	.75	.035	2.50	1-1/2
2-3/4	1.50	.065	2.46	1-1/3	.75	.035	2.75	2
2-3/4	1.50	.065	2.46	2-1/8	1.00	.065	2.30	2
3-3/8	2.00	.065	3.23	1-1/3	.75	.035	2.13	2-1/2
3-3/8	2.00	.065	3.23	2-1/8	1.00	.065	2.55	3
3-3/8	2.00	.065	3.23	2-3/4	1.50	.065	2.71	3-1/2
4-1/2	2.50	.065	3.38	2-3/4	1.50	.065	2.46	3-1/2
4-1/2	2.50	.065	3.38	3-3/8	2.00	.065	3.48	4-1/2
4-5/8	3.00	.065	3.63	2-3/4	1.50	.065	3.21	6
4-5/8	3.00	.065	3.63	3-3/8	2.00	.065	3.48	7
4-5/8	3.00	.065	3.63	4-1/2	2.50	.065	3.63	8-1/2
6	4.00	.083	4.31	3-3/8	2.00	.065	4.23	10
6	4.00	.083	4.31	4-1/2	2.50	.065	4.13	11
6	4.00	.083	4.31	4-1/2	3.00	.065	4.13	12-1/2
8	6.00	.109	5.50	4-5/8	3.00	.065	5.13	12-1/2
8	6.00	.109	5.50	6	4.00	.083	5.31	19

REFERENCE	PART NUMBER
100-3-075	404043
150-3-075	404044
150-3-100	404045
200-3-075	404058
200-3-100	404046
200-3-150	404047
250-3-150	404048
250-3-200	404049
300-3-150	404050
300-3-200	404051
300-3-250	404052
400-3-200	404053
400-3-250	404054
400-3-300	404055
600-3-300	404056
600-3-400	404057

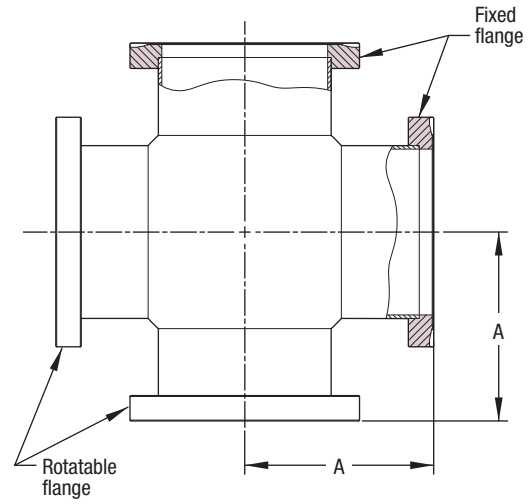
Four-Way Crosses



Tube body



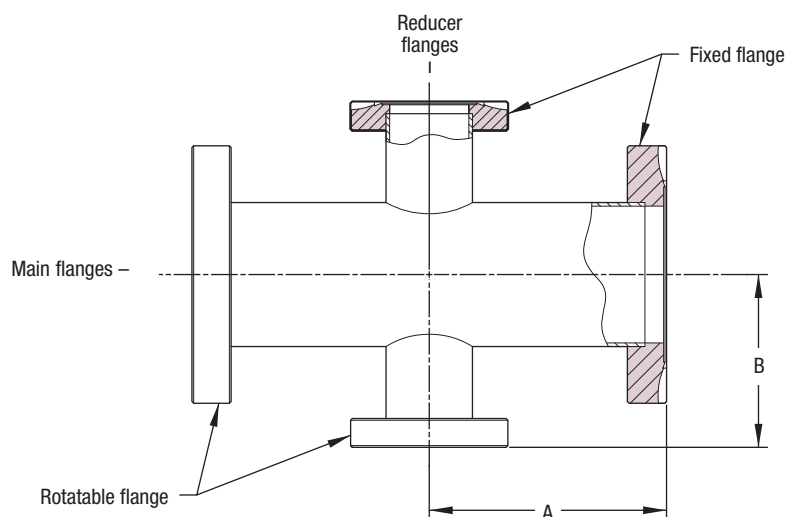
Spherical body



- Each axis has one rotatable flange
- Body type dependent on tube size

NOMINAL FLANGE	FLANGE O.D.	TUBE O.D.	TUBE WALL	BODY TYPE	SPHERE O.D.	SPHERE WALL	A	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	.75	.035	TUBE	-	-	1.50	1/2	075-4	405000
2-1/8	2.11	1.00	.065	TUBE	-	-	2.04	1-3/4	100-4	405001
2-3/4	2.73	1.50	.065	TUBE	-	-	2.46	2-1/2	150-4	405002
3-3/8	3.37	2.00	.065	TUBE	-	-	3.23	4-1/2	200-4	405003
4-1/2	4.47	2.50	.065	TUBE	-	-	3.38	4-1/2	250-4	405031
4-5/8	4.62	3.00	.065	TUBE	-	-	3.63	6	300-4	405032
6	5.97	4.00	.083	TUBE	-	-	4.31	14-1/2	400-4T	405033
6	5.97	4.00	.120	SPHERE	6-1/4	.120	5.31	14-1/2	400-4S	405006
6-3/4	6.75	5.00	.120	SPHERE	9	.120	4.93	22	500-4S	405007
8	7.97	6.00	.109	TUBE	-	-	6.12	32	600-4T	405034
8	7.97	6.00	.120	SPHERE	9	.120	6.56	32	600-4S	405008
10	9.97	8.00	.109	TUBE	-	-	7.50	47	800-4T	405035
10	9.97	8.00	.120	SPHERE	12	.120	8.00	47	800-4S	405009
13-1/4	13.25	10.00	.120	SPHERE	16	.120	10.00	70	1000-4S	405010

Reducing Crosses



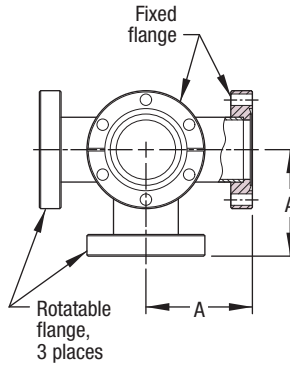
- Del-Seal™ CF to Del-Seal™ CF connections of different size flanges
- Each axis has one rotatable flange

MAIN FLANGES				REDUCER FLANGES				WT LB	REFERENCE	PART NUMBER
FLANGE	TUBE	WALL	A	FLANGE	TUBE	WALL	B			
2-1/8	1.00	.065	2.04	1-1/3	.75	.035	2.50	2	100-4-075	405036
2-3/4	1.50	.065	2.46	1-1/3	.75	.035	2.75	2-1/2	150-4-075	405037
2-3/4	1.50	.065	2.46	2-1/8	1.00	.065	2.30	2-1/2	150-4-100	405038
3-3/8	2.00	.065	3.23	1-1/3	.75	.035	2.13	3-1/2	200-4-075	405051
3-3/8	2.00	.065	3.23	2-1/8	1.00	.065	2.55	4	200-4-100	405039
3-3/8	2.00	.065	3.23	2-3/4	1.50	.065	2.71	4-1/2	200-4-150	405040
4-1/2	2.50	.065	3.38	2-3/4	1.50	.065	2.96	5	250-4-150	405041
4-1/2	2.50	.065	3.38	3-3/8	2.00	.065	3.44	6	250-4-200	405042
4-5/8	3.00	.065	3.63	2-3/4	1.50	.065	3.21	7-1/2	300-4-150	405043
4-5/8	3.00	.065	3.63	3-3/8	2.00	.065	3.73	8-1/2	300-4-200	405044
4-5/8	3.00	.065	3.63	4-1/2	2.50	.065	3.63	8-1/2	300-4-250	405045
6	4.00	.083	4.31	3-3/8	2.00	.065	4.23	12-1/2	400-4-200	405046
6	4.00	.083	4.31	4-1/2	2.50	.065	4.13	12-1/2	400-4-250	405047
6	4.00	.083	4.31	4-5/8	3.00	.065	4.13	12-1/2	400-4-300	405048
8	6.00	.109	5.50	4-5/8	3.00	.065	5.13	22	600-4-300	405049
8	6.00	.109	5.50	6	4.00	.083	5.31	24	600-4-400	405050

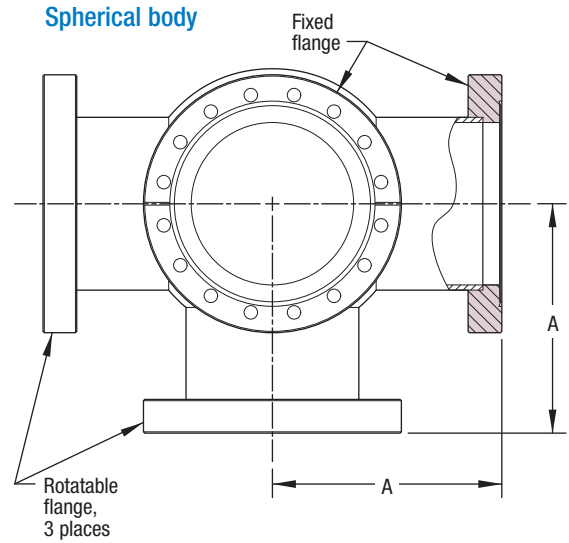
Five-Way Crosses



Tubular body



Spherical body



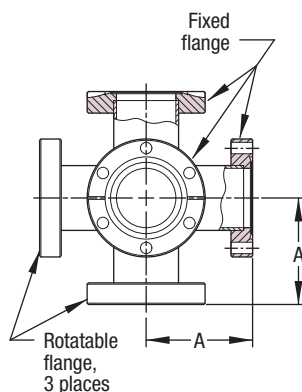
- Each axis has one rotatable flange
- Body type dependent on tube size

FLANGE NOM.	FLANGE O.D.	TUBE O.D.	WALL	BODY TYPE	BODY DIMEN. O.D.	WALL	A	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	.75	.035	TUBE	-	-	1.50	3/4	075-5	406000
2-1/8	2.11	1.00	.065	TUBE	-	-	2.04	2	100-5	406001
2-3/4	2.73	1.50	.065	TUBE	-	-	2.46	3-1/2	150-5	406002
3-3/8	3.37	2.00	.065	TUBE	-	-	3.21	6-1/2	200-5	406003
4-1/2	4.47	2.50	.120	TUBE	-	-	4.12	13	250-5	406004
4-5/8	4.62	3.00	.120	TUBE	-	-	3.53	14	300-5	406005
6	5.97	4.00	.120	SPHERE	6-1/4	.120	5.31	22	400-5S	406006
6-3/4	6.75	5.00	.120	SPHERE	9	.120	4.93	35	500-5S	406007
8	7.97	6.00	.120	SPHERE	9	.120	6.56	38	600-5S	406008
10	9.97	8.00	.120	SPHERE	12	.120	8.00	60	800-5S	406009
13-1/4	13.25	10.00	.120	SPHERE	16	.120	10.00	94	1000-5S	406010

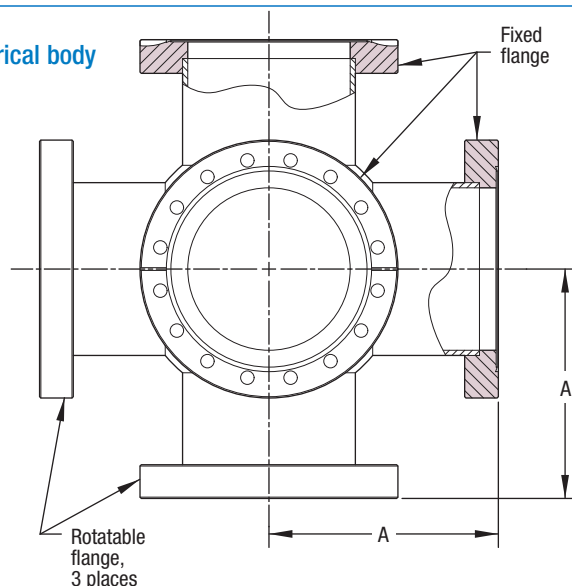
Six-Way Crosses



Tubular body



Spherical body



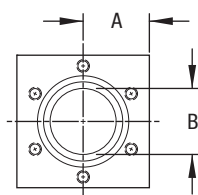
- Each axis has one rotatable flange
- Body type dependent on tube size

FLANGE NOM.	FLANGE O.D.	TUBE O.D.	TUBE WALL	BODY TYPE	BODY DIMEN. O.D.	WALL	A	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	.75	.035	TUBE	-	-	1.50	3/4	075-6	407000
2-1/8	2.11	1.00	.065	TUBE	-	-	2.04	2-1/2	100-6	407001
2-3/4	2.73	1.50	.065	TUBE	-	-	2.46	3-1/2	150-6	407002
3-3/8	3.37	2.00	.065	TUBE	-	-	3.21	7	200-6	407003
4-1/2	4.47	2.50	.120	TUBE	-	-	4.12	16-1/2	250-6	407004
4-5/8	4.62	3.00	.120	TUBE	-	-	3.53	17-1/2	300-6	407005
6	5.97	4.00	.120	SPHERE	6-1/4	.120	5.31	27	400-6S	407006
6-3/4	6.75	5.00	.120	SPHERE	9	.120	4.93	40	500-6S	407007
8	7.97	6.00	.120	SPHERE	9	.120	6.56	44	600-6S	407008
10	9.97	8.00	.120	SPHERE	12	.120	8.00	72	800-6S	407009
13-1/4	13.25	10.00	.120	SPHERE	16	.120	10.00	122	1000-6S	407010

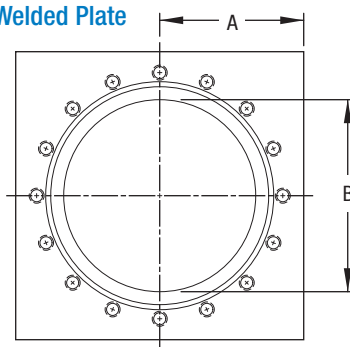
Cubes



Solid Block



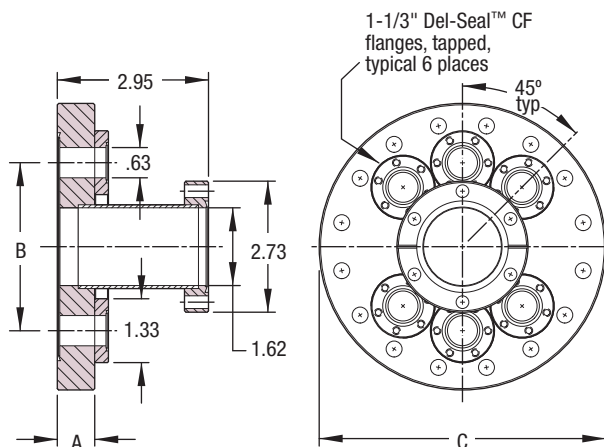
Welded Plate



- 1-1/3" to 4-1/2" sizes machined from solid block
- 6" to 10" sizes constructed with welded plates
- Requires special length bolts – refer to hardware listing for each individual flange size

FLANGE NOM.	REF. O.D.	CONSTRUCTION I.D.	WALL	HOLES THREAD	DEPTH	A	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	.62	SOLID	8-32	.25	.68	1	CU075-6	408000
2-3/4	2.73	1.50	SOLID	.250-28	.37	1.38	3	CU150-6	408001
3-3/8	3.37	2.00	SOLID	.312-24	.37	1.69	5	CU200-6	408002
4-1/2	4.47	2.50	SOLID	.312-24	.50	2.25	8	CU250-6	408003
6	5.97	4.00	.937	.312-24	.50	3.00	16	CU400-6	408004
8	7.97	6.00	.937	.312-24	.50	4.00	30	CU600-6	408005
10	9.97	8.00	.937	.312-24	.50	5.00	45	CU800-6	408006

Straight-In

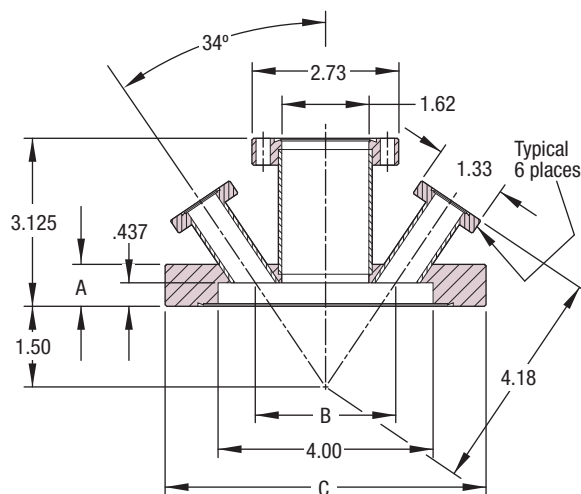


- Includes six straight-in tapped mini flanges around a 2-3/4" Del-Seal™ CF port
- Assemblies are fully electropolished

DESCRIPTION	A	B	C	WT LB
6" DEL-SEAL FLANGE	.78	3.50	5.97	7
8" DEL-SEAL FLANGE	.88	4.25	7.97	12

REFERENCE	PART NUMBER
MAF600-6-133T	409006
MAF800-6-133T	409010

Angled

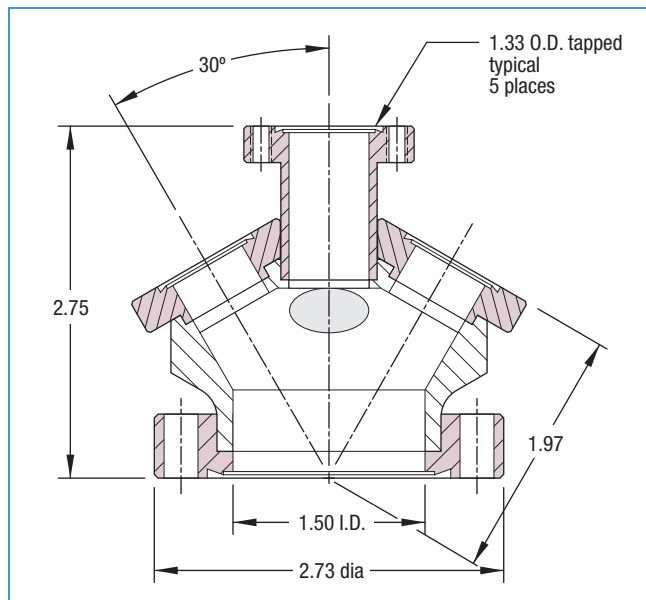


- Includes six angled clearance hole mini flanges equally spaced around a 2-3/4" Del-Seal™ CF port
- Assemblies are fully electropolished

DESCRIPTION	A	B	C	WT LB
6" DEL-SEAL FLANGE	.78	2.61	5.97	7
8" DEL-SEAL FLANGE	.88	2.61	7.97	12

REFERENCE	PART NUMBER
MAF600-133A	409005
MAF800-133A	409011

Multi-Mini Flange

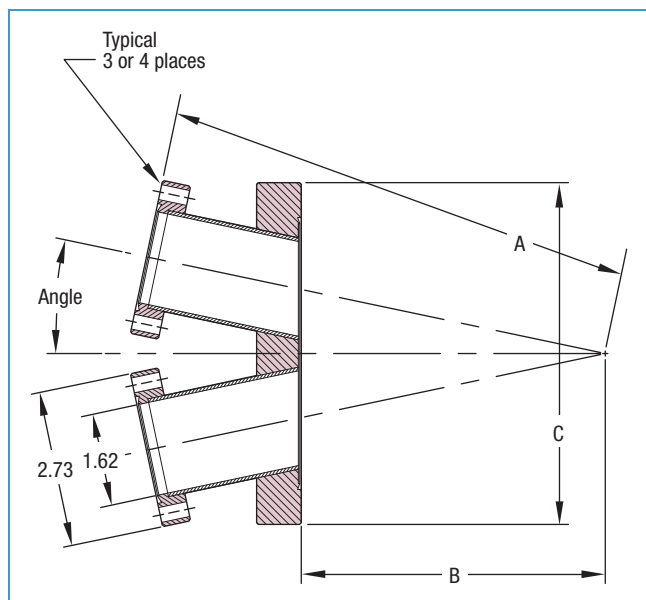


- Provides five tapped mini flanges mounted on a 2-3/4" Del-Seal™ CF port
- Assemblies are fully electropolished
- Requires use of studs on main flange

DESCRIPTION	WT LB
2-3/4" DEL-SEAL FLANGE WITH FIVE TAPPED MINI FLANGES	2-1/2

REFERENCE	PART NUMBER
MMF275-5-133	409004

Cluster Flange



- Angled ports are configured to focus three or four 2-3/4" Del-Seal™ CF ports at a specified flange-to-sample distance.
- Ports are directed towards the center of a standard Del-Seal™ CF six-way cross, page 73
- Assemblies are fully electropolished

DESCRIPTION	NO. OF PORTS	ANGLE	A	B	C	WT LB
6" DEL-SEAL FLANGE	3	11.9°	8.19	5.31	5.97	12
8" DEL-SEAL FLANGE	3	13°	9.84	6.57	7.97	12
8" DEL-SEAL FLANGE	4	13°	9.84	6.57	7.97	13

REFERENCE	PART NUMBER
CF600-3-275	409007
CF800-3-275	409009
CF800-4-275	409008



Blank Flanges



Bored Flanges

Features

- UHV rated to 1×10^{-13} Torr
- High temperature rated to 450°C
- Nonrotatable geometry
- Dished head blank or flat blank option
- OFE Copper or optional FKM / FPM fluoroelastomer gaskets
- Clearance bolt holes

Specifications

Material

Flanges	304ss
Gaskets	OFE Copper
Bolts	300ss

Fastening

Bolt Type	Hexagonal head
Nut Type	Hexagonal
Size / Torque	.375-24 UNF / 26 lb-ft
	.500-20 UNF / 33 lb-ft
	.625-18 UNF / 33 lb-ft

Vacuum Range	1×10^{-13} Torr
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Temperature Range	-200°C to 450°C
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Weight and Dimensions	See table
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See page 26 for elastomer specifications

ULTRAHIGH VACUUM SERIES

Figure 1 Female Blank

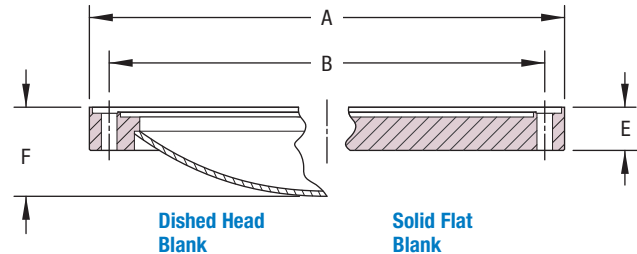


Figure 2 Female Bored

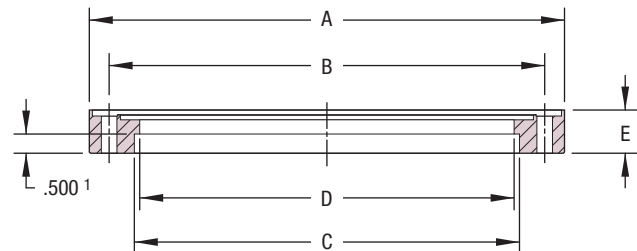


Figure 3 Male Blank

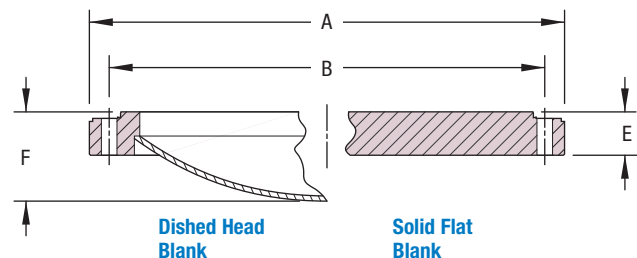
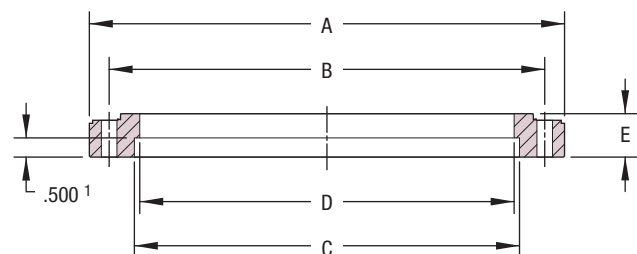
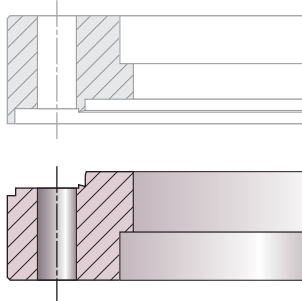


Figure 4 Male Bored



¹ 27-1/8" diameter flanges have a counterbore depth of .625

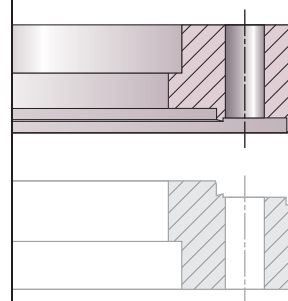
Male Flange



MDC Wire Seal Flanges provide a convenient method of metal-sealing relatively large diameter vacuum chambers. Applications include bell jars, vacuum furnaces, and a variety of other ultra-high vacuum enclosures. All MDC Wire Seal Flanges are made of 304ss material. To make the seal, an .080" cross-section diameter OFE copper wire gasket is compressed between mating male and female flanges. The geometry of the beveled sealing surface confines the flow of the crushed gasket material, causing it to fill in minor nicks and scratches in the seal area. These flanges can also be used with elastomer gaskets.

Dimensions given in the table below apply to both the male flanges on the left and the female flanges on the right.

Female Flange



PART NUMBER	REFERENCE	O.D. NOM.	A	B	NO. HOLES	C	D	E	F	WT LB	REFERENCE	PART NUMBER
180000	WSF12-00M	12-3/8	12.375	11.343	24	-	BLANK	1.125	2.33	15	WSF12-00F	180003
180024	WSF12-00MB	12-3/8	12.375	11.343	24	-	BLANK	1.125	-	35	WSF12-00FB	180025
180002	WSF12-10M	12-3/8	12.375	11.343	24	10	9.750	1.125	-	12	WSF12-10F	180001
180004	WSF14-00M	14-5/8	14.625	13.593	32	-	BLANK	1.125	2.33	20	WSF14-00F	180007
180026	WSF14-00MB	14-5/8	14.625	13.593	32	-	BLANK	1.125	-	49	WSF14-00FB	180027
180006	WSF14-12M	14-5/8	14.625	13.593	32	12	11.750	1.125	-	16	WSF14-12F	180005
180008	WSF17-00M	17-1/4	17.250	15.718	36	-	BLANK	1.125	2.60	28	WSF17-00F	180011
180028	WSF17-00MB	17-1/4	17.250	15.718	36	-	BLANK	1.125	-	68	WSF17-00FB	180029
180010	WSF17-14M	17-1/4	17.250	15.718	36	14	13.750	1.125	-	22	WSF17-14F	180009
180012	WSF19-00M	19-9/16	19.562	17.875	36	-	BLANK	1.312	3.04	41	WSF19-00F	180015
180030	WSF19-00MB	19-9/16	19.562	17.875	36	-	BLANK	1.312	-	105	WSF19-00FB	180031
180014	WSF19-16M	19-9/16	19.562	17.875	36	16	15.750	1.312	-	34	WSF19-16F	180013
180016	WSF22-00M	22-1/8	22.125	20.187	36	-	BLANK	1.500	3.50	61	WSF22-00F	180019
180032	WSF22-00MB	22-1/8	22.125	20.187	36	-	BLANK	1.500	-	155	WSF22-00FB	180033
180018	WSF22-18M	22-1/8	22.125	20.187	36	18	17.750	1.500	-	51	WSF22-18F	180017
180020	WSF27-00M	27-1/8	27.125	25.843	40	-	BLANK	1.750	4.43	76	WSF27-00F	180023
180034	WSF27-00MB	27-1/8	27.125	25.843	40	-	BLANK	1.750	-	276	WSF27-00FB	180035
180022	WSF27-24M	27-1/8	27.125	25.843	40	24	23.750	1.750	-	60	WSF27-24F	180021

Hardware



- Bolt Sets include bolts, nuts and flat washers.
- Copper wire gaskets .080" cross-section diameter
- FKM / FPM fluor elastomer O-rings .070" cross-section diameter (nominal 1/16")

USE ON FLANGE	DESCRIPTION	THREAD SIZE	BOLT LENGTH	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
12-3/8	HEX HEAD BOLT	.375-24	2-1/2	24	5	WBA-100	190016
12-3/8	GASKET, COPPER	-	-	1	1	WGK-100	191050
12-3/8	GASKET, FKM/FPM	-	-	1	1	WGK-100V	540007
14-5/8	HEX HEAD BOLT	.375-24	2-3/4	32	5	WBA-120	190017
14-5/8	GASKET, COPPER	-	-	1	1	WGK-120	191051
14-5/8	GASKET, FKM/FPM	-	-	1	1	WGK-120V	540008
17-1/4	HEX HEAD BOLT	.500-20	2-3/4	36	10	WBA-140	190018
17-1/4	GASKET, COPPER	-	-	1	1	WGK-140	191052
17-1/4	GASKET, FKM/FPM	-	-	1	1	WGK-140V	540009
19-9/16	HEX HEAD BOLT	.500-20	3	36	15	WBA-160	190019
19-9/16	GASKET, COPPER	-	-	1	1	WGK-160	191053
19-9/16	GASKET, FKM/FPM	-	-	1	1	WGK-160V	540010
22-1/8	HEX HEAD BOLT	.625-18	3-1/2	36	20	WBA-180	190020
22-1/8	GASKET, COPPER	-	-	1	1	WGK-180	191054
22-1/8	GASKET, FKM/FPM	-	-	1	1	WGK-180V	540011
27-1/8	HEX HEAD BOLT	.625-18	4	40	25	WBA-240	190021
27-1/8	GASKET, COPPER	-	-	1	1	WGK-240	191055
27-1/8	GASKET, FKM/FPM	-	-	1	1	WGK-240V	540012



Kwik-Flange™ ISO KF Assembly

Features

- Vacuum rated to 1×10^{-8} Torr
- Bakeable to 150°C
- Fast connect and disconnect
- Economical reusable fittings
- Genderless geometry
- Rotatable bolt ring adapter
- Elastomer gasket seal
- Varied fastening methods
- ISO KF and LF compatible
- Specialty fittings available
- Type 304 stainless steel construction

MDC's Kwik-Flange™ ISO KF components are an economical system of reusable interfacing stainless steel vacuum fittings for tube sizes ranging from 1/2" through 2" diameters. These flanges can operate in high vacuum environments to pressures in the 1×10^{-8} Torr range. The Kwik-Flange™ ISO KF flange system is ideally suited for applications requiring rapid and frequent assembly and disassembly. MDC ISO KF flanges comply with all ISO specifications for vacuum mounting hardware and are compatible with most third party ISO KF flanges and components.

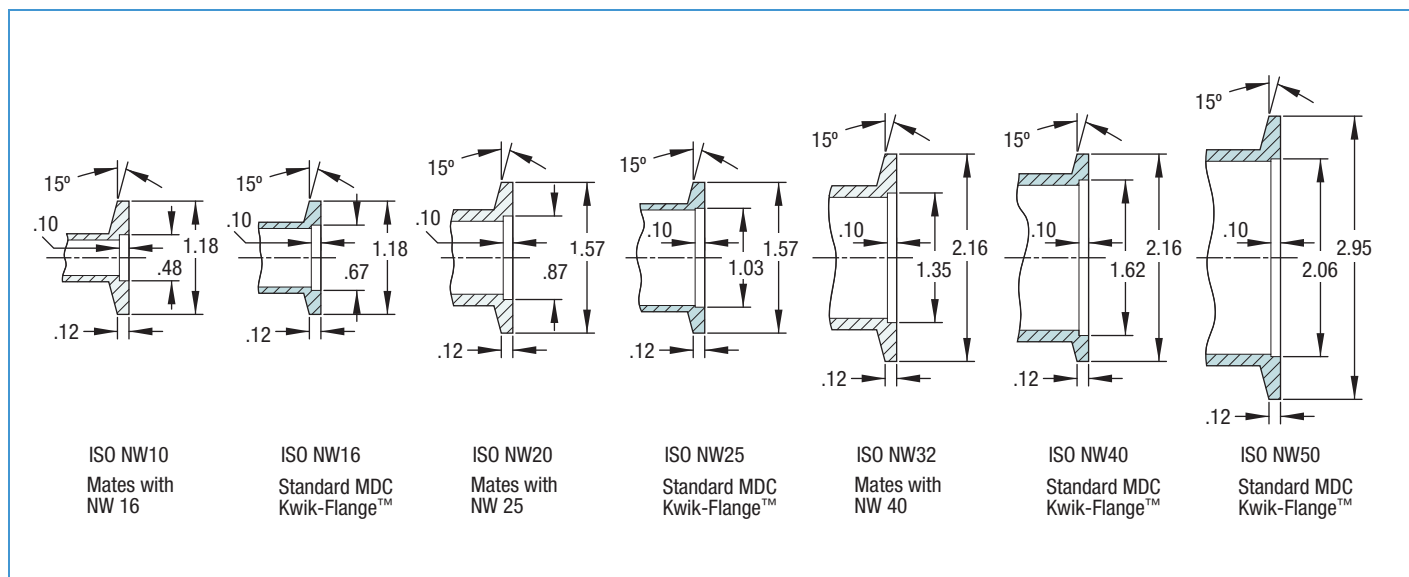
The primary method of fastening and sealing a Kwik-Flange™ is achieved by a hinged radial clamp that provides uniform compression of an elastomer gasket secured between two mating flanges. The elastomer gasket is mounted on a stainless steel centering ring with tubular rims or extensions that protrude on either side of the gasket. These rims or extensions fit into locator grooves on the respective mating flanges and conveniently center the gasket between the flanges prior to sealing. The seal is made on the flat surfaces outside the locator groove or counterbore. The seal can be made quickly by finger-tightening a wing nut on the all-metal hinged aluminum clamp or by securing bolts in an alternate crisscross pattern on the aluminum bulkhead style clamps. In both cases a uniform pressure is applied around the outer flange surfaces to make a reliable seal.

The MDC Kwik-Flange™ ISO KF family of modular building-block components includes

all of the commonly used standard hardware and fittings. Virtually all standard MDC feedthroughs and accessories are available for use with Kwik-Flange™ ISO KF flanges.

Reducer flanges are available to connect different size ISO components. This catalog includes ISO KF and ISO LF reducer flanges for KF to KF, KF to LF and LF to LF flange combinations. Hybrid adapters are available to connect ISO KF components to other non ISO vacuum fittings and mounts. These include Del-Seal™ CF metal seal flanges, ANSI ASA flanges, Swagelok® compression tube fittings and VCR® metal gasket tube fittings, national pipe thread fitting, etc. For more details and information on hybrid adapters please reference Section 1.5 of this catalog.

MDC Kwik-Flange™ ISO KF flanges are available in four standard maximum tube sizes including 3/4", 1", 1-1/2" and 2" diameters. Each of these basic flanges are then offered in weldable formats, prepped for varying smaller tube sizes. Typically, U.S. tube sizes are specified in inches and identified by their outside diameters. MDC standard ISO KF flange size designations are as follows... K075 for 0.75", K100 for 1.00", K150 for 1.50" and K200 for 2.00" tube diameters. It's worth mentioning that, with the exception of the centering ring locator diameter, three of the ISO KF flanges depicted in the diagram below, namely NW 10, 20 and 32, are identical to NW 16, 25 and 40 respectively. These latter flanges being the standard for all of MDC's ISO KF fitted products. Customers having vacuum



equipment fitted with NW 10, 20 and 32 flanges can mate them with MDC NW 16, 25 and 40, respectively, by using MDC's reducer centering ring. The reducer centering ring is constructed with two different size tubular rims or extensions which mate with the respective flange size centering ring locator groove or counterbore.

As previously noted, Kwik-Flange™ ISO KF flanges provide a vacuum mount interface for tube diameters up to 2.00 inches. For tube diameters above this, Large-Flange™ ISO LF flanges are used. Kwik-Flange™ and Large-Flange™ flanges are part of one and the same family of ISO standard elastomer sealed mounts. Together they provide a complete range of vacuum mounts for 0.75 to 20.0 inch diameter tubes. ISO KF and LF sealing mechanisms are similar but their fastening and clamping methods differ. Due to the wide variation of references used by ISO flange manufacturers, MDC emphasizes the use of the standard ISO NW reference. Note that for all practical purposes, NW and DN references are identical. Large-Flange™ ISO LF flanges are presented immediately after the Kwik-Flange™ ISO KF flanges.

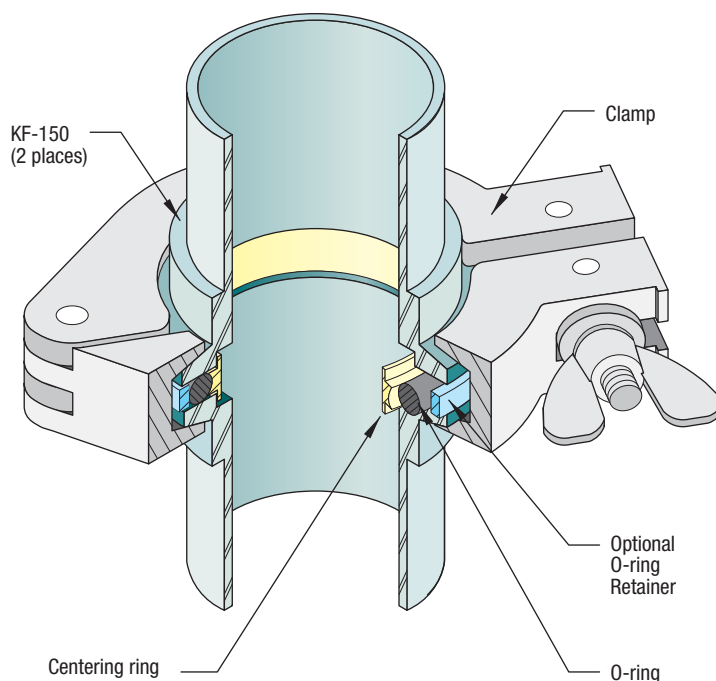
In general, MDC components compare with international components using an inch-to-millimeter ratio. U.S. sizes refer to a tube's outside diameter, whereas international sizes refer to a tube's inside diameter. The chart below gives a quick comparison between inch and metric ISO flange sizes.

All dimensions in this catalog are given in inches unless specified otherwise.

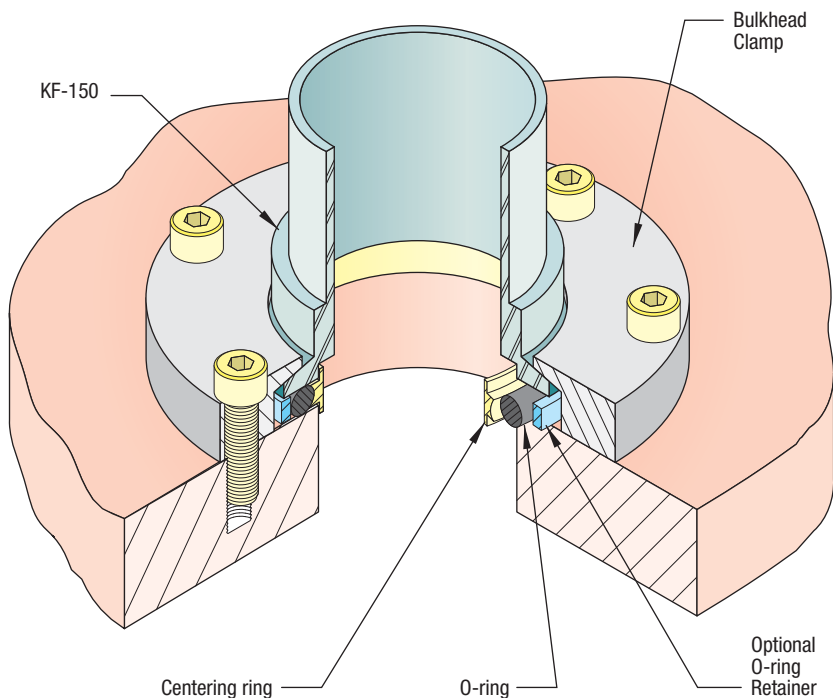
Inch-Metric ISO Comparison

MDC	O.D.	ISO	I.D.	
	Inches		mm	Inches
K075	.75	NW16	16	.63
K100	1.00	NW25	25	.98
K150	1.50	NW40	40	1.57
K200	2.00	NW50	50	1.97
L250	2.50	NW63	63	2.48
L300	3.00	NW80	80	3.15
L400	4.00	NW100	100	3.94
L600	6.00	NW160	160	6.30
L800	8.00	NW200	200	7.87
L1000	10.00	NW250	250	9.84
L1200	12.75	NW320	320	12.60
L1600	16.00	NW400	400	15.75
L2000	20.00	NW500	500	19.69

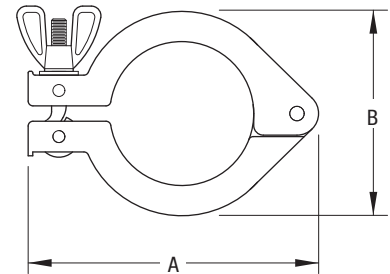
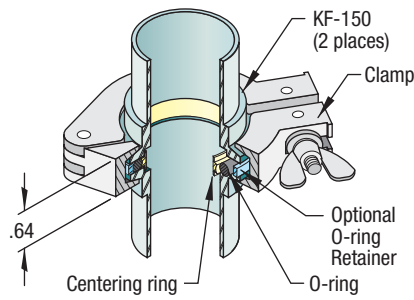
Kwik-Flange™ ISO KF
Typical Installation



Bulkhead Clamp
Typical Installation



Hinged Clamp



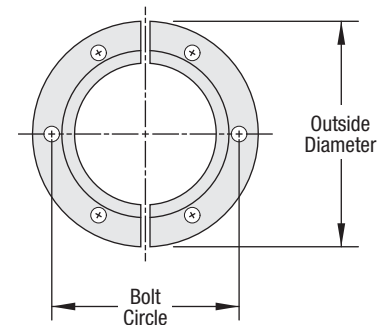
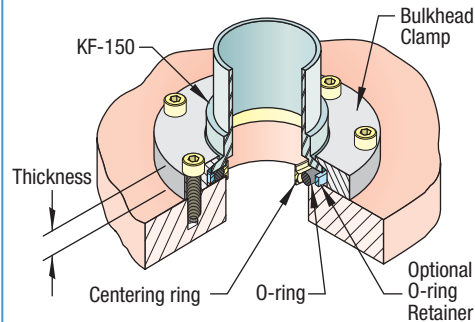
Features

- Fastens ISO KF Kwik-Flange™ of comparable size
- Quick make and break
- Stainless steel wing nut and bolt
- Aluminum clamp construction
- Requires centering ring with elastomer gasket

Hinged Clamp assemblies are the most commonly used method for making Kwik-Flange™ vacuum seal connections. Prior to clamping, flanges can be rotated 360° and accept self-locating centering ring seals. Pressure is applied uniformly around the 15° outer surface of both flanges by finger-tightening the single wing nut until the first metal-to-metal contact is made between the spacing lips of the centering ring and the inner surface of the mating flanges. This compresses the O-ring between the flanges and makes the vacuum seal.

FLANGE SIZE	TUBE SIZE	A	B	PART NUMBER
NW16	1/2 - 3/4	2.77	1.63	701000
NW25	1	3.14	2.00	701001
NW40	1-1/2	3.78	2.66	701002
NW50	2	4.54	3.44	701003

Bulkhead Clamp



Features

- Fastens ISO KF Kwik-Flange™ directly to flat plates
- Bolt fastening
- Split ring geometry
- Aluminum construction
- Requires centering ring with elastomer gasket

Bolted bulkhead clamps are commonly used to fasten Kwik-Flange™ ISO KF components to flat chamber walls or baseplates. Use of this product requires customer machining of six or eight 10-32 UNC threaded bolt holes on the mounting surface. Once a clamp has been positioned and aligned with the mating bolt holes, a vacuum seal is made by alternately wrench-tightening opposing pairs of bolts. A complete Bulkhead Clamp Assembly consists of two semicircular clamps, six or eight 10-32 x 5/8 inch bolts and washers.

FLANGE SIZE	NO. BOLTS	THK	BC	OD	PART NUMBER
NW16	6	.36	1.50	2.00	716000
NW25	6	.39	1.89	2.37	716001
NW40	6	.37	2.44	2.94	716002
NW50	8	.40	3.25	3.75	716003

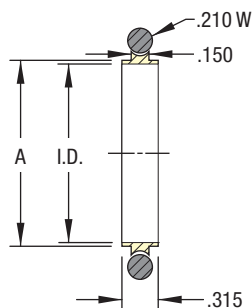
Centering Rings



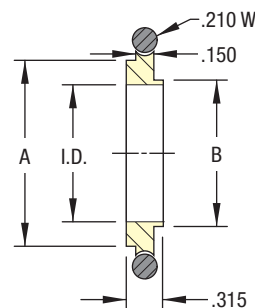
Features

- Standard ring mates two ISO KF Kwik-Flanges™ of equal size
- Reducer ring mates two ISO KF Kwik-Flanges™ of unequal sizes
- Includes elastomer gasket
- Stainless steel or aluminum construction

Standard Centering Ring



Reducer Centering Ring



Centering ring assemblies are placed between two ISO flanges with matching outer diameters. The widest portion of the centering ring rests inside a centering ring locator groove (blank flange) or counterbore (bored flange) on the Kwik-Flange™. The O-ring rests on the flat polished surface *outside* the locator groove or counterbore. Sizes in the table to the right apply to all variations of centering ring and elastomer combinations. Reference and part numbers are given with individual flanges.

FLANGE SIZE	A	B	ID	O-RING ID	PART NUMBER
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Standard Centering Ring

NW16	.66	-	.63	.73	710000
NW25	1.02	-	.97	1.10	710001
NW40	1.61	-	1.55	1.60	710002
NW50	2.05	-	1.97	2.10	710003

Reducer Centering Ring

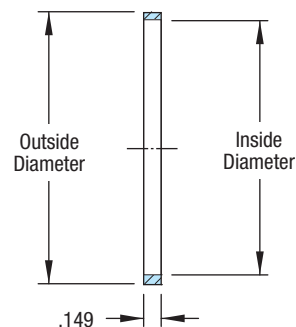
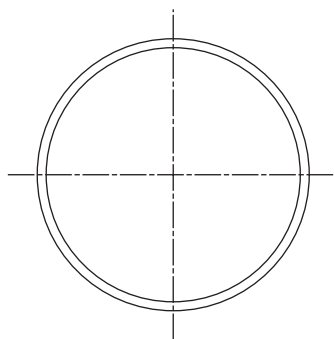
NW16-10	.67	.47	.39	.73	710010
NW25-20	1.02	.87	.83	1.10	710011
NW40-32	1.61	1.34	1.26	1.60	710012

O-Ring Retainer



Features

- Supports O-ring outside diameter during pressure burst
- Not for sustained pressures above one atmosphere
- Stainless steel construction



Place an O-ring retainer over a centering ring assembly which is already centered on a single flange face. Place the second flange over the centering ring and O-ring retainer and secure with a hinged clamp. Note that all MDC products are intended for vacuum applications only.

FLANGE ISO REF.	TUBE SIZE	OD	ID	PART NUMBER
NW16	3/4	1.31	1.16	710025
NW25	1	1.70	1.56	710026
NW40	1-1/2	2.31	2.16	710027
NW50	2	2.75	2.67	710028



Large-Flange™ ISO LF flange assembly

Features

- Vacuum rated to 1×10^{-8} Torr
- Bakeable to 150°C
- Fast connect and disconnect
- Economical reusable fittings
- Genderless geometry
- Rotatable bolt ring adapter
- Elastomer gasket seal
- Varied fastening methods
- ISO KF and LF compatible
- Specialty fittings available
- Type 304 stainless steel construction

Inch-Metric ISO Comparison

MDC	O.D. Inches	ISO	I.D. mm	Inches
K075	.75	NW16	16	.63
K100	1.00	NW25	25	.98
K150	1.50	NW40	40	1.57
K200	2.00	NW50	50	1.97
L250	2.50	NW63	63	2.48
L300	3.00	NW80	80	3.15
L400	4.00	NW100	100	3.94
L600	6.00	NW160	160	6.30
L800	8.00	NW200	200	7.87
L1000	10.00	NW250	250	9.84
L1200	12.75	NW320	320	12.60
L1600	16.00	NW400	400	15.75
L2000	20.00	NW500	500	19.69

MDC's Large-Flange™ ISO LF components are an economical system of reusable and interfacing stainless steel vacuum fittings for tube sizes ranging from 2-1/2" through 20" diameters. Large-Flange™ ISO LF flanges pick up where the Kwik-Flange™ ISO KF system leaves off. These flanges can operate in high vacuum environments to pressures in the 1×10^{-8} Torr range. The Large-Flange™ ISO LF flange system is ideally suited for applications requiring rapid and frequent assembly and disassembly. MDC ISO LF flanges comply with all ISO specifications for vacuum mounting hardware and are compatible with most third party ISO LF flanges and components.

The primary method of fastening and sealing a Large-Flange™ is achieved by using multiple double-claw clamp assemblies to provide uniform compression of an elastomer gasket trapped between two mating flanges. The elastomer gasket is mounted on an aluminum centering ring that has tubular rims or extensions that protrude on either side of the gasket. These rims or extensions fit into centering ring locator grooves or counterbores on the corresponding mating flanges and conveniently center the gasket between the flanges prior to sealing. A reliable seal is then made by tightening bolts in an alternating crisscross pattern and thus applying uniform pressure around the entire flange sealing surface.

Other fastening methods include single claw clamps, bolted rotatable, bolted nonrotatable and non ISO standard MDC band clamps. Geometries for each fastening method are depicted at the bottom of these two pages.

Single claw clamps are ideally suited for applications where one of the mating flanges is flush mounted and fitted with threaded bolt holes. This is typical on most MDC gate

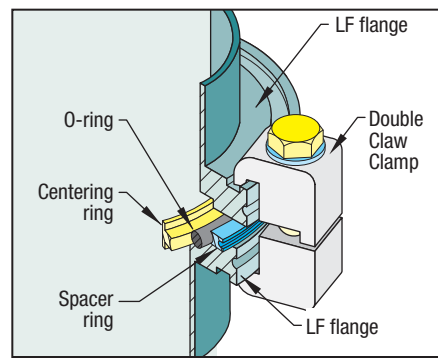
valves constructed with Large-Flange™ ISO LF port flanges. Both the double and single claw clamp fasteners provide unlimited rotation or positioning of mating flanges prior to final tightening of bolts.

Bolted rotatable adapter rings provide a convenient way of fastening claw style flanges to threaded ISO LF flanges, without the use of individual claw clamps. Rotatable bolt rings are ideally suited for use in applications where low profile geometry is required.

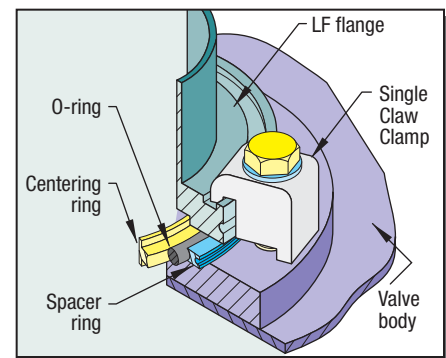
Bolted nonrotatable Large-Flange™ ISO LF flanges use bolts for fastening and are typically used where single claw fasteners are not desirable. They, too, are ideally suited for use in applications where low profile geometry is required, but do not offer rotatable construction.

Since the ISO LF standard does not provide the convenience of hinged clamping, MDC developed its own and unique band-clamp flange system that addresses this problem. The band-clamp style flanges are a modification of the Large-Flange™ ISO LF flange system. They provide the convenience of Kwik-Flange™ ISO KF hinged clamps for tube sizes from 2-1/2 to 8 inches in diameter. The band clamp uses a stainless steel strap fitted with an eye bolt and wing nut for quick assembly or disassembly.

The MDC Large-Flange™ ISO LF family of modular building-block components includes all of the commonly used standard hardware and fittings. Virtually all standard MDC feedthroughs and accessories are available for use with Large-Flange™ ISO LF flanges. Reducer flanges are available to connect different size ISO components. This section includes ISO KF and ISO LF reducer flanges for KF to KF, KF to LF and LF to LF flange



Double Claw Assembly



Single Claw Assembly

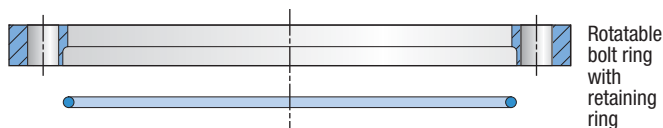
combinations. Hybrid adapters are available to connect ISO LF components to non ISO vacuum fittings and mounts. Some of these include Del-Seal™ CF metal seal flanges, ANSI ASA flanges, Swagelok® compression tube fittings and VCR® metal gasket tube fittings and national pipe thread fittings. For more details and information on hybrid adapters please reference Section 1.5 in this catalog.

MDC Large-Flange™ ISO LF flanges are available in nine standard maximum tube sizes including 2-1/2", 3", 4", 6", 8", 10", 12-3/4", 16" and 20" diameters. Each of these basic flanges are also offered in blanked formats which are suitable for custom modification or to blank-off unused chamber ports. Typically, U.S. tube sizes are specified in inches and identified by their outside diameters. MDC standard ISO LF flange size designations are as follows... L250 for 2.50", L300 for 3.00", L400 for 4.00", L600 for 6.00", L800 for 8.00", L1000 for 10.0", L1200 for 12.75", L1600 for 16.0" and L2000 for 20.0" tube diameters.

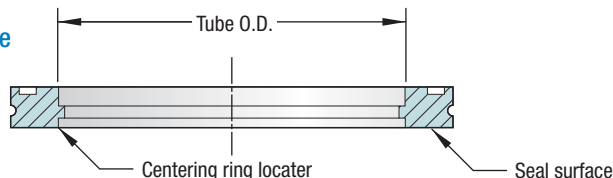
In general, MDC components compare with international components using an inch-to-millimeter ratio. U.S. sizes refer to a tube's outside diameter, whereas international sizes refer to a tube's inside diameter. The chart on the previous page gives a quick comparison between inch and metric ISO flange sizes.

All dimensions in this catalog are given in inches unless specified otherwise.

Rotatable bolt ring assembly



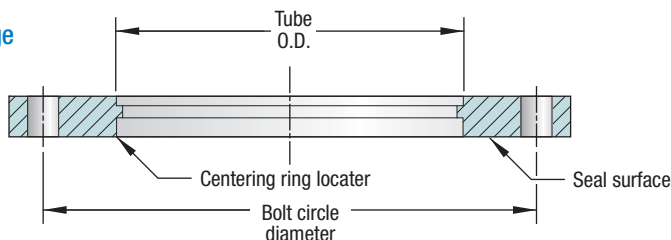
Claw clamp flange



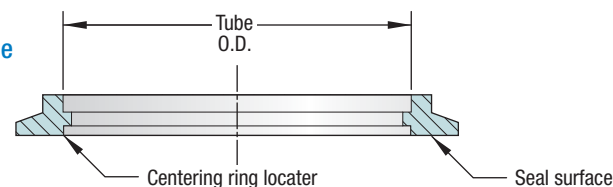
Centering ring assembly



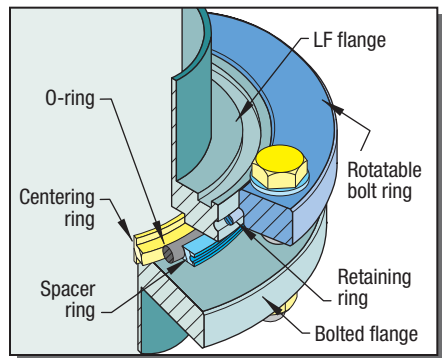
Bolted flange



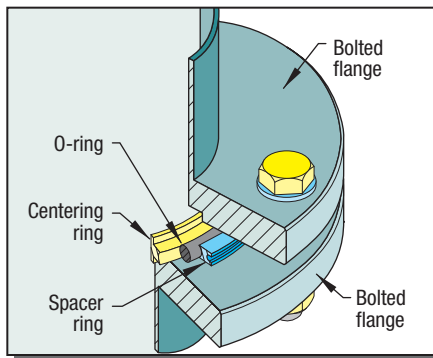
Band clamp flange



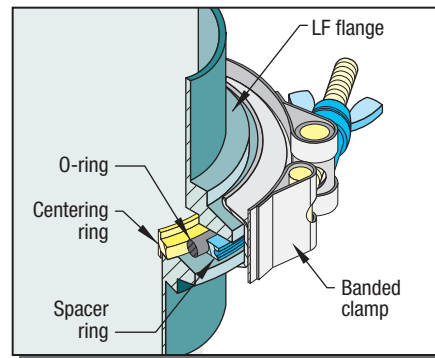
- Intermediate hardware may be required for joining components. These have been omitted for clarity.
- Seal surface is outside the centering ring locator groove (blank flanges) or counterbore (bored flanges).



Bolted Rotatable Assembly



Bolted Nonrotatable Assembly



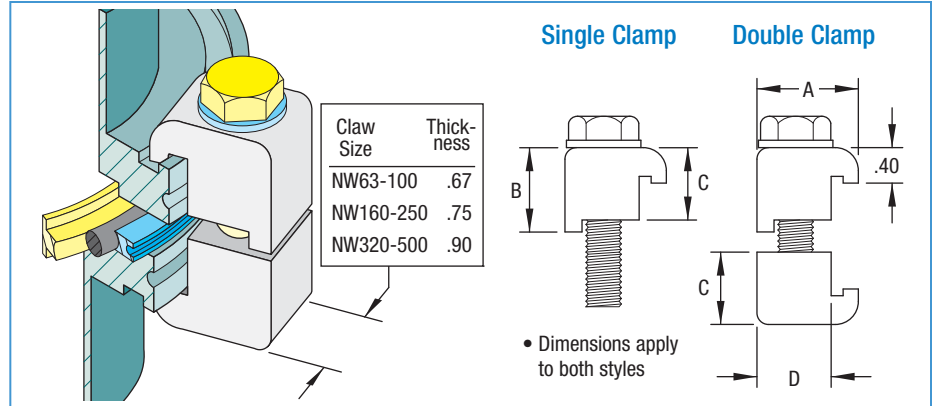
Band clamp Assembly

Claw Clamp



Features

- Fastens ISO LF Large-Flange™ of comparable size
- Quick make and break
- Zinc plated steel bolt
- Aluminum claw construction
- Requires centering ring with elastomer gasket



Double Claw-Clamp Assemblies are commonly used for making Large-Flange™ vacuum seal connections. Assembly is simplified by the 360° rotatable flanges and the self-centering feature of the centering ring. Single Claw-Clamp Assemblies are used to mate a clamp-style Large-Flange™ to a threaded bolt-style Large-Flange™, such as on a gate valve. The vacuum seal is made by compressing the O-ring between the mating flanges. This is done by alternately wrench-tightening opposing pairs of clamps until the first metal-to-metal contact is made between the inner surfaces of the flanges and the spacing lip of the centering ring.

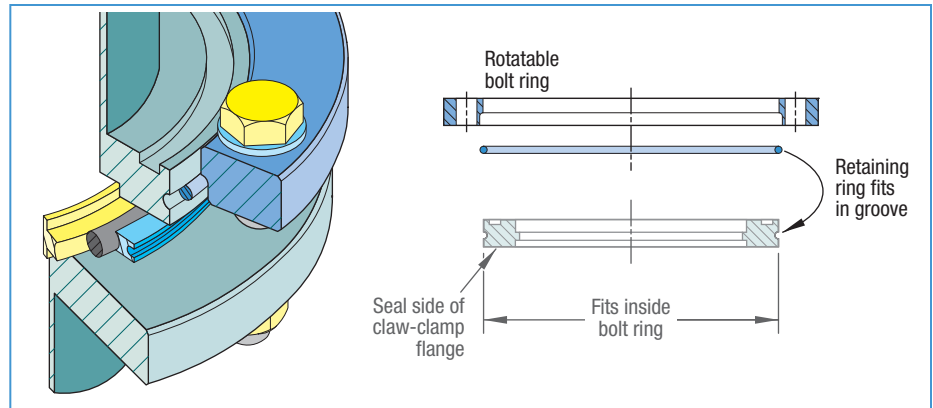
FLANGE SIZE	A	B	C	D	PART NUMBER
Single Claw					
NW63-100	.94	.93	.79	.64	801000
NW160-250	1.10	.93	.79	.80	801002
NW320-500	1.33	1.18	1.00	1.03	801005
Double Claw					
NW63-100	.94	.93	.79	.64	802000
NW160-250	1.10	.93	.79	.80	802002
NW320-500	1.33	1.18	1.00	1.03	802005

Rotatable Bolt Ring



Features

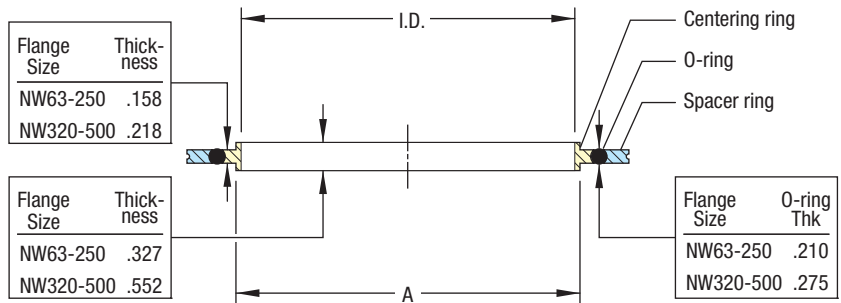
- Converts claw clamp flange to bolt style Large-Flange™
- Bolt fastening
- Aluminum construction
- Includes nickel plated spring steel retainer
- Does not include claw-clamp flange
- Requires centering ring with elastomer gasket and bolts



Slip the bolt ring over a standard claw-clamp style flange and install the retaining ring. After the bolt ring has been rotated to align the bolt holes, the vacuum seal is made by alternately wrench-tightening opposing pairs of bolts. One complete Rotatable Bolt Ring Assembly consists of one aluminum bolt ring and one nickel plated spring steel retaining ring.

FLANGE SIZE	RING O.D.	BOLT HOLES	HOLE SIZE	BOLT CIRCLE	PART NUMBER
NW63	5.12	4	.35	4.33	853000
NW80	5.71	8	.35	4.92	853008
NW100	6.50	8	.35	5.71	853001
NW160	8.86	8	.43	7.87	853002
NW200	11.22	12	.43	10.24	853003
NW250	13.19	12	.43	12.20	853004
NW320	16.73	12	.54	15.55	853005
NW400	20.08	16	.54	18.09	853006
NW500	24.02	16	.54	22.83	853007

Centering Rings



Features

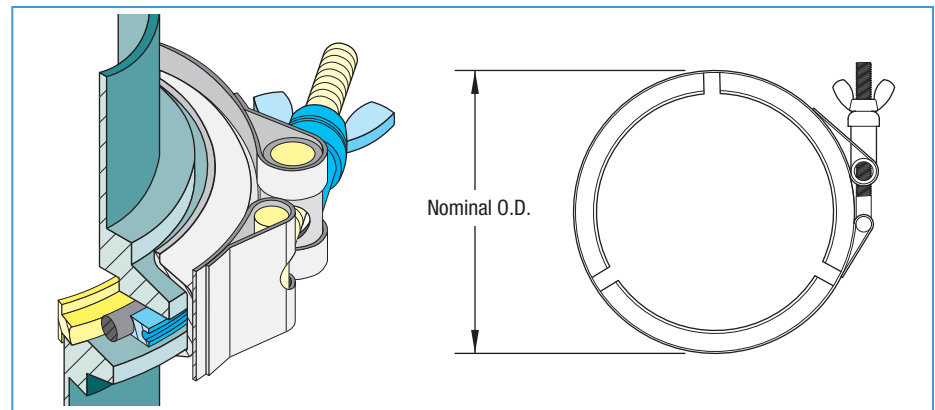
- Standard ring mates ISO LF Large-Flange™ of equal size
- Includes elastomer gasket and spacer ring
- Aluminum or stainless steel construction

Centering ring assemblies are placed between two ISO flanges with matching outer diameters. The widest portion of the centering ring rests inside a locator groove (blank flange) or counterbore (bored flange) on the Large-Flange™. The O-ring rests on the flat polished surface *outside* the groove or counterbore.

Sizes in the table to the right apply to all variations of centering ring and elastomer combinations. Reference and part numbers are given with individual flanges.

FLANGE SIZE	TUBE SIZE	A	ID	O-RING ID	PART NUMBER
NW63	2-1/2	2.73	2.61	2.85	810000
NW80	3	3.26	3.14	3.35	810008
NW100	4	3.99	3.86	4.10	810001
NW160	6	5.99	5.87	5.98	810002
NW200	8	8.35	8.23	8.48	810003
NW250	10	10.25	10.13	10.48	810004
NW320	12-3/4	12.46	12.25	12.48	810005
NW400	16	15.67	15.47	15.48	810006
NW500	20	19.65	19.45	19.46	810007

Band Clamp

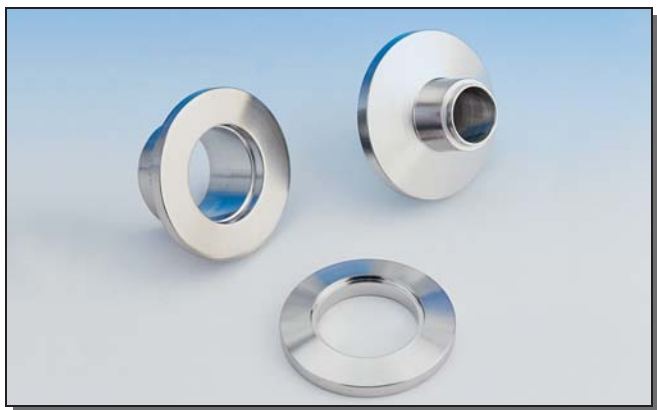


Features

- Fastens modified ISO Large-Flange™ of comparable size
- Wing nut fastener
- Quick make and break
- Stainless steel construction

Band clamp assemblies are used for fastening MDC's non ISO Large-Flange™. These flanges employ the same centering rings used in their ISO LF counterparts and provide the convenience of Kwik-Flange™ style fastening in Large-Flange™ tube sizes. Pressure is applied uniformly around the 20° outer surface of both flanges by finger-tightening the single wing nut until the first metal-to-metal contact is made between the spacing lips of the centering ring and the inner surface of the mating flanges. This compresses the O-ring between the flanges and makes a vacuum seal.

FLANGE ISO REF.	TUBE SIZE	NOMINAL O.D.	PART NUMBER
NW63	2-1/2	4	540002
NW80	3	4-1/2	540003
NW100	4	5-1/2	540004
NW160	6	7-1/4	540005
NW200	8	9-3/4	540006



Kwik-Flange™ ISO KF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric, nonrotatable geometry
- Elastomer O-ring seal
- Clamp style fastening
- ISO compatible design

Specifications

Material

Flanges	304ss
O-rings	FKM / FPM fluoroelastomer, Buna-N® or Silicone elastomer
Clamps, hinged & bulkhead	Aluminum

Fastening

Clamp Type	Hinged with 10-32 thread
Bulkhead Type	Hexagonal head bolts, 10-32 thread
Nut Type	Hexagonal
Torque	Clamp: Finger tight Bolts: 7-10 lb-ft

Vacuum Range 1×10^{-8} Torr

Temperature Range	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C
Silicone	-20°C	200°C	150°C

Weight 1/4 lb maximum

Dimensions 1.18 OD x .680 ID maximum

HIGH VACUUM SERIES

Figure 1 Blank

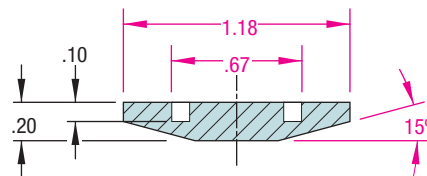


Figure 2 Unbored stub

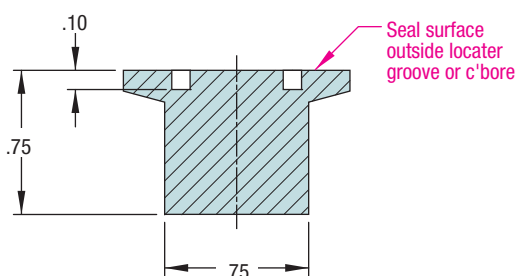


Figure 3 Weld flange - small tube

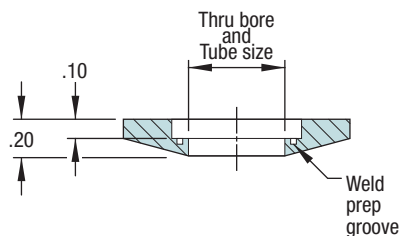


Figure 4 Weld flange

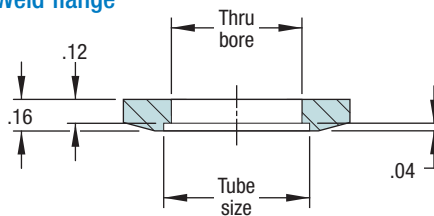
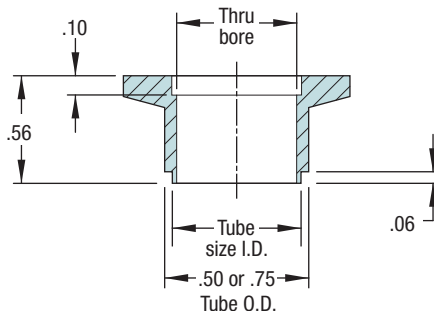


Figure 5 Socket weld



• Magenta colored dimensions are common to all flanges.

Flange Assembly

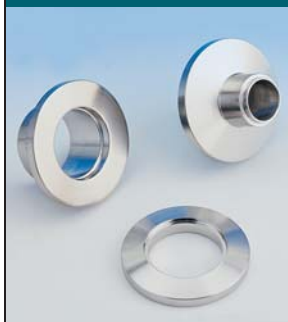


FLANGE ISO REF.	FLANGE O.D.	TUBE SIZE	WELD FLANGES	HINGED CLAMP	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW16	1.18	1/2	K050-W	K075-C	K075-CR	1/2	K050-CA	700000
NW16	1.18	3/4	K075-W	K075-C	K075-CR	1/2	K075-CA	700001

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Kwik-Flange™ assembly consists of two weld flanges, one hinged clamp and one stainless steel centering ring assembly with a FKM / FPM fluoroelastomer O-ring.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	TUBE SIZE	THRU BORE	WT LB	REFERENCE	PART NUMBER
BLANK	1	BLANK	-	-	1/4	K075-B	712000
BLANK	2	UNBORED STUB	-	-	1/4	K075-US	715000
3/8	3	WELD	.377	.377	1/4	K075W-038	713005
1/2	3	WELD	.502	.502	1/4	K075W-050	713006
1/2	5	SOCKET WELD	.425	.375	1/4	K050-W	713000
3/4	4	WELD	.760	.680	1/4	K075W-075	713007
3/4	5	SOCKET WELD	.670	.625	1/4	K075-W	713001

Hardware



DESCRIPTION	PRIMARY MATL	O-RING MATL	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	SS	FKM/FPM	1/4	K075-CR	710000
CENTERING RING ASSEMBLY	SS	BUNA-N	1/4	K075-CRB	710004
CENTERING RING ASSEMBLY	SS	SILICONE	1/4	K075-CRS	710021
CENTERING RING ASSEMBLY	AL	FKM/FPM	1/4	K075-CRA	710013
CENTERING RING ASSEMBLY	AL	BUNA-N	1/4	K075-CRAB	710017
CENTERING RING ADAPTER NW16 to NW10	SS	FKM/FPM	1/4	K075050-CR	710010
CENTERING RING ADAPTER NW16 to NW10	SS	BUNA-N	1/4	K075050-CRB	710029
CENTERING RING ADAPTER NW16 to NW10	SS	SILICONE	1/4	K075050-CRS	710030
O-RING, NON-STANDARD NW10, .60 ID	-	FKM/FPM	1/4	K050-O	711004
O-RING, NON-STANDARD NW10, .60 ID	-	BUNA-N	1/4	K050-OB	711020
O-RING, NON-STANDARD NW10, .60 ID	-	SILICONE	1/4	K050-OS	711005
O-RING, REPLACEMENT	-	FKM/FPM	1/4	K075-O	711000
O-RING, REPLACEMENT	-	BUNA-N	1/4	K075-OB	711021
O-RING, REPLACEMENT	-	SILICONE	1/4	K075-OS	711006
O-RING RETAINER	SS	-	1/4	K075-ORR	710025
CLAMP, HINGED	AL	-	1/2	K075-C	701000
CLAMP, BULKHEAD	ALUMINUM WITH 6 BOLTS	-	1/2	K075-BC	716000
FLANGE COVER	FLEXIBLE PLASTIC -6 PER PKG.	-	1/4	KFC075	192027



Kwik-Flange™ ISO KF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric, nonrotatable geometry
- Elastomer O-ring seal
- Clamp style fastening
- ISO compatible design

Specifications

Material

Flanges	304ss
O-rings	FKM / FPM fluoroelastomer, Buna-N® or Silicone elastomer
Clamps, hinged & bulkhead	Aluminum

Fastening

Clamp Type	Hinged with 10-32 thread
Bulkhead Type	Hexagonal head bolts, 10-32 thread
Nut Type	Hexagonal
Torque	Clamp: Finger tight Bolts: 7-10 lb-ft

Vacuum Range 1×10^{-8} Torr

Temperature Range	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C
Silicone	-20°C	200°C	150°C

Weight 1/4 lb maximum

Dimensions 1.57 OD x .875 ID maximum

HIGH VACUUM SERIES

Figure 1 Blank

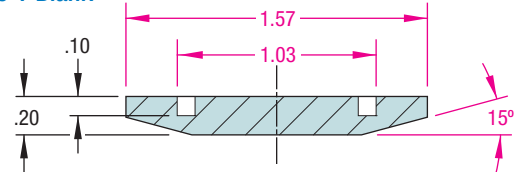


Figure 2 Unbored stub

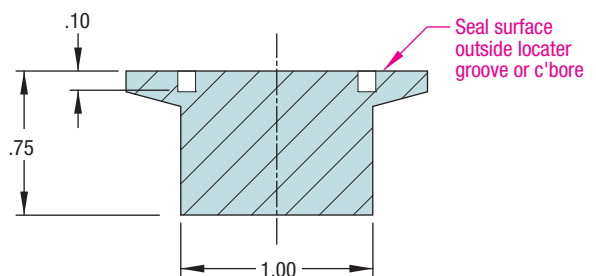


Figure 3 Weld flange - small tube

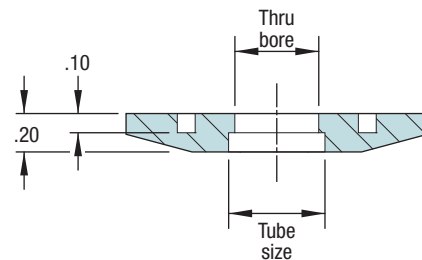


Figure 4 Weld flange

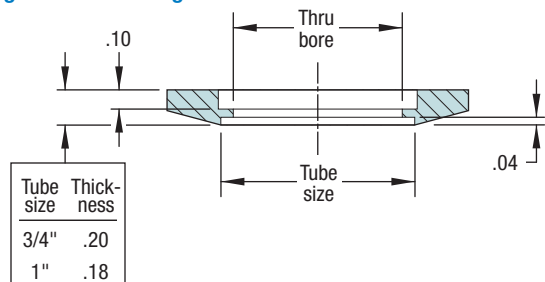
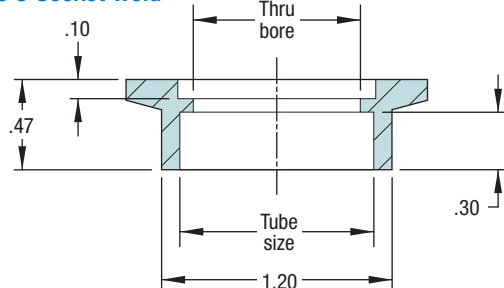


Figure 5 Socket weld



• Magenta colored dimensions are common to all flanges.

Flange Assembly



FLANGE ISO REF.	FLANGE O.D.	TUBE SIZE	WELD FLANGES	HINGED CLAMP	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW25	1.57	1	K100-W	K100-C	K100-CR	1	K100-CA	700002

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Kwik-Flange™ assembly consists of two weld flanges, one hinged clamp and one stainless steel centering ring assembly with a FKM / FPM fluoroelastomer O-ring.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	TUBE SIZE	THRU BORE	WT LB	REFERENCE	PART NUMBER
BLANK	1	BLANK	-	-	1/4	K100-B	712001
BLANK	2	UNBORED STUB	-	-	1/4	K100-US	715001
3/8	3	WELD	.377	.312	1/4	K100W-038	713008
1/2	3	WELD	.502	.437	1/4	K100W-050	713009
3/4	4	WELD	.760	.680	1/4	K100W-075	713010
1	4	WELD	1.010	.880	1/4	K100W-100	713011
1	5	SOCKET WELD	1.010	.870	1/4	K100-W	713002

Hardware



DESCRIPTION	PRIMARY MATL	O-RING MATL	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	SS	FKM / FPM	1/4	K100-CR	710001
CENTERING RING ASSEMBLY	SS	BUNA-N	1/4	K100-CRB	710005
CENTERING RING ASSEMBLY	SS	SILICONE	1/4	K100-CRS	710022
CENTERING RING ASSEMBLY	AL	FKM / FPM	1/4	K100-CRA	710014
CENTERING RING ASSEMBLY	AL	BUNA-N	1/4	K100-CRAB	710018
CENTERING RING ADAPTER NW25 to NW20	SS	FKM / FPM	1/4	K100087-CR	710011
CENTERING RING ADAPTER NW25 to NW20	SS	BUNA-N	1/4	K100087-CRB	710031
CENTERING RING ADAPTER NW25 to NW20	SS	SILICONE	1/4	K100087-CRS	710032
O-RING, REPLACEMENT	-	FKM / FPM	1/4	K100-O	711001
O-RING, REPLACEMENT	-	BUNA-N	1/4	K100-OB	711022
O-RING, REPLACEMENT	-	SILICONE	1/4	K100-OS	711007
O-RING RETAINER	SS	-	1/4	K100-ORR	710026
CLAMP, HINGED	AL	-	1/2	K100-C	701001
CLAMP, BULKHEAD	ALUMINUM WITH 6 BOLTS	-	1/2	K100-BC	716001
FLANGE COVER	FLEXIBLE PLASTIC -6 PER PKG.	-	1/4	KFC100	192028



Kwik-Flange™ ISO KF

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric, nonrotatable geometry
- Elastomer O-ring seal
- Clamp style fastening
- ISO compatible design
- Watercooled fitting available, page 113

Specifications

Material

Flanges	304ss
O-rings	FKM / FPM fluoroelastomer, Buna-N® or Silicone elastomer
Clamps, hinged & bulkhead	Aluminum

Fastening

Clamp Type	Hinged with 10-32 thread
Bulkhead Type	Hexagonal head bolts, 10-32 thread
Nut Type	Hexagonal
Torque	Clamp: Finger tight Bolts: 7-10 lb-ft

Vacuum Range	1×10^{-8} Torr
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Temperature Range	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C
Silicone	-20°C	200°C	150°C

Weight	1/2 lb maximum
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Dimensions	2.16 OD x 1.375 ID maximum
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HIGH VACUUM SERIES

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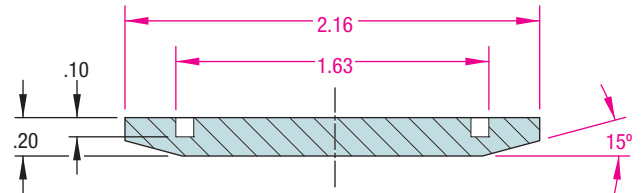


Figure 2 Unbored stub

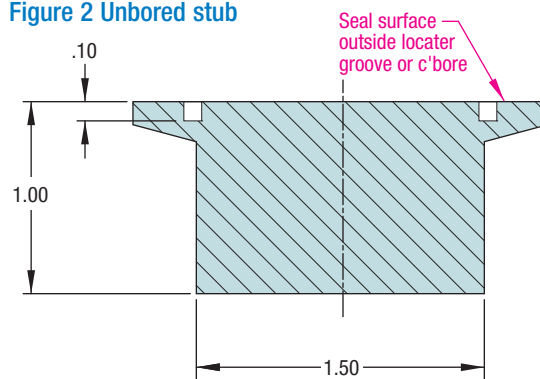


Figure 3 Weld flange - small tube

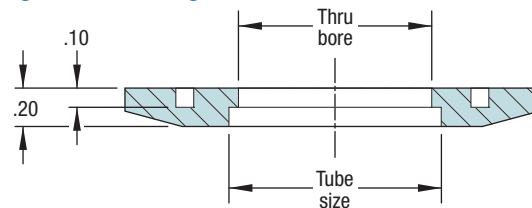


Figure 4 Weld flange

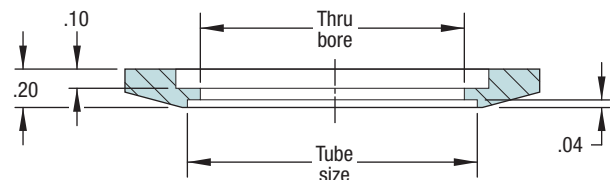
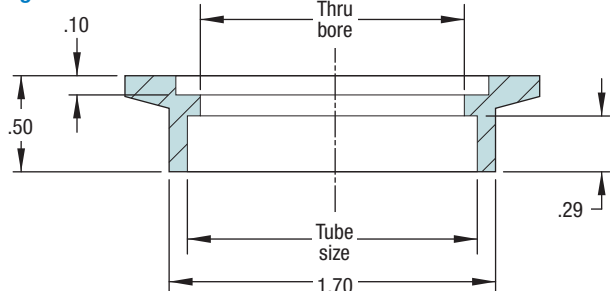


Figure 5 Socket weld



• Magenta colored dimensions are common to all flanges.

Flange Assembly



FLANGE ISO REF.	FLANGE O.D.	TUBE SIZE	WELD FLANGES	HINGED CLAMP	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW40	2.16	1-1/2	K150-W	K150-C	K150-CR	1	K150-CA	700003

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Kwik-Flange™ assembly consists of two weld flanges, one hinged clamp and one stainless steel centering ring assembly with a FKM / FPM fluoroelastomer O-ring.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	TUBE SIZE	THRU BORE	WT LB	REFERENCE	PART NUMBER
BLANK	1	BLANK	-	-	1/4	K150-B	712002
BLANK	2	UNBORED STUB	-	-	1/2	K150-US	715002
3/8	3	WELD	.377	.312	1/4	K150W-038	713012
1/2	3	WELD	.502	.437	1/4	K150W-050	713013
3/4	3	WELD	.760	.680	1/4	K150W-075	713014
1	3	WELD	1.010	.870	1/4	K150W-100	713015
1-1/2	4	WELD	1.510	1.375	1/4	K150W-150	713016
1-1/2	5	SOCKET WELD	1.510	1.375	1/4	K150-W	713003

Hardware



DESCRIPTION	PRIMARY MATL	O-RING MATL	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	SS	FKM / FPM	1/4	K150-CR	710002
CENTERING RING ASSEMBLY	SS	BUNA-N	1/4	K150-CRB	710006
CENTERING RING ASSEMBLY	SS	SILICONE	1/4	K150-CRS	710023
CENTERING RING ASSEMBLY	AL	FKM / FPM	1/4	K150-CRA	710015
CENTERING RING ASSEMBLY	AL	BUNA-N	1/4	K150-CRAB	710019
CENTERING RING ADAPTER NW40 to NW32	SS	FKM / FPM	1/4	K150137-CR	710012
CENTERING RING ADAPTER NW40 to NW32	SS	BUNA-N	1/4	K150137-CRB	710033
CENTERING RING ADAPTER NW40 to NW32	SS	SILICONE	1/4	K150137-CRS	710034
O-RING, REPLACEMENT	-	FKM / FPM	1/4	K150-O	711002
O-RING, REPLACEMENT	-	BUNA-N	1/4	K150-OB	711024
O-RING, REPLACEMENT	-	SILICONE	1/4	K150-OS	711008
O-RING RETAINER	SS	-	1/4	K150-ORR	710027
CLAMP, HINGED	AL	-	3/4	K150-C	701002
CLAMP, BULKHEAD	ALUMINUM WITH 6 BOLTS	-	1/2	K150-BC	716002
FLANGE COVER	FLEXIBLE PLASTIC -6 PER PKG.	-	1/4	KFC150	192029



Kwik-Flange™ ISO KF

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric & nonrotatable geometry
- Elastomer O-ring seal
- Clamp style fastening
- ISO compatible design
- Watercooled fitting available, page 113

Specifications

Material

Flanges	304ss
O-rings	FKM / FPM fluoroelastomer, Buna-N® or Silicone elastomer
Clamps, hinged & bulkhead	Aluminum

Fastening

Clamp Type	Hinged with 10-32 thread
Bulkhead Type	Hexagonal head bolts, 10-32 thread
Nut Type	Hexagonal
Torque	Clamp: Finger tight Bolts: 7-10 lb-ft

Vacuum Range 1×10^{-8} Torr

Temperature Range	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C
Silicone	-20°C	200°C	150°C

Weight 1/2 lb maximum

Dimensions 2.16 OD x 1.375 ID maximum

HIGH VACUUM SERIES

Figure 1 Blank

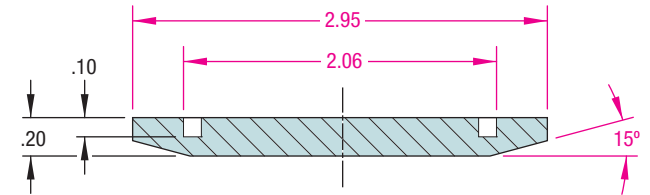


Figure 2 Unbored stub

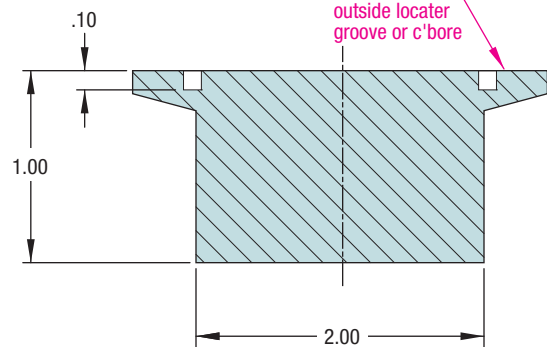


Figure 3 Weld flange - small tube

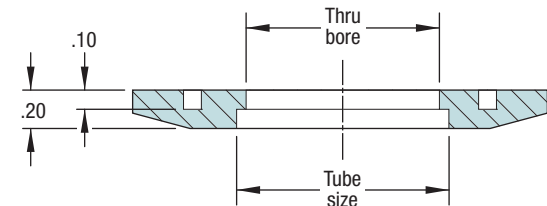


Figure 4 Weld flange

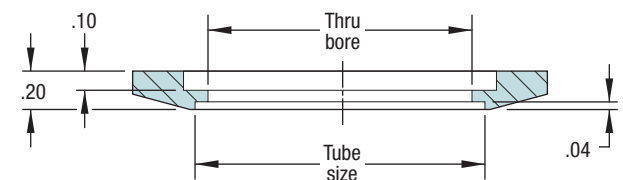
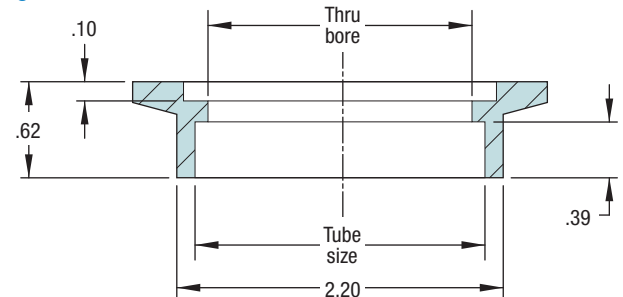


Figure 5 Socket weld



• Magenta colored dimensions are common to all flanges.

Flange Assembly



FLANGE ISO REF.	FLANGE O.D.	TUBE SIZE	WELD FLANGES	HINGED CLAMP	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW50	2.95	2	K200-W	K200-C	K200-CR	1-1/2	K200-CA	700004

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Kwik-Flange™ assembly consists of two weld flanges, one hinged clamp and one stainless steel centering ring assembly with a FKM / FPM fluoroelastomer O-ring.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	TUBE SIZE	THRU BORE	WT LB	REFERENCE	PART NUMBER
BLANK	1	BLANK	-	-	1/4	K200-B	712003
BLANK	2	UNBORED STUB	-	-	1/2	K200-US	715003
3/8	3	WELD	.377	.312	1/4	K200W-038	713017
1/2	3	WELD	.502	.437	1/4	K200W-050	713018
3/4	3	WELD	.760	.680	1/4	K200W-075	713019
1	3	WELD	1.010	.870	1/4	K200W-100	713020
1-1/2	3	WELD	1.510	1.370	1/4	K200W-150	713021
2	4	WELD	2.010	1.875	1/4	K200W-200	713022
2	5	SOCKET WELD	2.010	1.870	1/4	K200-W	713004

Hardware



DESCRIPTION	PRIMARY MATL	O-RING MATL	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	SS	FKM / FPM	1/4	K200-CR	710003
CENTERING RING ASSEMBLY	SS	BUNA-N	1/4	K200-CRB	710007
CENTERING RING ASSEMBLY	SS	SILICONE	1/4	K200-CRS	710024
CENTERING RING ASSEMBLY	AL	FKM / FPM	1/4	K200-CRA	710016
CENTERING RING ASSEMBLY	AL	BUNA-N	1/4	K200-CRAB	710020
O-RING, REPLACEMENT	-	FKM / FPM	1/4	K200-O	711003
O-RING, REPLACEMENT	-	BUNA-N	1/4	K200-OB	711025
O-RING, REPLACEMENT	-	SILICONE	1/4	K200-OS	711009
O-RING RETAINER	SS	-	1/4	K200-ORR	710028
CLAMP, HINGED	AL	-	1	K200-C	701003
CLAMP, BULKHEAD	AL WITH 8 BOLTS	-	1/2	K200-BC	716003
FLANGE COVER	FLEXIBLE PLASTIC -6 PER PKG.	-	1/4	KFC200	192030



Large-Flange™ ISO LF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric & nonrotatable geometry
- Rotatable bolt ring available
- Elastomer O-ring seal
- Three methods of fastening
- ISO compatible & modified ISO design
- Watercooled fitting available, page 113

Specifications

Material

Flanges	304ss
Rotatable Bolt Ring	Aluminum
O-rings	FKM / FPM fluoroelastomer or Buna-N® elastomer
Claw Clamps	Aluminum
Band clamps	431ss, heat treated

Fastening

Claw Clamp	M8-1.25 thread, 3-4 required
Band clamp	.250-28 thread
Bolt Type	Hexagonal head, M8-1.25 thread
Nut Type	Hexagonal
Torque	Band clamps: Finger tight Bolts: 7-10 lb-ft

Vacuum Range

1×10^{-8} Torr

Temperature Range

	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C

Weight

3 lb maximum

Dimensions

Clamp style: 3.74 OD x 2.37 ID maximum
Bolt style: 5.12 OD x 2.37 ID maximum

HIGH VACUUM SERIES

Figure 1 Claw-clamp style

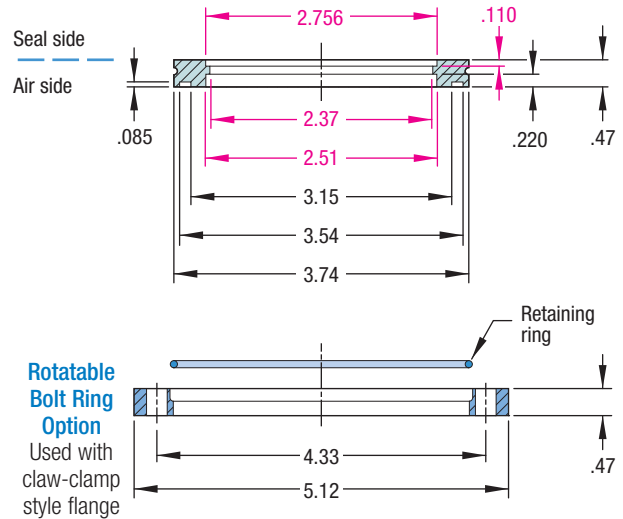


Figure 2 Bolt style

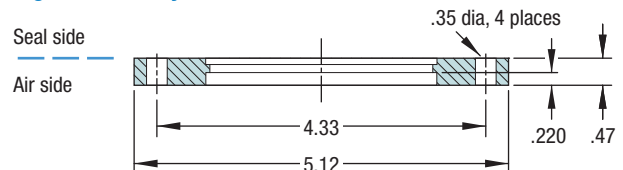


Figure 3 Band clamp style, modified ISO design

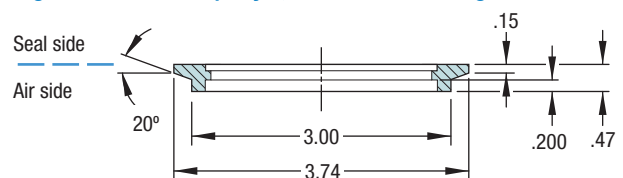
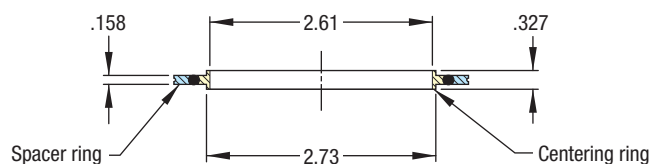


Figure 4 Centering Ring Assembly



- Magenta colored dimensions are common to all flanges.
- Centering ring locator groove on blank flanges is .250" wide.

Flange Assembly



FLANGE ISO REF.	TUBE SIZE	WELD FLANGES	CLAW-CLAMP REF.	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW63	2.50	L250-W	DC-8	L250-CR	2-1/2	L250-CA	800000

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Large-Flange™ assembly consists of two weld flanges, four double claw-clamps and one aluminum centering ring assembly with a FKM / FPM fluoroelastomer O-ring. These units are available only in the claw-clamp style configuration.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	FASTENING METHOD	WT LB	REFERENCE	PART NUMBER
-	1	BLANK	CLAW-CLAMP	1	L250-B	812000
2.50	1	WELD	CLAW-CLAMP	1/2	L250-W	813000
-	2	BLANK	BOLT	4	L250-BB	852000
2.50	2	WELD	BOLT	3	L250-BW	850000
-	3	BLANK	BANDED-CLAMP	1	L250-CFB	812014
2.50	3	WELD	BANDED-CLAMP	1/2	L250-CFW	813014

OPTIONAL FLANGE CONVERTER				WT LB	REFERENCE	PART NUMBER
ROTATABLE BOLT RING ASSEMBLY (ALUMINUM)				2	L250-RBF	853000
RETAINING RING, NICKEL PLATED STEEL				1/4	L250-RR	853020

A rotatable bolt ring assembly is used to add bolt holes to a standard claw-clamp style Large-Flange™. An assembly consists of one aluminum bolt ring and one nickel plated spring steel retaining ring. The retaining ring fits into a groove on a claw-clamp style flange and holds the bolt ring onto the flange. Replacement retaining rings are also available separately.

Hardware



DESCRIPTION	RING OR CLAMP MATL	O-RING OR BOLT MATL	THREAD	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	AL	FKM / FPM	-	1	L250-CR	810000
CENTERING RING ASSEMBLY	AL	BUNA-N	-	1	L250-CRB	810020
CENTERING RING ASSEMBLY	SS	FKM / FPM	-	1	L250-CRSS	810009
O-RING	-	FKM / FPM	-	1/4	L250-O	811000
O-RING	-	BUNA-N	-	1/4	L250-OB	811020
CLAMP, SINGLE CLAW	AL	STEEL	M8X35	1/4	SC-8	801000
CLAMP, DOUBLE CLAW	AL	STEEL	M8X45	1/4	DC-8	802000
CLAMP, BANDED	SS	STEEL	.250-28	1	L250-CFC	540002
BOLTS, CLEARANCE HOLE, PKG OF 4	-	STEEL	M8X45	1	LBA-250	854000
BOLTS, TAPPED HOLE, PKG OF 4	-	STEEL	M8X30	1	LBA-251	854020

- Clamps sold individually
- Bolts for clearance holes included nuts and washers
- Bolts for tapped holes include washer only



Large-Flange™ ISO LF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric & nonrotatable geometry
- Rotatable bolt ring available
- Elastomer O-ring seal
- Three methods of fastening
- ISO compatible & modified ISO design
- Watercooled fitting available, page 113

Specifications

Material

Flanges	304ss
Rotatable Bolt Ring	Aluminum
O-rings	FKM / FPM fluoroelastomer or Buna-N® elastomer
Claw Clamps	Aluminum
Band clamps	431ss, heat treated

Fastening

Claw Clamp	M8-1.25 thread, 4-8 required
Band clamp	.250-28 thread
Bolt Type	Hexagonal head, M8-1.25 thread
Nut Type	Hexagonal
Torque	Band clamps: Finger tight Bolts: 7-10 lb-ft

Vacuum Range

1×10^{-8} Torr

Temperature Range

	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C

Weight

3 lb maximum

Dimensions

Clamp style: 4.33 OD x 2.87 ID maximum
Bolt style: 5.71 OD x 2.87 ID maximum

HIGH VACUUM SERIES

Figure 1 Claw-clamp style

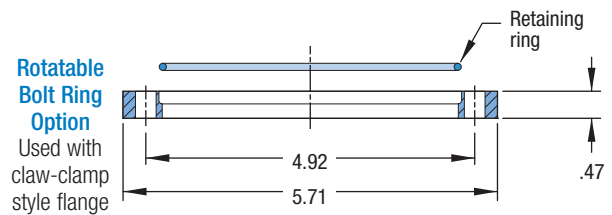
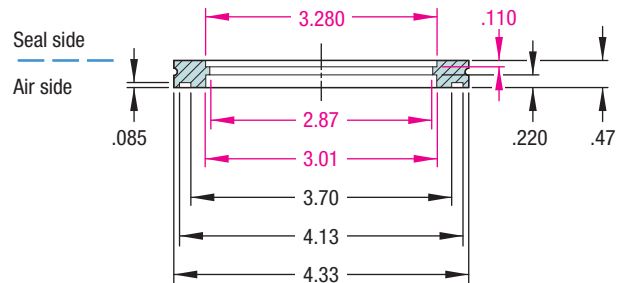


Figure 2 Bolt style

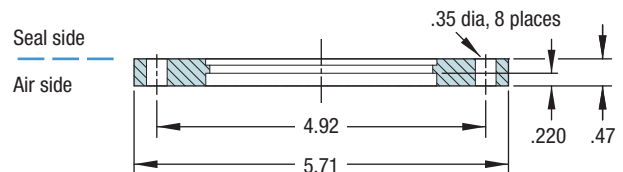


Figure 3 Band clamp style, modified ISO design

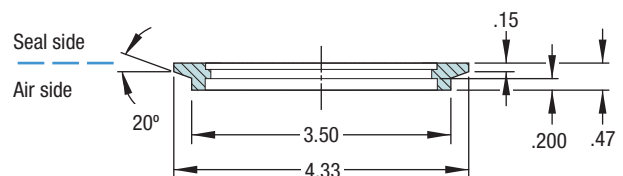
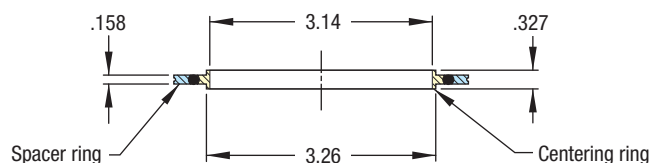


Figure 4 Centering Ring Assembly



- Magenta colored dimensions are common to all flanges.
- Centering ring locator groove on blank flanges is .250" wide.

Flange Assembly



FLANGE ISO REF.	TUBE SIZE	WELD FLANGES	CLAW-CLAMP REF.	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW80	3.00	L300-W	DC-8	L300-CR	2-1/2	L300-CA	800008

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Large-Flange™ assembly consists of two weld flanges, four double claw-clamps and one aluminum centering ring assembly with a FKM / FPM fluoroelastomer O-ring. These units are available only in the claw-clamp style configuration.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	FASTENING METHOD	WT LB	REFERENCE	PART NUMBER
-	1	BLANK	CLAW-CLAMP	1	L300-B	812008
3.00	1	WELD	CLAW-CLAMP	1/2	L300-W	813008
-	2	BLANK	BOLT	4	L300-BB	852008
3.00	2	WELD	BOLT	3	L300-BW	850008
-	3	BLANK	BANDED-CLAMP	1	L300-CFB	812015
3.00	3	WELD	BANDED-CLAMP	1/2	L300-CFW	813015

OPTIONAL FLANGE CONVERTER				WT LB	REFERENCE	PART NUMBER
ROTATABLE BOLT RING ASSEMBLY (ALUMINUM)				2	L300-RBF	853008
RETAINING RING, NICKEL PLATED STEEL				1/4	L300-RR	853028

A rotatable bolt ring assembly is used to add bolt holes to a standard claw-clamp style Large-Flange™. An assembly consists of one aluminum bolt ring and one nickel plated spring steel retaining ring. The retaining ring fits into a groove on a claw-clamp style flange and holds the bolt ring onto the flange. Replacement retaining rings are also available separately.

Hardware



DESCRIPTION	RING OR CLAMP MATL	O-RING OR BOLT MATL	THREAD	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	AL	FKM / FPM	-	1	L300-CR	810008
CENTERING RING ASSEMBLY	AL	BUNA-N	-	1	L300-CRB	810028
CENTERING RING ASSEMBLY	SS	FKM / FPM	-	1	L300-CRSS	810010
O-RING	-	FKM / FPM	-	1/4	L300-O	811008
O-RING	-	BUNA-N	-	1/4	L300-OB	811028
CLAMP, SINGLE CLAW	AL	STEEL	M8X35	1/4	SC-8	801000
CLAMP, DOUBLE CLAW	AL	STEEL	M8X45	1/4	DC-8	802000
CLAMP, BANDED	SS	STEEL	.250-28	1	L300-CFC	540003
BOLTS, CLEARANCE HOLE, PKG OF 8	-	STEEL	M8X45	1	LBA-300	854001
BOLTS, TAPPED HOLE, PKG OF 8	-	STEEL	M8X30	1	LBA-301	854021

- Clamps sold individually
- Bolts for clearance holes included nuts and washers
- Bolts for tapped holes include washer only



Large-Flange™ ISO LF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric & nonrotatable geometry
- Rotatable bolt ring available
- Elastomer O-ring seal
- Three methods of fastening
- ISO compatible & modified ISO design
- Watercooled fitting available, page 113

Specifications

Material

Flanges	304ss
Rotatable Bolt Ring	Aluminum
O-rings	FKM / FPM fluoroelastomer or Buna-N® elastomer
Claw Clamps	Aluminum
Band clamps	431ss, heat treated

Fastening

Claw Clamp	M8-1.25 thread, 4-8 required
Band clamp	.250-28 thread
Bolt Type	Hexagonal head, M8-1.25 thread
Nut Type	Hexagonal
Torque	Band clamps: Finger tight Bolts: 7-10 lb-ft

Vacuum Range

1×10^{-8} Torr

Temperature Range

	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C

Weight

6 lb maximum

Dimensions

Clamp style: 5.12 OD x 3.83 ID maximum
Bolt style: 6.50 OD x 3.87 ID maximum

HIGH VACUUM SERIES

Figure 1 Claw-clamp style

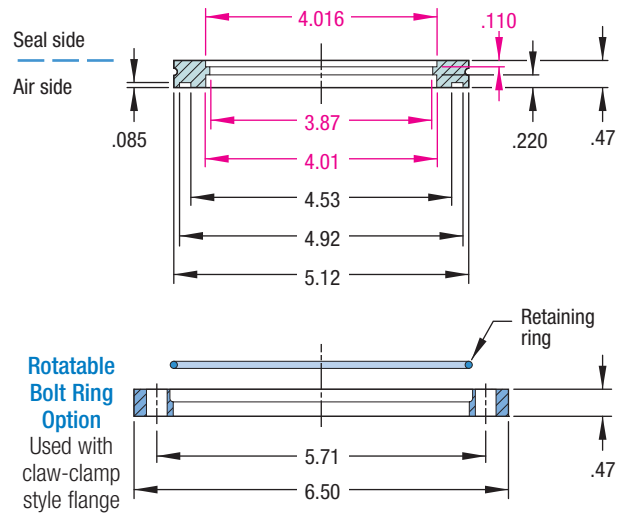


Figure 2 Bolt style

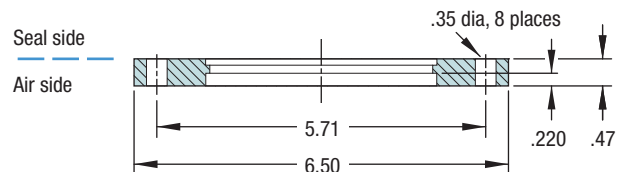


Figure 3 Band clamp style, modified ISO design

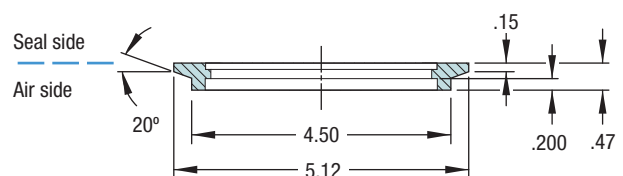
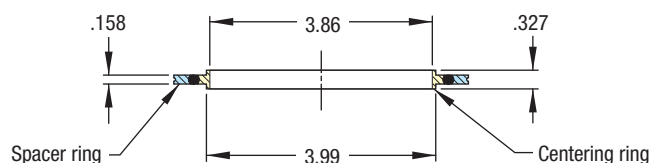


Figure 4 Centering Ring Assembly



- Magenta colored dimensions are common to all flanges.
- Centering ring locater groove on blank flanges is .250" wide.

Flange Assembly



FLANGE ISO REF.	TUBE SIZE	WELD FLANGES	CLAW-CLAMP REF.	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW100	4.00	L400-W	DC-8	L400-CR	3	L400-CA	800001

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Large-Flange™ assembly consists of two weld flanges, four double claw-clamps and one aluminum centering ring assembly with a FKM / FPM fluoroelastomer O-ring. These units are available only in the claw-clamp style configuration.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	FASTENING METHOD	WT LB	REFERENCE	PART NUMBER
-	1	BLANK	CLAW-CLAMP	1	L400-B	812001
4.00	1	WELD	CLAW-CLAMP	1/2	L400-W	813001
-	2	BLANK	BOLT	4	L400-BB	852001
4.00	2	WELD	BOLT	3	L400-BW	850001
-	3	BLANK	BANDED-CLAMP	1	L400-CFB	812016
4.00	3	WELD	BANDED-CLAMP	1/2	L400-CFW	813016

OPTIONAL FLANGE CONVERTER				WT LB	REFERENCE	PART NUMBER
ROTATABLE BOLT RING ASSEMBLY (ALUMINUM)				2	L400-RBF	853001
RETAINING RING, NICKEL PLATED STEEL				1/4	L400-RR	853021

A rotatable bolt ring assembly is used to add bolt holes to a standard claw-clamp style Large-Flange™. An assembly consists of one aluminum bolt ring and one nickel plated spring steel retaining ring. The retaining ring fits into a groove on a claw-clamp style flange and holds the bolt ring onto the flange. Replacement retaining rings are also available separately.

Hardware



DESCRIPTION	RING OR CLAMP MATL	O-RING OR BOLT MATL	THREAD	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	AL	FKM / FPM	-	1	L400-CR	810001
CENTERING RING ASSEMBLY	AL	BUNA-N	-	1	L400-CRB	810021
CENTERING RING ASSEMBLY	SS	FKM / FPM	-	1	L400-CRSS	810011
O-RING	-	FKM / FPM	-	1/4	L400-O	811001
O-RING	-	BUNA-N	-	1/4	L400-OB	811021
CLAMP, SINGLE CLAW	AL	STEEL	M8X35	1/4	SC-8	801000
CLAMP, DOUBLE CLAW	AL	STEEL	M8X45	1/4	DC-8	802000
CLAMP, BANDED	SS	STEEL	.250-28	1	L400-CFC	540004
BOLTS, CLEARANCE HOLE, PKG OF 8	-	STEEL	M8X45	1	LBA-300	854001
BOLTS, TAPPED HOLE, PKG OF 8	-	STEEL	M8X30	1	LBA-301	854021

- Clamps sold individually
- Bolts for clearance holes included nuts and washers
- Bolts for tapped holes include washer only



Large-Flange™ ISO LF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric & nonrotatable geometry
- Rotatable bolt ring available
- Elastomer O-ring seal
- Three methods of fastening
- ISO compatible & modified ISO design
- Watercooled fitting available, page 113

Specifications

Material

Flanges	304ss
Rotatable Bolt Ring	Aluminum
O-rings	FKM / FPM fluoroelastomer or Buna-N® elastomer
Claw Clamps	Aluminum
Band clamps	431ss, heat treated

Fastening

Claw Clamp	M10-1.50 thread, 4-8 required
Band clamp	.250-28 thread
Bolt Type	Hexagonal head, M10-1.50 thread
Nut Type	Hexagonal
Torque	Band clamps: Finger tight Bolts: 7-10 lb-ft

Vacuum Range

1×10^{-8} Torr

Temperature Range

	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C

Weight

11 lb maximum

Dimensions

Clamp style: 7.09 OD x 5.87 ID maximum
Bolt style: 8.86 OD x 5.83 ID maximum

HIGH VACUUM SERIES

Figure 1 Claw-clamp style

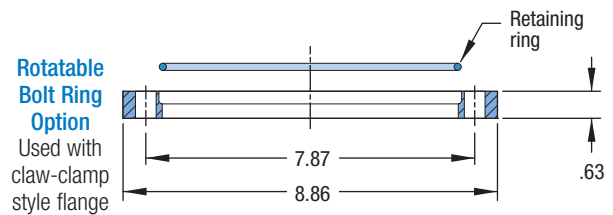
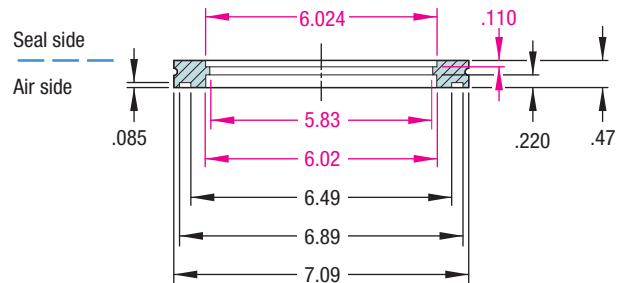


Figure 2 Bolt style

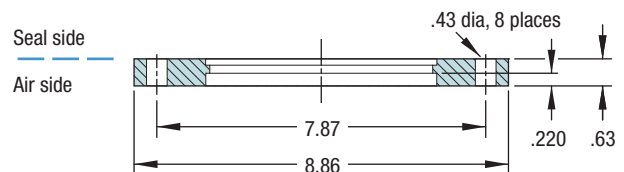


Figure 3 Band clamp style, modified ISO design

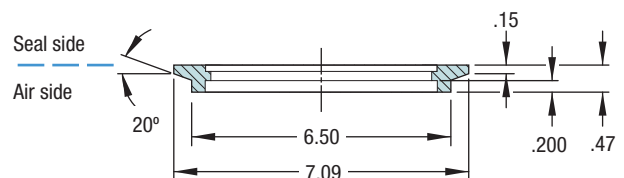
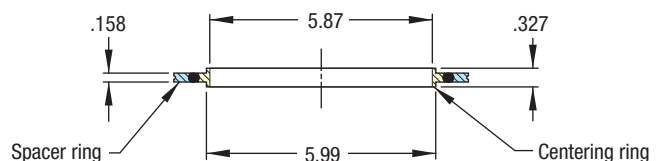


Figure 4 Centering Ring Assembly



- Magenta colored dimensions are common to all flanges.
- Centering ring locator groove on blank flanges is .250" wide.

Flange Assembly



FLANGE ISO REF.	TUBE SIZE	WELD FLANGES	CLAW-CLAMP REF.	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW160	6.00	L600-W	DC-10	L600-CR	4	L600-CA	800002

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Large-Flange™ assembly consists of two weld flanges, four double claw-clamps and one aluminum centering ring assembly with a FKM / FPM fluoroelastomer O-ring. These units are available only in the claw-clamp style configuration.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	FASTENING METHOD	WT LB	REFERENCE	PART NUMBER
-	1	BLANK	CLAW-CLAMP	5	L600-B	812002
6.00	1	WELD	CLAW-CLAMP	1-1/2	L600-W	813002
-	2	BLANK	BOLT	11	L600-BB	852002
6.00	2	WELD	BOLT	5	L600-BW	850002
-	3	BLANK	BANDED-CLAMP	5	L600-CFB	812017
6.00	3	WELD	BANDED-CLAMP	2	L600-CFW	813017

OPTIONAL FLANGE CONVERTER				WT LB	REFERENCE	PART NUMBER
ROTATABLE BOLT RING ASSEMBLY (ALUMINUM)				3	L600-RBF	853002
RETAINING RING, NICKEL PLATED STEEL				1/2	L600-RR	853022

A rotatable bolt ring assembly is used to add bolt holes to a standard claw-clamp style Large-Flange™. An assembly consists of one aluminum bolt ring and one nickel plated spring steel retaining ring. The retaining ring fits into a groove on a claw-clamp style flange and holds the bolt ring onto the flange. Replacement retaining rings are also available separately.

Hardware



DESCRIPTION	RING OR CLAMP MATL	O-RING OR BOLT MATL	THREAD	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	AL	FKM / FPM	-	1	L600-CR	810002
CENTERING RING ASSEMBLY	AL	BUNA-N	-	1	L600-CRB	810022
CENTERING RING ASSEMBLY	SS	FKM / FPM	-	1	L600-CRSS	810012
O-RING	-	FKM / FPM	-	1/4	L600-O	811002
O-RING	-	BUNA-N	-	1/4	L600-OB	811022
CLAMP, SINGLE CLAW	AL	STEEL	M10X35	1/4	SC-10	801002
CLAMP, DOUBLE CLAW	AL	STEEL	M10X45	1/4	DC-10	802002
CLAMP, BANDED	SS	STEEL	.250-28	2	L600-CFC	540005
BOLTS, CLEARANCE HOLE, PKG OF 8	-	STEEL	M10X45	2	LBA-600	854002
BOLTS, TAPPED HOLE, PKG OF 8	-	STEEL	M10X30	2	LBA-601	854022

- Clamps sold individually
- Bolts for clearance holes included nuts and washers
- Bolts for tapped holes include washer only



Large-Flange™ ISO LF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric & nonrotatable geometry
- Rotatable bolt ring available
- Elastomer O-ring seal
- Three methods of fastening
- ISO compatible & modified ISO design
- Watercooled fitting available, page 113

Specifications

Material

Flanges	304ss
Rotatable Bolt Ring	Aluminum
O-rings	FKM / FPM fluoroelastomer or Buna-N® elastomer
Claw Clamps	Aluminum
Band clamps	431ss, heat treated

Fastening

Claw Clamp	M10-1.50 thread, 6-12 required
Band clamp	.250-28 thread
Bolt Type	Hexagonal head, M10-1.50 thread
Nut Type	Hexagonal
Torque	Band clamps: Finger tight Bolts: 7-10 lb-ft

Vacuum Range 1×10^{-8} Torr

Temperature Range	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C

Weight 3 lb maximum

Dimensions Clamp style: 9.45 OD x 7.83 ID maximum
Bolt style: 11.22 OD x 7.83 ID maximum

HIGH VACUUM SERIES

Figure 1 Claw-clamp style

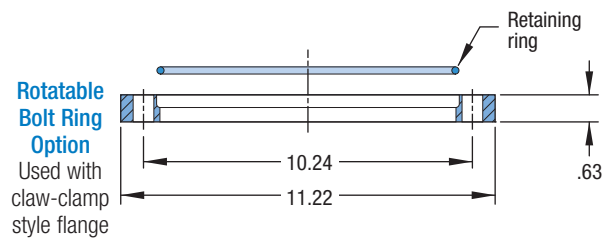
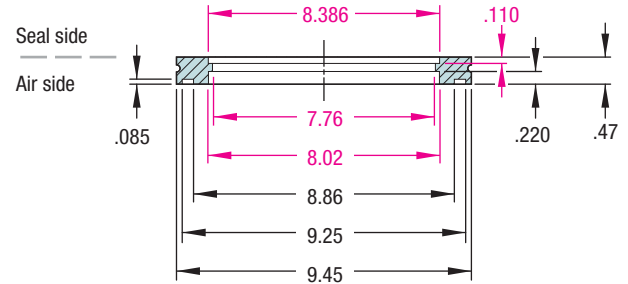


Figure 2 Bolt style

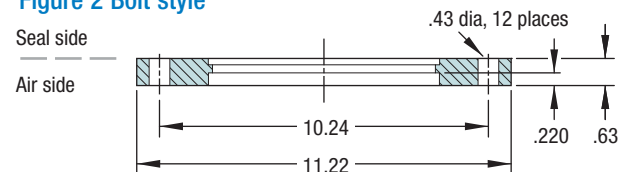


Figure 3 Band clamp style, modified ISO design

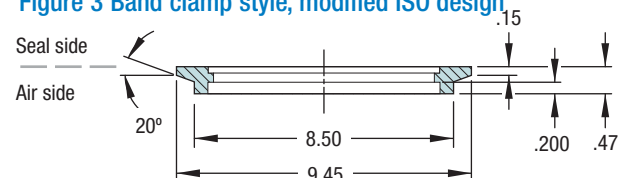
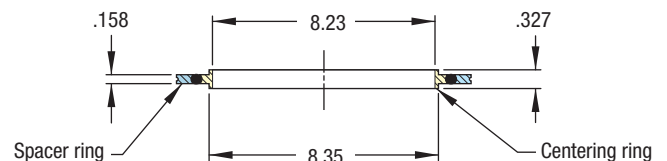


Figure 4 Centering Ring Assembly



- Magenta colored dimensions are common to all flanges.
- Centering ring locator groove on blank flanges is .250" wide.

Flange Assembly



FLANGE ISO REF.	TUBE SIZE	WELD FLANGES	CLAW-CLAMP REF.	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW200	8.00	L800-W	DC-10	L800-CR	4	L800-CA	800003

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Large-Flange™ assembly consists of two weld flanges, six double claw-clamps and one aluminum centering ring assembly with a FKM / FPM fluoroelastomer O-ring. These units are available only in the claw-clamp style configuration.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	FASTENING METHOD	WT LB	REFERENCE	PART NUMBER
-	1	BLANK	CLAW-CLAMP	8	L800-B	812003
8.00	1	WELD	CLAW-CLAMP	2	L800-W	813003
-	2	BLANK	BOLT	18	L800-BB	852003
8.00	2	WELD	BOLT	8	L800-BW	850003
-	3	BLANK	BANDED-CLAMP	8	L800-CFB	812018
8.00	3	WELD	BANDED-CLAMP	2	L800-CFW	813018

OPTIONAL FLANGE CONVERTER				WT LB	REFERENCE	PART NUMBER
ROTATABLE BOLT RING ASSEMBLY (ALUMINUM)				6	L800-RBF	853003
RETAINING RING, NICKEL PLATED STEEL				1/2	L800-RR	853023

A rotatable bolt ring assembly is used to add bolt holes to a standard claw-clamp style Large-Flange™. An assembly consists of one aluminum bolt ring and one nickel plated spring steel retaining ring. The retaining ring fits into a groove on a claw-clamp style flange and holds the bolt ring onto the flange. Replacement retaining rings are also available separately.

Hardware



DESCRIPTION	RING OR CLAMP MATL	O-RING OR BOLT MATL	THREAD	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	AL	FKM / FPM	-	1	L800-CR	810003
CENTERING RING ASSEMBLY	AL	BUNA-N	-	1	L800-CRB	810023
CENTERING RING ASSEMBLY	SS	FKM / FPM	-	1	L800-CRSS	810013
O-RING	-	FKM / FPM	-	1/4	L800-O	811003
O-RING	-	BUNA-N	-	1/4	L800-OB	811023
CLAMP, SINGLE CLAW	AL	STEEL	M10X35	1/4	SC-10	801002
CLAMP, DOUBLE CLAW	AL	STEEL	M10X45	1/4	DC-10	802002
CLAMP, BANDED	SS	STEEL	.250-28	2	L800-CFC	540006
BOLTS, CLEARANCE HOLE, PKG OF 12	-	STEEL	M10X45	2	LBA-800	854003
BOLTS, TAPPED HOLE, PKG OF 12	-	STEEL	M10X30	2	LBA-801	854023

- Clamps sold individually
- Bolts for clearance holes included nuts and washers
- Bolts for tapped holes include washer only



Large-Flange™ ISO LF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric & nonrotatable geometry
- Rotatable bolt ring available
- Elastomer O-ring seal
- Claw-clamp style or bolt style fastening
- ISO compatible design

Specifications

Material

Flanges	304ss
Rotatable Bolt Ring	Aluminum
O-rings	FKM / FPM fluoroelastomer or Buna-N® elastomer
Claw Clamps	Aluminum

Fastening

Claw Clamp	M10-1.50 thread, 6-12 required
Bolt Type	Hexagonal head, M10-1.50 thread
Nut Type	Hexagonal
Torque	Bolts: 7-10 lb-ft

Vacuum Range 1×10^{-8} Torr

Temperature Range	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C

Weight 25 lb maximum

Dimensions Clamp style: 11.42 OD x 9.75 ID maximum
Bolt style: 13.19 OD x 9.75 ID maximum

HIGH VACUUM SERIES

Figure 1 Claw-clamp style

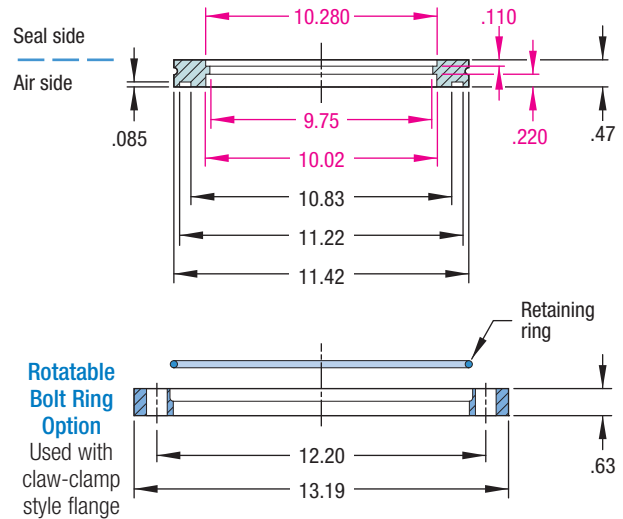


Figure 2 Bolt style

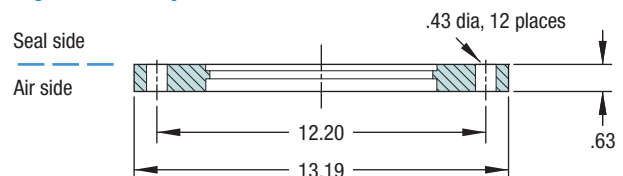
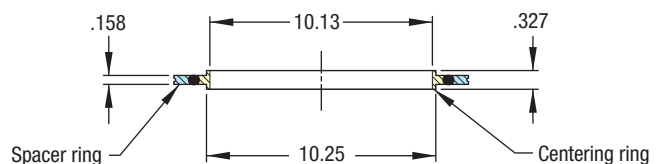


Figure 3 Centering Ring Assembly



- Magenta colored dimensions are common to all flanges.
- Centering ring locator groove on blank flanges is .250" wide.

Flange Assembly



FLANGE ISO REF.	TUBE SIZE	WELD FLANGES	CLAW-CLAMP REF.	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW250	10.00	L1000-W	DC-10	L1000-CR	7	L1000-CA	800004

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Large-Flange™ assembly consists of two weld flanges, six double claw-clamps and one aluminum centering ring assembly with a FKM / FPM fluoroelastomer O-ring. These units are available only in the claw-clamp style configuration.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	FASTENING METHOD	WT LB	REFERENCE	PART NUMBER
-	1	BLANK	CLAW-CLAMP	13	L1000-B	812004
10.00	1	WELD	CLAW-CLAMP	3	L1000-W	813004
-	2	BLANK	BOLT	25	L1000-BB	852004
10.00	2	WELD	BOLT	10	L1000-BW	850004

OPTIONAL FLANGE CONVERTER				WT LB	REFERENCE	PART NUMBER
ROTATABLE BOLT RING ASSEMBLY (ALUMINUM)				10	L1000-RBF	853004
RETAINING RING, NICKEL PLATED STEEL				1/2	L1000-RR	853024

A rotatable bolt ring assembly is used to add bolt holes to a standard claw-clamp style Large-Flange™. An assembly consists of one aluminum bolt ring and one nickel plated spring steel retaining ring. The retaining ring fits into a groove on a claw-clamp style flange and holds the bolt ring onto the flange. Replacement retaining rings are also available separately.

Hardware



DESCRIPTION	RING OR CLAMP MATL	O-RING OR BOLT MATL	THREAD	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	AL	FKM / FPM	-	1	L1000-CR	810004
CENTERING RING ASSEMBLY	AL	BUNA-N	-	1	L1000-CRB	810024
CENTERING RING ASSEMBLY	SS	FKM / FPM	-	1	L1000-CRSS	810014
O-RING	-	FKM / FPM	-	1/4	L1000-O	811004
O-RING	-	BUNA-N	-	1/4	L1000-OB	811024
CLAMP, SINGLE CLAW	AL	STEEL	M10X35	1/4	SC-10	801002
CLAMP, DOUBLE CLAW	AL	STEEL	M10X45	1/4	DC-10	802002
BOLTS, CLEARANCE HOLE, PKG OF 12	-	STEEL	M10X45	2	LBA-800	854003
BOLTS, TAPPED HOLE, PKG OF 12	-	STEEL	M10X30	2	LBA-801	854023

- Clamps sold individually
- Bolts for clearance holes included nuts and washers
- Bolts for tapped holes include washer only



Large-Flange™ ISO LF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric & nonrotatable geometry
- Rotatable bolt ring available
- Elastomer O-ring seal
- Claw-clamp style or bolt style fastening
- ISO compatible design

Specifications

Material

Flanges	304ss
Rotatable Bolt Ring	Aluminum
O-rings	FKM / FPM fluoroelastomer or Buna-N® elastomer
Claw Clamps	Aluminum

Fastening

Claw Clamp	M12-1.75 thread, 8-12 required
Bolt Type	Hexagonal head, M12-1.75 thread
Nut Type	Hexagonal
Torque	Bolts: 7-10 lb-ft

Vacuum Range	1×10^{-8} Torr
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Temperature Range	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C

Weight	50 lb maximum
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Dimensions	Clamp style: 14.57 OD x 12.42 ID maximum
	Bolt style: 16.73 OD x 12.42 ID maximum

HIGH VACUUM SERIES

Figure 1 Claw-clamp style

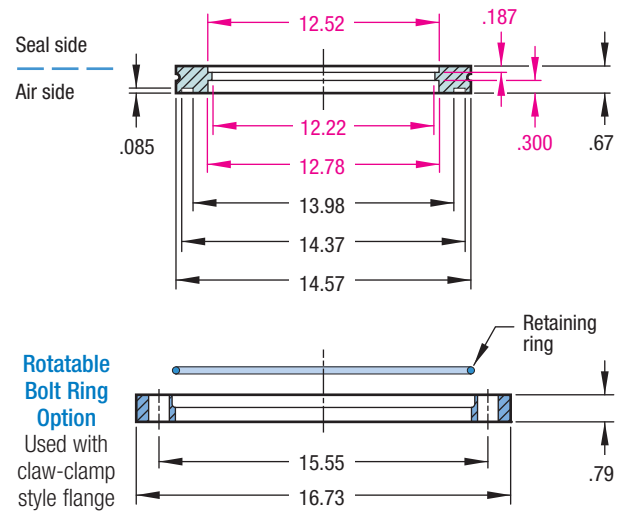


Figure 2 Bolt style

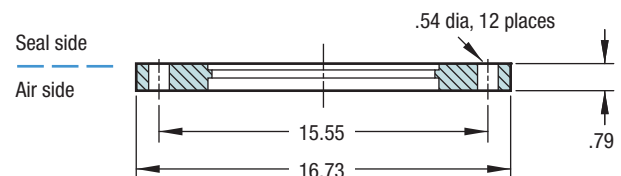
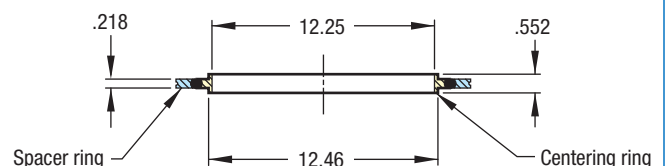


Figure 3 Centering Ring Assembly



- Magenta colored dimensions are common to all flanges.
- Centering ring locator groove on blank flanges is .250" wide.

Flange Assembly



FLANGE ISO REF.	TUBE SIZE	WELD FLANGES	CLAW-CLAMP REF.	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW320	12.75	L1200-W	DC-12	L1200-CR	18	L1200-CA	800005

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Large-Flange™ assembly consists of two weld flanges, eight double claw-clamps and one aluminum centering ring assembly with a FKM / FPM fluoroeelastomer O-ring. These units are available only in the claw-clamp style configuration.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	FASTENING METHOD	WT LB	REFERENCE	PART NUMBER
-	1	BLANK	CLAW-CLAMP	32	L1200-B	812005
12.75	1	WELD	CLAW-CLAMP	8	L1200-W	813005
-	2	BLANK	BOLT	50	L1200-BB	852005
12.75	2	WELD	BOLT	25	L1200-BW	850005

OPTIONAL FLANGE CONVERTER	WT LB	REFERENCE	PART NUMBER
ROTATABLE BOLT RING ASSEMBLY (ALUMINUM)	12	L1200-RBF	853005
RETAINING RING, NICKEL PLATED STEEL	1/2	L1200-RR	853025

A rotatable bolt ring assembly is used to add bolt holes to a standard claw-clamp style Large-Flange™. An assembly consists of one aluminum bolt ring and one nickel plated spring steel retaining ring. The retaining ring fits into a groove on a claw-clamp style flange and holds the bolt ring onto the flange. Replacement retaining rings are also available separately.

Hardware



DESCRIPTION	RING OR CLAMP MATL	O-RING OR BOLT MATL	THREAD	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	AL	FKM / FPM	-	1	L1200-CR	810005
CENTERING RING ASSEMBLY	AL	BUNA-N	-	1	L1200-CRB	810025
CENTERING RING ASSEMBLY	SS	FKM / FPM	-	1	L1200-CRSS	810015
O-RING	-	FKM / FPM	-	1/4	L1200-O	811005
O-RING	-	BUNA-N	-	1/4	L1200-OB	811025
CLAMP, SINGLE CLAW	AL	STEEL	M12X50	1/4	SC-12	801005
CLAMP, DOUBLE CLAW	AL	STEEL	M12X55	1/4	DC-12	802005
BOLTS, CLEARANCE HOLE, PKG OF 12	-	STEEL	M12X60	2	LBA-1275	854005
BOLTS, TAPPED HOLE, PKG OF 12	-	STEEL	M12X45	2	LBA-1276	854025

- Clamps sold individually
- Bolts for clearance holes included nuts and washers
- Bolts for tapped holes include washer only



Large-Flange™ ISO LF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric & nonrotatable geometry
- Rotatable bolt ring available
- Elastomer O-ring seal
- Claw-clamp style or bolt style fastening
- ISO compatible design

Specifications

Material

Flanges	304ss
Rotatable Bolt Ring	Aluminum
O-rings	FKM / FPM fluoroelastomer or Buna-N® elastomer
Claw Clamps	Aluminum

Fastening

Claw Clamp	M12-1.75 thread, 8-16 required
Bolt Type	Hexagonal head, M12-1.75 thread
Nut Type	Hexagonal
Torque	Bolts: 7-10 lb-ft

Vacuum Range 1×10^{-8} Torr

Temperature Range	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C

Weight 75 lb maximum

Dimensions Clamp style: 17.72 OD x 15.50 ID maximum
Bolt style: 20.08 OD x 15.50 ID maximum

HIGH VACUUM SERIES

Figure 1 Claw-clamp style

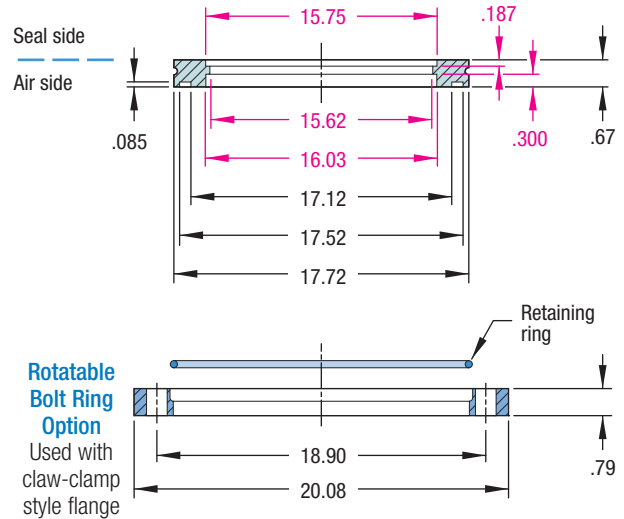


Figure 2 Bolt style

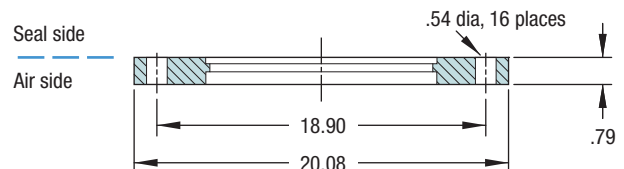
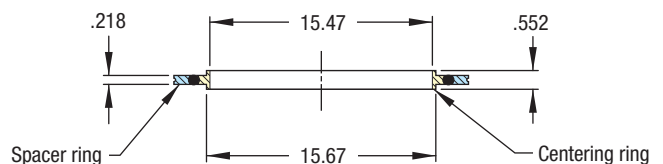


Figure 3 Centering Ring Assembly



- Magenta colored dimensions are common to all flanges.
- Centering ring locator groove on blank flanges is .250" wide.

Flange Assembly



FLANGE ISO REF.	TUBE SIZE	WELD FLANGES	CLAW-CLAMP REF.	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW400	16.00	L1600-W	DC-12	L1600-CR	21	L1600-CA	800006

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Large-Flange™ assembly consists of two weld flanges, eight double claw-clamps and one aluminum centering ring assembly with a FKM / FPM fluoroelastomer O-ring. These units are available only in the claw-clamp style configuration.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	FASTENING METHOD	WT LB	REFERENCE	PART NUMBER
-	1	BLANK	CLAW-CLAMP	45	L1600-B	812006
16.00	1	WELD	CLAW-CLAMP	10	L1600-W	813006
-	2	BLANK	BOLT	75	L1600-BB	852006
16.00	2	WELD	BOLT	25	L1600-BW	850006

OPTIONAL FLANGE CONVERTER	WT LB	REFERENCE	PART NUMBER
ROTATABLE BOLT RING ASSEMBLY (ALUMINUM)	30	L1600-RBF	853006
RETAINING RING, NICKEL PLATED STEEL	1/2	L1600-RR	853026

A rotatable bolt ring assembly is used to add bolt holes to a standard claw-clamp style Large-Flange™. An assembly consists of one aluminum bolt ring and one nickel plated spring steel retaining ring. The retaining ring fits into a groove on a claw-clamp style flange and holds the bolt ring onto the flange. Replacement retaining rings are also available separately.

Hardware



DESCRIPTION	RING OR CLAMP MATL	O-RING OR BOLT MATL	THREAD	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	AL	FKM / FPM	-	1	L1600-CR	810006
CENTERING RING ASSEMBLY	AL	BUNA-N	-	1	L1600-CRB	810026
CENTERING RING ASSEMBLY	SS	FKM / FPM	-	1	L1600-CRSS	810016
O-RING	-	FKM / FPM	-	1/4	L1600-O	811006
O-RING	-	BUNA-N	-	1/4	L1600-OB	811026
CLAMP, SINGLE CLAW	AL	STEEL	M12X50	1/4	SC-12	801005
CLAMP, DOUBLE CLAW	AL	STEEL	M12X55	1/4	DC-12	802005
BOLTS, CLEARANCE HOLE, PKG OF 16	-	STEEL	M12X60	4	LBA-1600	854006
BOLTS, TAPPED HOLE, PKG OF 16	-	STEEL	M12X45	4	LBA-1601	854026

- Clamps sold individually
- Bolts for clearance holes included nuts and washers
- Bolts for tapped holes include washer only



Large-Flange™ ISO LF

Features

- HV rated to 1×10^{-8} Torr
- High temperature rated to 200°C
- Symmetric & nonrotatable geometry
- Rotatable bolt ring available
- Elastomer O-ring seal
- Claw-clamp style or bolt style fastening
- ISO compatible design

Specifications

Material

Flanges	304ss
Rotatable Bolt Ring	Aluminum
O-rings	FKM / FPM fluoroelastomer or Buna-N® elastomer
Claw Clamps	Aluminum

Fastening

Claw Clamp	M12-1.75 thread, 12-16 required
Bolt Type	Hexagonal head, M12-1.75 thread
Nut Type	Hexagonal
Torque	Bolts: 7-10 lb-ft

Vacuum Range 1×10^{-8} Torr

Temperature Range	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C

Weight 95 lb maximum

Dimensions Clamp style: 21.65 OD x 19.50 ID maximum
Bolt style: 24.02 OD x 19.50 ID maximum

HIGH VACUUM SERIES

Figure 1 Claw-clamp style

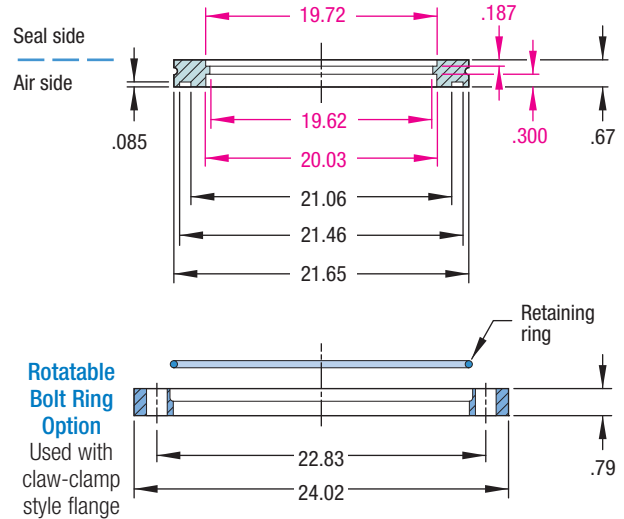


Figure 2 Bolt style

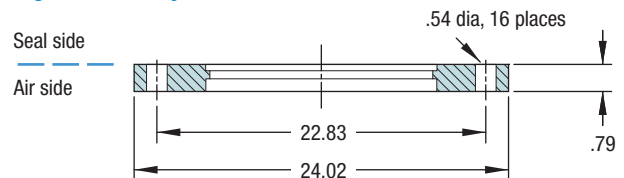
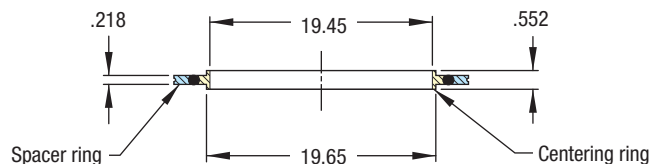


Figure 3 Centering Ring Assembly



- Magenta colored dimensions are common to all flanges.
- Centering ring locator groove on blank flanges is .250" wide.

Flange Assembly



FLANGE ISO REF.	TUBE SIZE	WELD FLANGES	CLAW-CLAMP REF.	CENTERING RING	WT LB	REFERENCE	PART NUMBER
NW500	20.00	L2000-W	DC-12	L2000-CR	25	L2000-CA	800007

A flange assembly provides all the flange components for making a single vacuum seal in a system.

Only tubing is required for welding to the flanges. One complete Large-Flange™ assembly consists of two weld flanges, twelve double claw-clamps and one aluminum centering ring assembly with a FKM / FPM fluoroelastomer O-ring. These units are available only in the claw-clamp style configuration.

Flange



TUBE O.D. NOMINAL	FIG.	FLANGE REF.	FASTENING METHOD	WT LB	REFERENCE	PART NUMBER
-	1	BLANK	CLAW-CLAMP	69	L2000-B	812007
20.00	1	WELD	CLAW-CLAMP	12	L2000-W	813007
-	2	BLANK	BOLT	95	L2000-BB	852007
20.00	2	WELD	BOLT	55	L2000-BW	850007

OPTIONAL FLANGE CONVERTER	WT LB	REFERENCE	PART NUMBER
ROTATABLE BOLT RING ASSEMBLY (ALUMINUM)	35	L2000-RBF	853007
RETAINING RING, NICKEL PLATED STEEL	1/2	L2000-RR	853027

A rotatable bolt ring assembly is used to add bolt holes to a standard claw-clamp style Large-Flange™. An assembly consists of one aluminum bolt ring and one nickel plated spring steel retaining ring. The retaining ring fits into a groove on a claw-clamp style flange and holds the bolt ring onto the flange. Replacement retaining rings are also available separately.

Hardware



DESCRIPTION	RING OR CLAMP MATL	O-RING OR BOLT MATL	THREAD	WT LB	REFERENCE	PART NUMBER
CENTERING RING ASSEMBLY	AL	FKM/FPM	-	1	L2000-CR	810007
CENTERING RING ASSEMBLY	AL	BUNA-N	-	1	L2000-CRB	810027
CENTERING RING ASSEMBLY	SS	FKM/FPM	-	1	L2000-CRSS	810017
O-RING	-	FKM / FPM	-	1/4	L2000-O	811007
O-RING	-	BUNA-N	-	1/4	L2000-OB	811027
CLAMP, SINGLE CLAW	AL	STEEL	M12X50	1/4	SC-12	801005
CLAMP, DOUBLE CLAW	AL	STEEL	M12X55	1/4	DC-12	802005
BOLTS, CLEARANCE HOLE, PKG OF 16	-	STEEL	M12X60	4	LBA-1600	854006
BOLTS, TAPPED HOLE, PKG OF 16	-	STEEL	M12X45	4	LBA-1601	854026

- Clamps sold individually
- Bolts for clearance holes included nuts and washers
- Bolts for tapped holes include washer only



45° Elbow Fittings page 121



Conical Nipple Reducers page 120



Four-Way Crosses page 126



90° Elbows page 122

Features

- High vacuum rated to 1×10^{-8} Torr
- Temperature rated to 200°C maximum
- Symmetric, nonrotatable geometries
- Rotatable Bolt Rings available for LF sizes
- FKM / FPM fluoroelastomer or Buna-N® O-rings
- Standard matte finish
- ISO compatible design for full range of KF and LF sizes, NW16 to NW500

Specifications

Material

Flanges	304ss
Tubing	304ss
Finish	Standard matte finish

Vacuum

Range	1×10^{-8} Torr
Fittings Leak Test	2×10^{-10} cc/sec of He

Temperature Range	Minimum	Intermittent	Sustained
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C
Silicone	-50°C	200°C	150°C

Weight and Dimensions	See table
-----------------------	-----------

HIGH VACUUM SERIES

Description

MDC Kwik-Flange™ ISO KF and Large-Flange™ ISO LF Tube Fittings are convenient “building-block” components. They offer great flexibility in the design and construction of high vacuum systems. All fittings are fabricated from type 304 stainless steel drawn and welded vacuum tubing. Flanges do not need to be rotatable since they are completely symmetric. If desired, Rotatable Bolt Ring Assemblies can be retrofitted to existing Claw-Clamp style flanges to add bolt holes to ISO LF fittings.

Reducers are used for a change in size of flanges within a single method of sealing, such as elastomer sealing of ISO KF and LF flanges. All ISO reducers are found in Section 1.2.

Adapters are used to change from one method of sealing to another, such as elastomer seal ISO to metal seal CF. Common configurations of Kwik-Flange™ and Large-Flange™ to various other vacuum connections are listed in Section 1.5, Hybrid Flange Adapters, page 148.

Inch-Metric Comparison

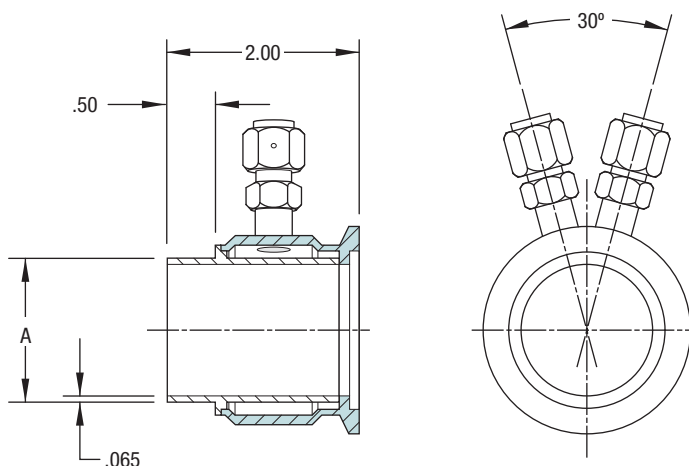
MDC	O.D.	ISO	I.D.	
	Inches		mm	Inches
K075	.75	NW16	16	.63
K100	1.00	NW25	25	.98
K150	1.50	NW40	40	1.57
K200	2.00	NW50	50	1.97
L250	2.50	NW63	63	2.48
L300	3.00	NW80	80	3.15
L400	4.00	NW100	100	3.94
L600	6.00	NW160	160	6.30
L800	8.00	NW200	200	7.87
L1000	10.00	NW250	250	9.84
L1200	12.75	NW320	320	12.60
L1600	16.00	NW400	400	15.75
L2000	20.00	NW500	500	19.69

All dimensions in this catalog are given in inches unless specified otherwise.

KF Clamp style



- 1/4" Swagelok® fittings
- Maximum operating temperature of system surrounding flange 300°C
- Nominal water flow rate of 6 to 8 gpm at 60 psi

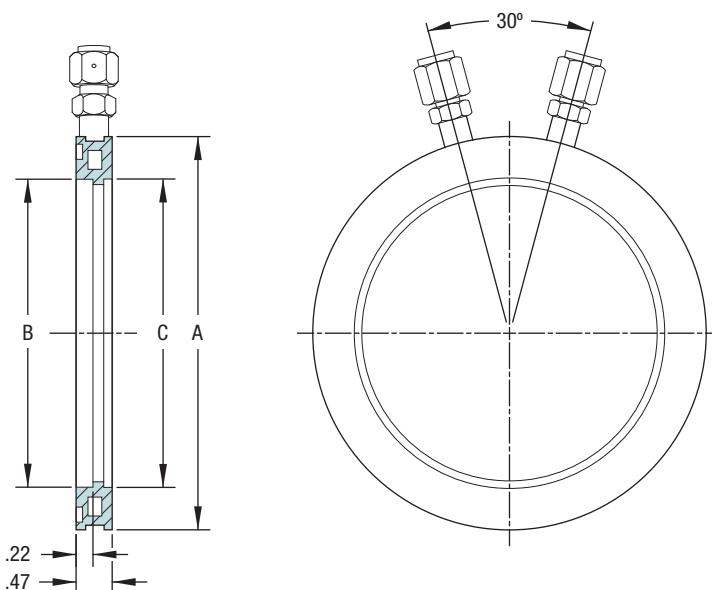


FLANGE ISO REF	FLANGE O.D.	TUBE SIZE	A	WT LB	REFERENCE	PART NUMBER
NW40	2.16	1-1/2	1.50	1/2	K150-WWC	715114
NW50	2.95	2	2.00	1/2	K200-WWC	715115

LF Clamp style



- 1/4" Swagelok® fittings
- Maximum operating temperature of system surrounding flange 300°C
- Nominal water flow rate of 4 to 6 gpm at 60 psi



FLANGE ISO REF	TUBE SIZE	A	B	C	WT LB	REFERENCE	PART NUMBER
NW63	2.50	3.74	2.51	2.37	1/2	L250-WWC	813009
NW80	3.00	4.33	3.01	2.87	3/4	L300-WWC	813010
NW100	4.00	5.12	4.01	3.83	1	L400-WWC	813011
NW160	6.00	7.09	6.02	5.87	1-1/2	L600-WWC	813012
NW200	8.00	9.45	8.02	7.83	2	L800-WWC	813013

KF Clamp style

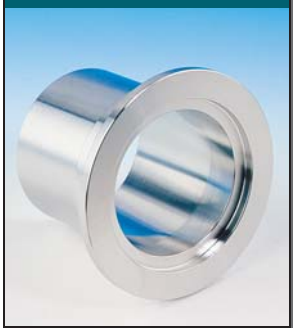


Figure 1

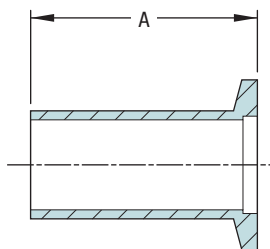
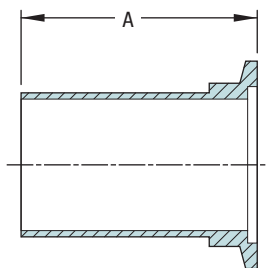


Figure 2

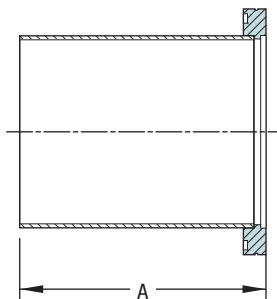


- NW16 through NW50 sizes
- Requires hinged clamp or bulkhead clamp - see individual flange size
- One-piece construction, except where noted
- Stainless Steel or Aluminum

FLANGE ISO REF	FLANGE O.D.	NOMINAL TUBE SIZE	FIGURE	TUBE O.D.	WALL THICKNESS	A	WT LB	REFERENCE	PART NUMBER
STAINLESS STEEL									
NW16	1.18	1/2	1	.50	.065	.50	1/4	K050-SWS	715100
NW16	1.18	1/2	1	.50	.065	1.58	1/4	K050-LWS	715105
NW16	1.18	3/4	1	.75	.065	.50	1/4	K075-SWS	715101
NW16	1.18	3/4	1	.75	.065	1.50	1/4	K075-1	720000
NW16	1.18	3/4	1	.75	.065	1.58	1/4	K075-LWS	715106
NW25	1.57	1	1	1.00	.065	.50	1/4	K100-SWS	715102
NW25	1.57	1	2	1.00	.065	1.58	1/4	K100-LWS	715107
NW25	1.57	1	2	1.00	.065	2.04	1/4	K100-1	720001
NW40	2.16	1	2	1.00	.065	2.04	1/4	K101-1	720002
NW40	2.16	1-1/2	1	1.50	.065	.75	1/4	K150-SWS	715103
NW40	2.16	1-1/2	2	1.50	.065	1.58	1/4	K150-LWS	715108
NW40	2.16	1-1/2	2	1.50	.065	2.46	1/4	K150-1	720003
NW50	2.95	2	1	2.00	.065	.75	1/4	K200-SWS	715104
NW50	2.95	2	1	2.00 ¹	.065	1.58	1/4	K200-LWS	715109
NW50	2.95	2	2	2.00 ¹	.065	3.21	1/4	K200-1	720004
ALUMINUM 6061-T6									
NW16	1.18	3/4	1	.75	.065	1.58	1/4	K075-LWSA	715110
NW25	1.57	1	2	1.00	.065	1.58	1/4	K100-LWSA	715111
NW40	2.16	1-1/2	2	1.50	.065	1.58	1/4	K150-LWSA	715112
NW50	2.95	2	2	2.00	.065	1.58	1/4	K200-LWSA	715113

¹ Welded

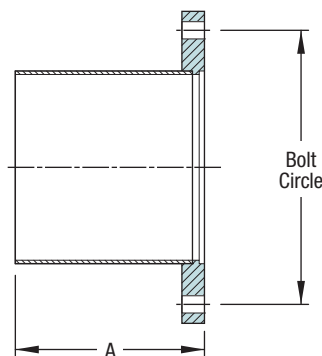
LF Clamp style



- NW63 through NW500 sizes
- Requires claw clamps - see individual flange size

FLANGE ISO REF	FLANGE O.D.	TUBE / ROLL-UP O.D.	WALL	A	WT LB	REFERENCE	PART NUMBER
NW63	3.74	2.50	.065	4.00	1	L250-1	820000
NW80	4.33	3.00	.065	3.41	1	L300-1	820008
NW100	5.12	4.00	.083	5.12	2	L400-1	820001
NW160	7.09	6.00	.120	6.31	4	L600-1	820002
NW200	9.45	8.00	.120	7.75	5	L800-1	820003
NW250	11.42	10.00	.120	9.75	13	L1000-1	820004
NW320	14.57	12.75	.188	10.87	14	L1200-1	820005
NW400	17.72	16.00	.188	13.37	17	L1600-1	820006
NW500	21.65	20.00	.188	15.87	22	L2000-1	820007

LF Bolt style



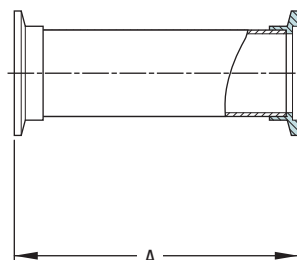
- NW63 through NW500 sizes
- Requires bolts - see individual flange size

FLANGE ISO REF	FLANGE O.D.	BOLT HOLES NO.	DIA.	B.C.	TUBE / ROLL-UP O.D.	WALL	A	WT LB	REFERENCE	PART NUMBER
NW63	5.12	4	.35	4.33	2.50	.065	3.94	4	L250-BL	851000
NW80	5.71	8	.35	4.92	3.00	.065	3.94	4	L300-BL	851008
NW100	6.50	8	.35	5.71	4.00	.083	3.94	5	L400-BL	851001
NW160	8.86	8	.43	7.87	6.00	.120	3.94	7	L600-BL	851002
NW200	11.22	12	.43	10.24	8.00	.120	3.94	12	L800-BL	851003
NW250	13.19	12	.43	12.20	10.00	.120	3.94	15	L1000-BL	851004
NW320	16.73	12	.54	15.55	12.75	.188	3.94	34	L1200-BL	851005
NW400	20.08	16	.54	18.90	16.00	.188	3.94	40	L1600-BL	851006
NW500	24.02	16	.54	22.83	20.00	.188	3.94	74	L2000-BL	851007

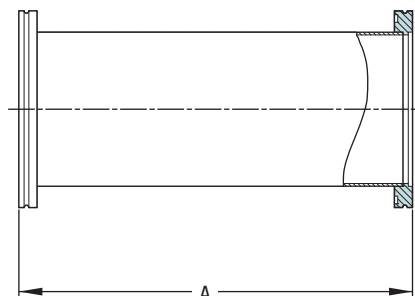
Straight Tube



Kwik-Flange™



Large-Flange™



- NW16 through NW500 sizes
- Welded construction

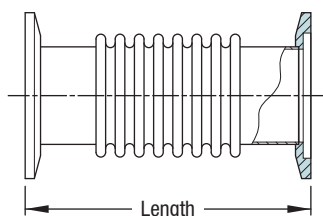
FLANGE ISO REF	FLANGE O.D.	TUBE SIZE	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™								
NW16	1.18	3/4	.75	.035	3.00	1/2	K075-2	721000
NW25	1.57	1	1.00	.065	4.08	1/2	K100-2	721001
NW40	2.16	1-1/2	1.50	.065	4.93	1/2	K150-2	721002
NW50	2.95	2	2.00	.065	6.43	1	K200-2	721003
LARGE-FLANGE™								
NW63	3.74	2-1/2	2.50	.065	8.00	2	L250-2	821000
NW80	4.33	3	3.00	.065	6.81	3	L300-2	821008
NW100	5.12	4	4.00	.083	10.25	4	L400-2	821001
NW160	7.09	6	6.00	.120	12.62	10	L600-2	821002
NW200	9.45	8	8.00	.120	15.50	12	L800-2	821003
NW250	11.42	10	10.00	.120	19.50	16	L1000-2	821004
NW320	14.57	12-3/4	12.75	.188	21.74	19	L1200-2	821005
NW400	17.72	16	16.00	.188	26.74	25	L1600-2	821006
NW500	21.65	20	20.00	.188	31.74	31	L2000-2	821007

Flexible Coupling

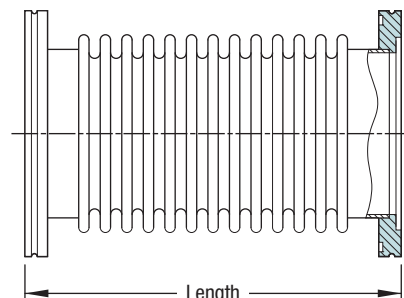


- For longer lengths, see Flexible Hose in Section 3.3

Kwik-Flange™



Large-Flange™



- NW16 through NW250 sizes
- Used for short misalignment connections
- 321ss Bellows
- Thin wall and thick wall

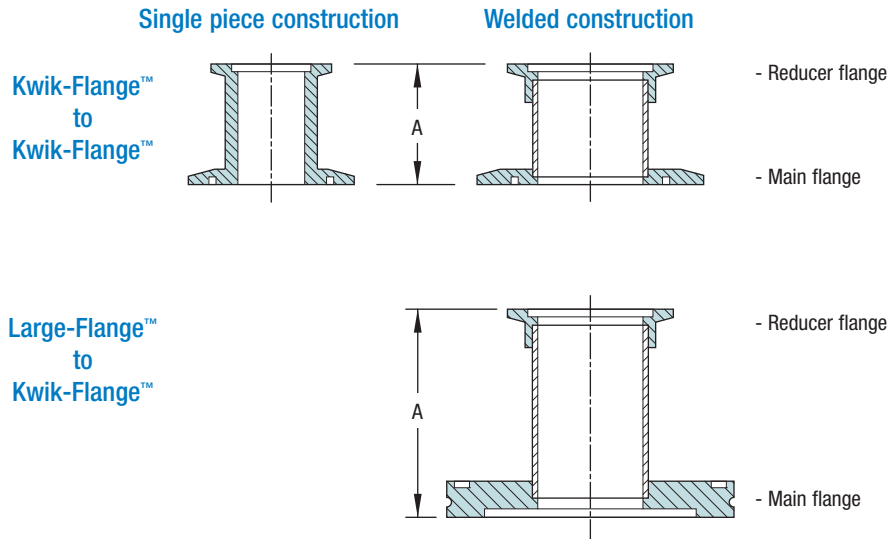
FLANGE ISO REF	FLANGE O.D.	BELLOWS I.D.	WALL THICKNESS	FREE LENGTH	COMPR'D LENGTH	SPRING RATE	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™									
NW16	1.18	.50	.006	3.00	2.62	68	1	K075-X	722000
NW16	1.18	.50	.008	10.00	-	-	2	K075-X-10	722004
NW16	1.18	.50	.010	10.00	-	-	2	K075-XT-10	722020
NW25	1.57	.75	.006	3.56	3.18	67	1	K100-X	722001
NW25	1.57	.75	.010	10.00	-	-	2	K100-XT-10	722021
NW40	2.16	1.25	.006	3.72	3.22	85	1	K150-X	722002
NW40	2.16	1.25	.016	10.00	-	-	3	K150-XT-10	722022
NW50	2.95	1.62	.006	4.22	3.72	87	2	K200-X	722003
NW50	2.95	1.62	.012	10.00	-	-	3	K200-XT-10	722023
LARGE-FLANGE™									
NW63	3.74	2.00	.006	6.47	5.72	43	5	L250-X	822000
NW80	4.33	2.50	.006	7.47	6.72	25	5	L300-X	822013
NW100	5.12	3.50	.008	7.84	6.84	40	8	L400-X	822001
NW160	7.09	5.50	.010	9.22	8.22	120	12	L600-X	822002
NW200	9.45	7.50	.012	10.22	9.22	132	15	L800-X	822003
NW250	11.42	10.00	.012	11.22	10.08	58	18	L1000-X	822004

Spring rate is in pounds per inch, axial.
Some specifications are not available for 10-inch length components.

Straight Tube



- Kwik-Flange™ termination



- Main flange NW25 through NW160
- Single piece and welded construction
- Large-Flange™ to Large-Flange™ units on next page

MAIN FLANGE ISO REF	O.D.	REDUCER FLANGE ISO REF	O.D.	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™ TO KWIK-FLANGE™									
NW25	1.57	NW16	1.18	.75 ¹	.065	1.57	1/2	K100x075	732000
NW40	2.16	NW16	1.18	.75	.035	1.57	1/2	K150x075	732001
NW40	2.16	NW25	1.57	1.20 ¹	.165	1.57	1/2	K150x100	732003
NW50	2.95	NW16	1.18	.75	.035	1.57	3/4	K200x075	732002
NW50	2.95	NW25	1.57	1.00	.065	1.57	3/4	K200x100	732004
NW50	2.95	NW40	2.16	1.50	.065	1.57	3/4	K200x150	732005
LARGE-FLANGE™ TO KWIK-FLANGE™									
NW63	3.74	NW16	1.18	.75	.035	1.75	1	L250xK075-LP	840004
NW63	3.74	NW25	1.57	1.00	.065	1.75	1	L250xK100-LP	840005
NW63	3.74	NW40	2.16	1.50	.065	1.75	1	L250xK150-LP	840006
NW63	3.74	NW40	2.16	1.50	.065	2.71	1-1/2	L250XK150	840000
NW63	3.74	NW50	2.95	2.00	.065	1.75	1-1/2	L250xK200-LP	840007
NW63	3.74	NW50	2.95	2.00	.065	3.46	2-1/2	L250XK200	840001
NW80	4.33	NW25	1.57	1.00	.065	1.75	1-1/2	L300xK100-LP	840008
NW80	4.33	NW40	2.16	1.50	.065	1.75	1-1/2	L300xK150-LP	840009
NW80	4.33	NW40	2.16	1.50	.065	2.71	3	L300XK150	840003
NW80	4.33	NW50	2.95	2.00	.065	1.75	2	L300xK200-LP	840010
NW80	4.33	NW50	2.95	2.00	.065	3.46	3	L300XK200	840002
NW100	5.12	NW25	1.57	1.00	.065	1.75	1-3/4	L400xK100-LP	840011
NW100	5.12	NW40	2.16	1.50	.065	1.75	2	L400xK150-LP	840012
NW100	5.12	NW50	2.95	2.00	.065	1.75	2-1/2	L400xK200-LP	840013
NW160	7.09	NW40	2.16	1.50	.065	1.75	5	L600xK150-LP	840014
NW160	7.09	NW50	2.95	2.00	.065	1.75	6	L600xK200-LP	840015

LARGE-FLANGE™ TO LARGE-FLANGE™ Continued on next page

¹ Single piece construction

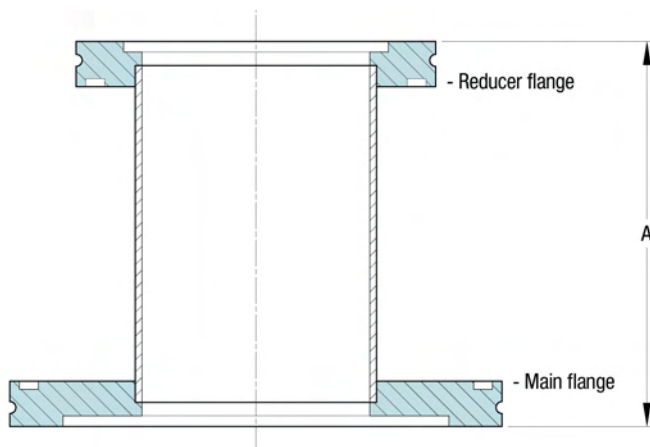
Straight Tube (cont)



• Large-Flange™ termination

Continued from previous page

Large-Flange™
to
Large-Flange™



- Main flange NW80 through NW250
- Welded construction

MAIN FLANGE		REDUCER FLANGE		TUBE	TUBE	A	WT	REFERENCE	PART NUMBER
ISO REF	O.D.	ISO REF	O.D.	O.D.	WALL		LB		
LARGE-FLANGE™ TO LARGE-FLANGE™									
NW80	4.33	NW63	3.74	2.50	.065	4.00	3	L300xL250	832005
NW100	5.12	NW63	3.74	2.50	.065	4.00	4-1/2	L400xL250	832000
NW160	7.09	NW63	3.74	2.50	.065	4.00	6	L600xL250	832001
NW160	7.09	NW100	5.12	4.00	.083	4.00	10-1/2	L600xL400	832002
NW200	9.45	NW160	7.09	6.00	.120	4.00	13-1/2	L800xL600	832003
NW250	11.42	NW200	9.45	8.00	.120	4.00	18	L1000xL800	832004

Application Note

Reducers are used for a reduction in size of flanges within a single method of sealing, such as ISO KF to ISO KF, or ISO LF to ISO KF. Zero-length reducers are not available in the ISO style of connection.

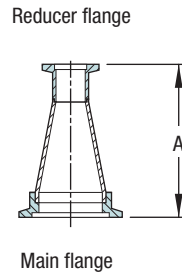
Adapters are used to change from one method of sealing to another, such as elastomer seal ISO to metal seal CF. Common configurations of ISO to various other vacuum connections are listed in Section 1.5, Hybrid Adapters, page 148.

Conical

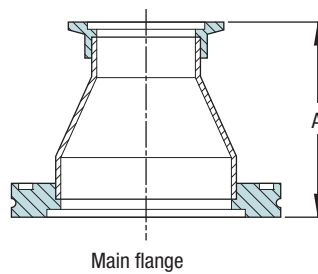


• For ISO to other vacuum connections, see Section 1.5

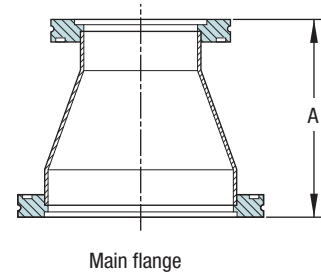
Kwik-Flange™
to
Kwik-Flange™



Large-Flange™
to
Kwik-Flange™



Large-Flange™
to
Large-Flange™



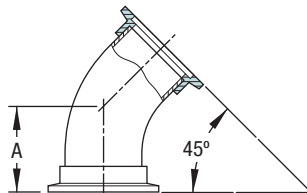
Main flange NW25
through NW160 sizes

MAIN FLANGE ISO REF	O.D.	REDUCER FLANGE ISO REF	O.D.	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™ TO KWIK-FLANGE™									
NW25	1.57	NW16	1.18	1.0 - .75	.065	2.04	3/4	K100xK075FCR	732006
NW40	2.16	NW16	1.18	1.5 - .75	.065	3.08	1	K150xK075FCR	732007
NW40	2.16	NW25	1.57	1.5 - 1.0	.065	2.75	1	K150xK100FCR	732010
NW50	2.95	NW25	1.57	2.0 - 1.0	.065	2.75	1	K200xK100FCR	732008
NW50	2.95	NW40	2.16	2.0 - 1.5	.065	2.80	1	K200xK150FCR	732009
LARGE-FLANGE™ TO KWIK-FLANGE™									
NW63	3.74	NW40	2.16	2.5 - 1.5	.065	2.83	1-1/2	L250xK150FCR	840016
NW63	3.74	NW50	2.95	2.5 - 2.0	.065	2.85	2-1/2	L250xK200FCR	840017
NW80	4.33	NW40	2.16	3.0 - 1.5	.065	4.08	3	L300xK150FCR	840018
NW80	4.33	NW50	2.95	3.0 - 2.0	.065	4.10	3	L300xK200FCR	840019
NW100	5.12	NW50	2.95	4.0 - 2.0	.065	4.10	3-1/2	L400xK200FCR	840020
LARGE-FLANGE™ TO LARGE-FLANGE™									
NW80	4.33	NW63	3.74	3.0 - 2.0	.065	4.12	3-1/2	L300xL250FCR	832006
NW100	5.12	NW63	3.74	4.0 - 2.5	.065	4.12	4-1/2	L400xL250FCR	832007
NW100	5.12	NW80	4.33	4.0 - 3.0	.065	4.12	4-1/2	L400xL300FCR	832008
NW160	7.09	NW80	4.33	6.0 - 3.0	.120	9.35	5	L600xL300FCR	832009
NW160	7.09	NW100	5.12	6.0 - 4.0	.120	9.35	5	L600xL400FCR	832010

45° with Tangents

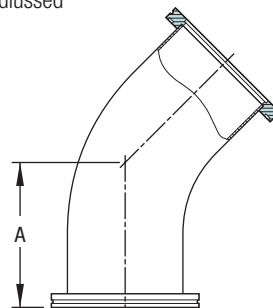


Kwik-Flange™



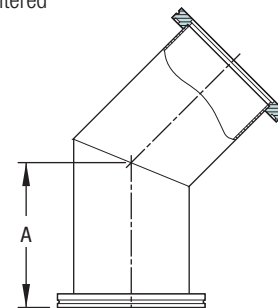
Large-Flange™

Radiussed



Large-Flange™

Mitered



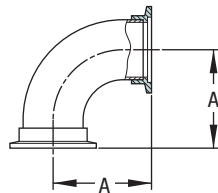
- NW16 through NW160 sizes
- Radiussed or mitered tube

FLANGE ISO REF	FLANGE O.D.	TUBE SIZE	BEND TYPE	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™									
NW16	1.18	3/4	RADIUS	.75	.035	1.26	1/2	K075-45L	723014
NW25	1.57	1	RADIUS	1.00	.065	1.36	1/2	K100-45L	723015
NW40	2.16	1-1/2	RADIUS	1.50	.065	1.83	1/2	K150-45L	723006
NW50	2.95	2	RADIUS	2.00	.065	2.54	3/4	K200-45L	723016
LARGE-FLANGE™									
NW63	3.74	2-1/2	RADIUS	2.50	.065	3.25	2	L250-45L	823008
NW80	4.33	3	RADIUS	3.00	.065	3.93	4	L300-45L	823011
NW100	5.12	4	RADIUS	4.00	.083	5.06	6	L400-45L	823009
NW160	7.09	6	MITER	6.00	.120	9.71	10	L600-45L	823010

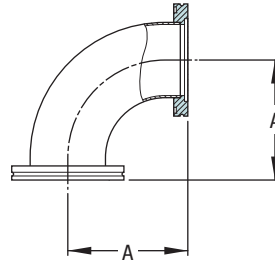
90 Degree



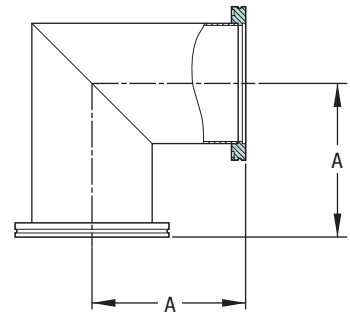
Kwik-Flange™



Large-Flange™
Radiussed



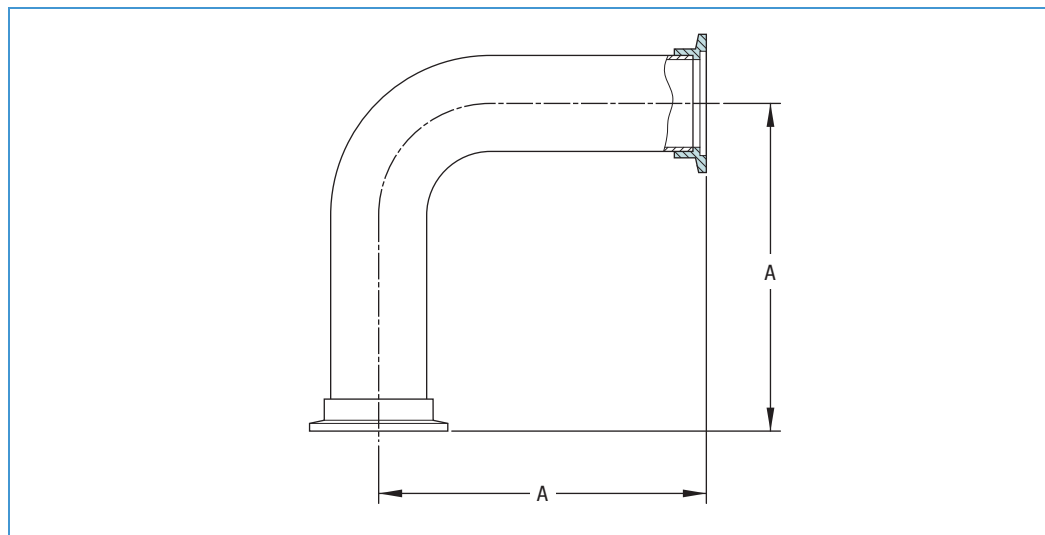
Large-Flange™
Mitered



- NW16 through NW500 sizes
- Radiussed or mitered tube

FLANGE ISO REF	FLANGE O.D.	TUBE SIZE	BEND TYPE	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™									
NW16	1.18	3/4	RADIUS	.75	.035	1.63	1/2	K075-2L	723000
NW25	1.57	1	RADIUS	1.00	.065	1.67	1/2	K100-2L	723017
NW40	2.16	1-1/2	RADIUS	1.50	.065	2.46	1/2	K150-2L	723002
NW50	2.95	2	RADIUS	2.00	.065	3.23	1	K200-2L	723003
LARGE-FLANGE™									
NW63	3.74	2-1/2	RADIUS	2.50	.065	4.00	2	L250-2L	823000
NW80	4.33	3	RADIUS	3.00	.065	4.75	4	L300-2LR	823017
NW80	4.33	3	MITER	3.00	.120	3.40	4	L300-2LM	823012
NW100	5.12	4	RADIUS	4.00	.083	6.25	6	L400-2LR	823018
NW100	5.12	4	MITER	4.00	.120	5.12	6	L400-2LM	823001
NW160	7.09	6	RADIUS	6.00	.109	9.25	12	L600-2LR	823019
NW160	7.09	6	MITER	6.00	.120	6.31	10	L600-2LM	823002
NW200	9.45	8	MITER	8.00	.120	7.75	14	L800-2LM	823003
NW250	11.42	10	MITER	10.00	.120	9.75	19	L1000-2LM	823004
NW320	14.57	12-3/4	MITER	12.75	.165	10.87	21	L1200-2LM	823005
NW400	17.72	16	MITER	16.00	.188	13.37	27	L1600-2LM	823006
NW500	21.65	20	MITER	20.00	.188	15.87	35	L2000-2LM	823007

90° with Tangents

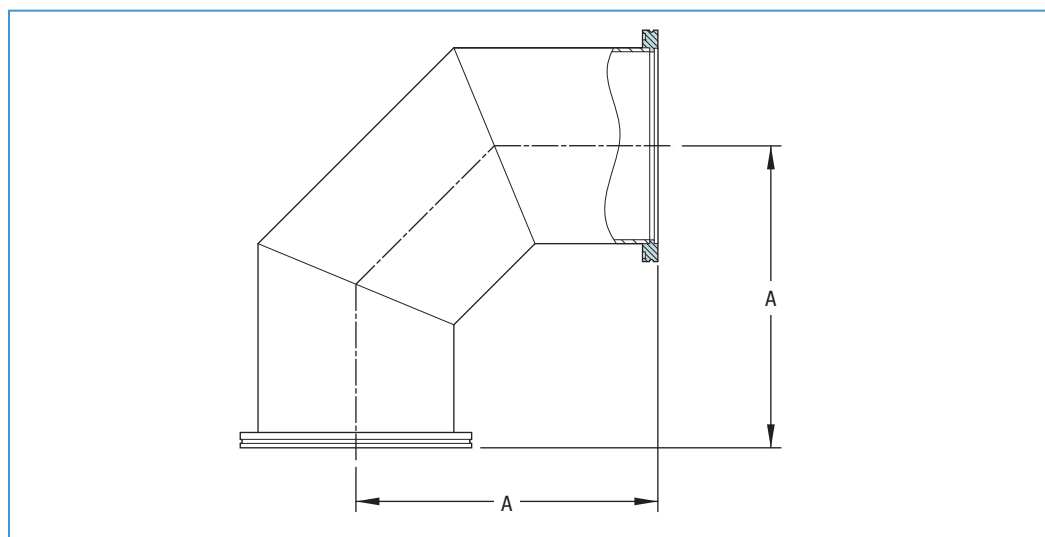


- NW16 through NW100 sizes
- Radiussed tube

FLANGE ISO REF	FLANGE O.D.	TUBE SIZE	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™								
NW16	1.18	3/4	.75	.035	1.92	1/2	K075-2LL	723018
NW25	1.57	1	1.00	.065	2.23	1	K100-2LL	723019
NW40	2.16	1-1/2	1.50	.065	3.15	1-1/2	K150-2LL	723020
NW50	2.95	2	2.00	.065	4.29	2	K200-2LL	723021

LARGE-FLANGE™								
NW63	3.74	2-1/2	2.50	.065	5.44	3	L250-2LL	823020
NW80	4.33	3	3.00	.065	6.56	4	L300-2LL	823021
NW100	5.12	4	4.00	.083	8.56	5	L400-2LL	823022

High Conductance



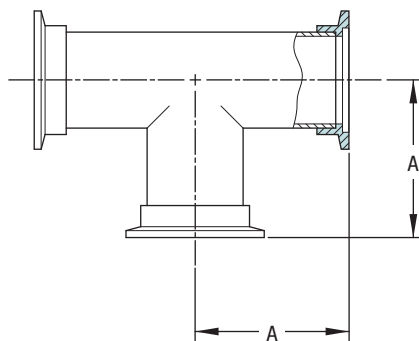
- NW160 through NW250 sizes
- Mitered tube

FLANGE ISO REF	FLANGE O.D.	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
NW160	7.09	6.00	.120	9.25	11	L600-2L-HC	823013
NW200	9.45	8.00	.120	12.25	14	L800-2L-HC	823014
NW250	11.42	10.00	.120	15.25	18	L1000-2L-HC	823015

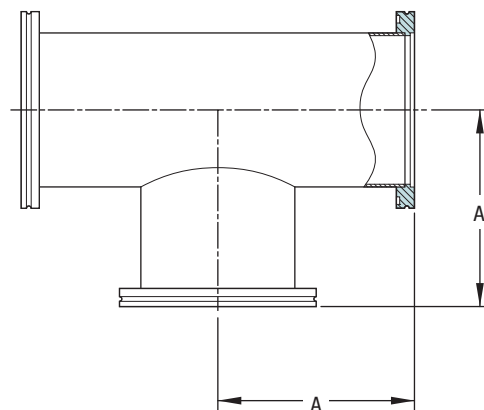
Tee



Kwik-Flange™



Large-Flange™



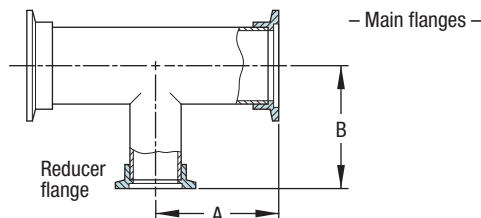
■ NW16 through
NW500 sizes

FLANGE ISO REF	FLANGE O.D.	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™							
NW16	1.18	.75	.035	1.50	1/2	K075-3	724000
NW25	1.57	1.00	.065	2.04	1/2	K100-3	724001
NW40	2.16	1.50	.065	2.46	1/2	K150-3	724002
NW50	2.95	2.00	.065	3.23	1	K200-3	724003
LARGE-FLANGE™							
NW63	3.74	2.50	.065	3.25	3	L250-3	824036
NW80	4.33	3.00	.065	3.50	5	L300-3	824037
NW100	5.12	4.00	.083	4.12	8	L400-3	824038
NW160	7.09	6.00	.120	5.87	13	L600-3	824039
NW200	9.45	8.00	.120	7.25	18	L800-3	824040
NW250	11.42	10.00	.120	9.75	24	L1000-3	824004
NW320	14.57	12.75	.188	10.87	33	L1200-3	824005
NW400	17.72	16.00	.188	13.37	41	L1600-3	824006
NW500	21.65	20.00	.188	15.87	52	L2000-3	824007

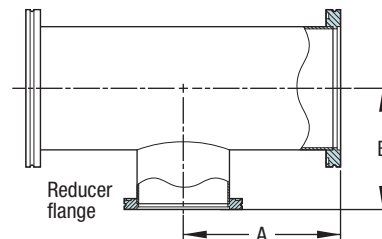
Reducing Tees



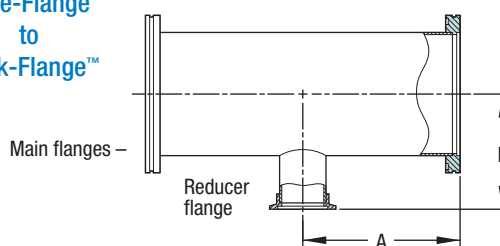
Kwik-Flange™
to
Kwik-Flange™



Large-Flange™
to
Large-Flange™



Large-Flange™
to
Kwik-Flange™



■ Main flange NW25
through NW160 sizes

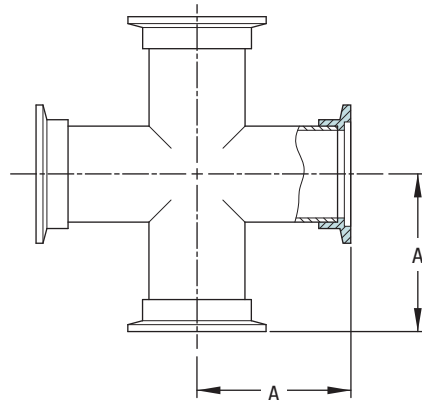
MAIN FLANGE				REDUCER FLANGE				WT LB	REFERENCE	PART NUMBER
ISO REF	TUBE O.D.	WALL	A	ISO REF	TUBE O.D.	WALL	B			
KWIK-FLANGE™ TO KWIK-FLANGE™										
NW25	1.00	.065	2.04	NW16	.75	.035	2.50	1	K100-3-K075	724010
NW40	1.50	.065	2.46	NW16	.75	.035	2.75	1	K150-3-K075	724011
NW40	1.50	.065	2.46	NW25	1.00	.065	2.30	1	K150-3-K100	724012
NW50	2.00	.065	3.23	NW25	1.00	.065	2.55	2	K200-3-K100	724013
NW50	2.00	.065	3.23	NW40	1.50	.065	2.71	2	K200-3-K150	724014
LARGE-FLANGE™ TO KWIK-FLANGE™										
NW63	2.50	.065	3.25	NW40	1.50	.065	2.46	2	L250-3-K150	824041
NW63	2.50	.065	3.25	NW50	2.00	.065	3.48	2	L250-3-K200	824042
NW80	3.00	.065	3.50	NW40	1.50	.065	3.21	3	L300-3-K150	824043
NW80	3.00	.065	3.50	NW50	2.00	.065	3.48	3	L300-3-K200	824044
NW100	4.00	.083	4.12	NW50	2.00	.065	4.23	5	L400-3-K200	824046
LARGE-FLANGE™ TO LARGE-FLANGE™										
NW80	3.00	.065	3.50	NW63	2.50	.065	3.50	4	L300-3-L250	824045
NW100	4.00	.083	4.12	NW63	2.50	.065	4.00	7	L400-3-L250	824047
NW100	4.00	.083	4.12	NW80	3.00	.065	4.00	7	L400-3-L300	824048
NW160	6.00	.120	5.25	NW80	3.00	.065	5.00	11	L600-3-L300	824049
NW160	6.00	.120	5.25	NW100	4.00	.120	5.12	12	L600-3-L400	824050

Four-Way Crosses

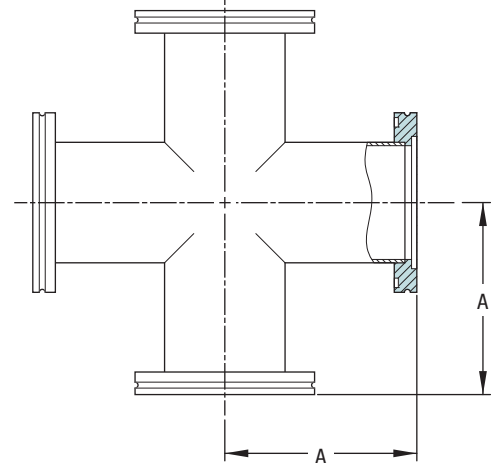


- Spherical main body on some units

Kwik-Flange™



Large-Flange™



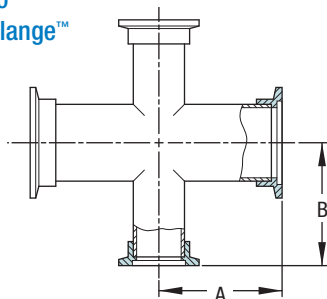
- NW16 through NW500 sizes
- Body type dependent on tube size

FLANGE ISO REF	FLANGE O.D.	BODY TYPE	TUBE / ROLL-UP O.D.	WALL	SPHERE O.D.	WALL	A	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™										
NW16	1.18	TUBE	.75	.035	-	-	1.50	1/2	K075-4	725000
NW25	1.57	TUBE	1.00	.065	-	-	2.04	1	K100-4	725001
NW40	2.16	TUBE	1.50	.065	-	-	2.46	1	K150-4	725002
NW50	2.95	TUBE	2.00	.065	-	-	3.23	2	K200-4	725003
LARGE-FLANGE™										
NW63	3.74	TUBE	2.50	.065	-	-	3.25	6	L250-4	825036
NW80	4.33	TUBE	3.00	.065	-	-	3.50	8	L300-4	825037
NW100	5.12	TUBE	4.00	.083	-	-	4.12	10	L400-4T	825038
NW100	5.12	SPHERE	4.00	.083	6-1/4	.120	5.12	10	L400-4S	825001
NW160	7.09	TUBE	6.00	.109	-	-	5.87	15	L600-4T	825039
NW160	7.09	SPHERE	6.00	.120	9	.120	6.31	15	L600-4S	825002
NW200	9.45	TUBE	8.00	.109	-	-	7.25	21	L800-4T	825040
NW200	9.45	SPHERE	8.00	.120	12	.120	7.75	21	L800-4S	825003
NW250	11.42	SPHERE	10.00	.120	16	.120	9.75	26	L1000-4S	825004
NW320	14.57	TUBE	12.75	.165	-	-	10.87	45	L1200-4	825005
NW400	17.72	TUBE	16.00	.188	-	-	13.37	57	L1600-4	825006
NW500	21.65	TUBE	20.00	.188	-	-	15.87	74	L2000-4	825007

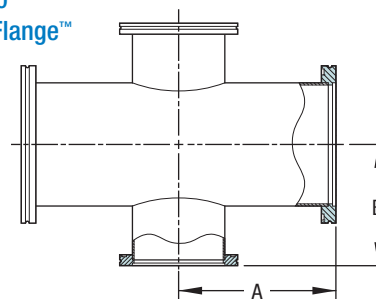
Reducing Crosses



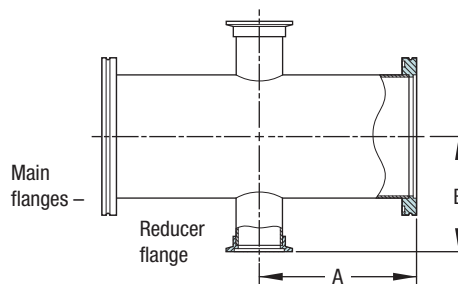
Kwik-Flange™
to
Kwik-Flange™



Large-Flange™
to
Large-Flange™



Large-Flange™
to
Kwik-Flange™



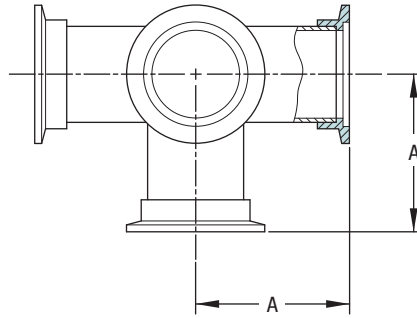
■ Main flange NW25
through NW160 sizes

MAIN FLANGE				REDUCER FLANGE				WT LB	REFERENCE	PART NUMBER
ISO REF	TUBE O.D.	WALL	A	ISO REF	TUBE O.D.	WALL	B			
KWIK-FLANGE™ TO KWIK-FLANGE™										
NW25	1.00	.065	2.04	NW16	.75	.035	2.50	1	K100-4-K075	725010
NW40	1.50	.065	2.46	NW16	.75	.035	2.75	1	K150-4-K075	725011
NW40	1.50	.065	2.46	NW25	1.00	.065	2.30	1	K150-4-K100	725012
NW50	2.00	.065	3.23	NW25	1.00	.065	2.55	2	K200-4-K100	725013
NW50	2.00	.065	3.23	NW40	1.50	.065	2.71	2	K200-4-K150	725014
LARGE-FLANGE™ TO KWIK-FLANGE™										
NW63	2.50	.065	3.25	NW40	1.50	.065	2.96	2	L250-4-K150	825041
NW63	2.50	.065	3.25	NW50	2.00	.065	3.44	2	L250-4-K200	825042
NW80	3.00	.065	3.50	NW40	1.50	.065	3.21	3	L300-4-K150	825043
NW80	3.00	.065	3.50	NW50	2.00	.065	3.73	3	L300-4-K200	825044
NW100	4.00	.120	4.12	NW50	2.00	.065	4.23	5	L400-4-K200	825046
LARGE-FLANGE™ TO LARGE-FLANGE™										
NW80	3.00	.065	3.50	NW63	2.50	.065	3.50	6	L300-4-L250	825045
NW100	4.00	.120	4.12	NW63	2.50	.065	4.00	9	L400-4-L250	825047
NW100	4.00	.120	4.12	NW80	3.00	.065	4.00	10	L400-4-L300	825048
NW160	6.00	.120	5.25	NW80	3.00	.065	5.00	15	L600-4-L300	825049
NW160	6.00	.120	5.25	NW100	4.00	.120	5.12	15	L600-4-L400	825050

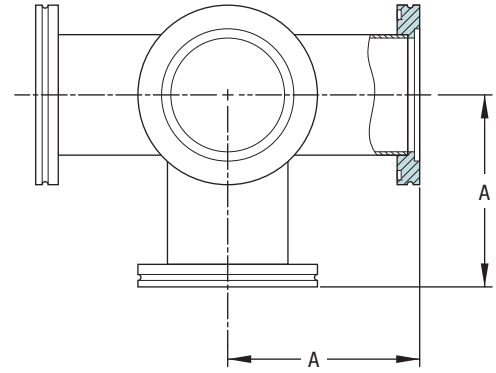
Five-Way Crosses



Kwik-Flange™



Large-Flange™



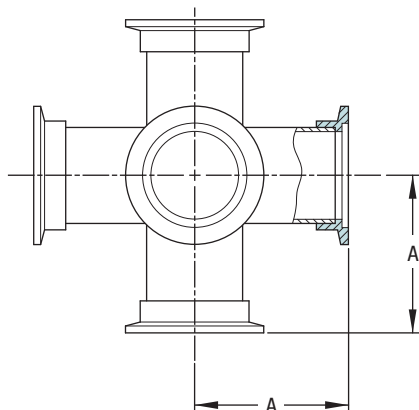
- NW16 through NW500 sizes
- Body type dependent on tube size

FLANGE ISO REF	FLANGE O.D.	TUBE / ROLL-UP O.D.	WALL	BODY TYPE	BODY DIMEN. O.D.	WALL	A	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™										
NW16	1.18	.75	.035	TUBE	-	-	1.50	1/2	K075-5	726000
NW25	1.57	1.00	.065	TUBE	-	-	2.04	1	K100-5	726001
NW40	2.16	1.50	.065	TUBE	-	-	2.46	1	K150-5	726002
NW50	2.95	2.00	.065	TUBE	-	-	3.21	2	K200-5	726003
LARGE-FLANGE™										
NW63	3.74	2.50	.120	TUBE	-	-	3.98	8	L250-5	826000
NW80	4.33	3.00	.120	TUBE	-	-	3.39	10	L300-5	826008
NW100	5.12	4.00	.120	SPHERE	6-1/4	.120	5.12	12	L400-5S	826001
NW160	7.09	6.00	.120	SPHERE	9	.120	6.31	18	L600-5S	826002
NW200	9.45	8.00	.120	SPHERE	12	.120	7.75	22	L800-5S	826003
NW250	11.42	10.00	.120	SPHERE	16	.120	9.75	30	L1000-5S	826004
NW320	14.57	12.75	.188	TUBE	-	-	10.87	57	L1200-5	826005
NW400	17.72	16.00	.188	TUBE	-	-	13.37	70	L1600-5	826006
NW500	21.65	20.00	.188	TUBE	-	-	15.87	94	L2000-5	826007

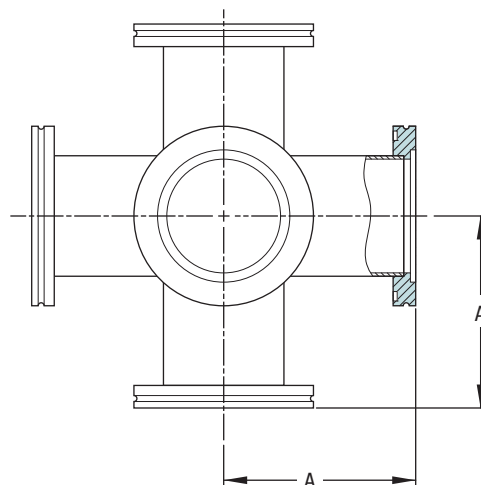
Six-Way Crosses



Kwik-Flange™



Large-Flange™



- NW16 through NW500 sizes
- Body type dependent on tube size

FLANGE ISO REF	FLANGE O.D.	TUBE / ROLL-UP O.D.	WALL	BODY TYPE	BODY DIMEN. O.D.	WALL	A	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™										
NW16	1.18	.75	.035	TUBE	-	-	1.50	1/2	K075-6	727000
NW25	1.57	1.00	.065	TUBE	-	-	2.04	1	K100-6	727001
NW40	2.16	1.50	.065	TUBE	-	-	2.46	1	K150-6	727002
NW50	2.95	2.00	.065	TUBE	-	-	3.21	2	K200-6	727003
LARGE-FLANGE™										
NW63	3.74	2.50	.120	TUBE	-	-	3.98	9	L250-6	827000
NW80	4.33	3.00	.120	TUBE	-	-	3.39	11	L300-6	827008
NW100	5.12	4.00	.120	SPHERE	6-1/4	.120	5.12	13	L400-6S	827001
NW160	7.09	6.00	.120	SPHERE	9	.120	6.31	19	L600-6S	827002
NW200	9.45	8.00	.120	SPHERE	12	.120	7.75	23	L800-6S	827003
NW250	11.42	10.00	.120	SPHERE	16	.120	9.75	33	L1000-6S	827004
NW320	14.57	12.75	.188	TUBE	-	-	10.87	77	L1200-6	827005
NW400	17.72	16.00	.188	TUBE	-	-	13.37	93	L1600-6	827006
NW500	21.65	20.00	.188	TUBE	-	-	15.87	119	L2000-6	827007



Description

MDC ASA-style flanges mate with standard 150 lb. ASA-ANSI flanges. Flanges are offered with choice of smooth face or O-ring groove. Eight flange sizes are detailed in this section. They are available blank or bored to fit tube sizes 1-1/2" through 12" O.D. The vacuum seal is made by compressing an O-ring between a mating pair of flanges. The pair includes a smooth face flange and an O-ring grooved flange.

Flanges are fabricated from type 304 stainless steel with a surface finish of 32 micro-inches. All corners are chamfered 45°. Sealed flange assemblies are useable to 10^{-8} Torr and can be baked to 200°C. The maximum temperature for sustained use is 150°C. Note that repeated bakeout to 200°C can cause deterioration of O-rings and require their periodic replacement.

Applications include use with various types of vacuum chambers, manifolds, furnaces, diffusion pump stations, valves, test equipment, pumps, special viewports, and a variety of experimental devices. Hybrid Adapters for interfacing with non-ASA flanges are located in Section 1.5.

Specifications

Material

Flanges	304ss
O-rings	FKM / FPM fluoroelastomer Bolts
300ss	

Fastening

Bolt Type	Hexagonal head
Nut Type	Hexagonal
Size	.500-13, .625-11 and .750-10 UNC
Torque	ASA-4 through ASA-9 14 lb-ft ASA-11 through ASA-19 24 lb-ft

Vacuum Range 1×10^{-8} Torr

Temperature Range Maximum: 200°C
Sustained: -20°C to 150°C

Weight & Dimensions See table

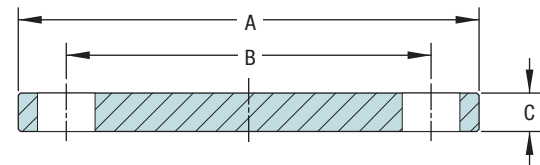
HIGH VACUUM SERIES

Features

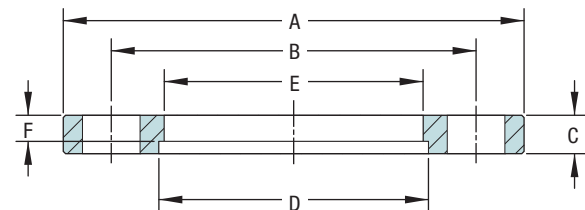
- High vacuum rated to 1×10^{-8} Torr
- Temperature rated to 200°C maximum
- FKM / FPM fluoroelastomer seal
- Smooth face or with O-ring groove
- ANSI compatible design

Nonrotatable

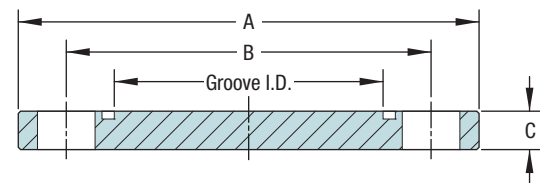
Blank, smooth face



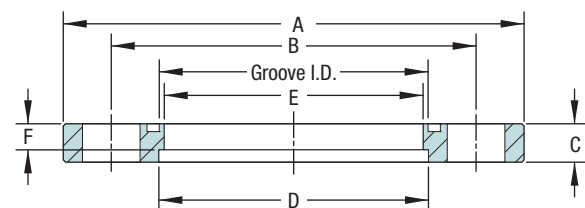
Bored, smooth face



Blank, O-ring groove



Bored, O-ring groove



• O-ring grooves are .16 wide, except ASA-19 .24 wide

ASA Smooth Face



ASA O-ring Groove



Dimensions given in the table below apply to both the smooth face flanges on the left and the O-ring grooved flanges on the right.

Smooth Face Type

PART NUMBER	REFERENCE	ANSI SIZE	A	B	BOLT HOLES NO.	DIA	C	D	E	F	WT LB
160000	ASA-4	1	4.25	3.125	4	.62	.50	-	-	-	1
160001	ASA-4B	1	4.25	3.125	4	.62	.50	1.51	1.37	.34	1
160002	ASA-5	1-1/2	5.00	3.875	4	.62	.50	-	-	-	2
160040	ASA-5B1	1-1/2	5.00	3.875	4	.62	.50	2.01	1.87	.34	2
160042	ASA-5B2	1-1/2	5.00	3.875	4	.62	.50	2.51	2.37	.34	2
160004	ASA-6	2	6.00	4.750	4	.75	.50	-	-	-	3
160044	ASA-6B2	2	6.00	4.750	4	.75	.50	3.01	2.87	.34	2
160005	ASA-6B	2	6.00	4.750	4	.75	.50	3.51	3.37	.34	2
160006	ASA-7	3	7.50	6.000	4	.75	.50	-	-	-	6
160007	ASA-7B	3	7.50	6.000	4	.75	.50	4.01	3.83	.34	4
160008	ASA-9	4	9.00	7.500	8	.75	.50	-	-	-	9
160046	ASA-9B2	4	9.00	7.500	8	.75	.50	5.01	4.84	.34	5
160048	ASA-9B3	4	9.00	7.500	8	.75	.50	6.02	5.83	.34	5
160010	ASA-11	6	11.00	9.500	8	.81	.75	-	-	-	19
160036	ASA-11ST	6	11.00	9.500	8	.81	.75	6.02	5.83	.34	10
160014	ASA-11B1	6	11.00	9.500	8	.81	.75	8.02	7.83	.34	9
160012	ASA-16	10	16.00	14.250	12	.81	1.00	-	-	-	55
160053	ASA-16B1	10	16.00	14.250	12	.81	1.00	10.03	9.76	.34	23
160055	ASA-16B2	10	16.00	14.250	12	.81	1.00	10.76	10.50	.34	23
160018	ASA-19	12	19.00	17.000	12	1.00	1.06	-	-	-	84
160019	ASA-19B	12	19.00	17.000	12	1.00	1.06	12.03	11.62	.34	52

O-ring Groove Type

REFERENCE	PART NUMBER
ASA-4-OR	160020
ASA-4B-OR	160021
ASA-5-OR	160022
ASA-5B1-OR	160041
ASA-5B2-OR	160043
ASA-6-OR	160024
ASA-6B2-OR	160045
ASA-6B-OR	160025
ASA-7-OR	160026
ASA-7B-OR	160027
ASA-9-OR	160028
ASA-9B2-OR	160047
ASA-9B3-OR	160049
ASA-11-OR	160030
ASA-11ST-OR	160037
ASA-11B1-OR	160032
ASA-16-OR	160033
ASA-16B1-OR	160054
ASA-16B2-OR	160056
ASA-19-OR	160038
ASA-19B-OR	160039

Hardware



- Bolt Sets include bolts, nuts and flat washers.
- Bolt Hole Bushings used on ASA-6 through ASA-9 flanges when mating to 2-1/2" through 5" Gate Valves with ASA port flanges, see pages 175-181.

USE ON FLANGE	DESCRIPTION	THREAD SIZE / GROOVE I.D.	LENGTH / O-RING W	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
ASA-4	HEX HEAD BOLT	.500-13	1-3/4	4	3/4	ASABA-4	190100
ASA-4	O-RING, FKM/FPM	1.870	1/8	1	1/4	ASAOR-4	540016
ASA-5	HEX HEAD BOLT	.500-13	1-3/4	4	3/4	ASABA-5	190100
ASA-5	O-RING, FKM/FPM	2.500	1/8	1	1/4	ASAOR-5	540017
ASA-6	HEX HEAD BOLT	.625-11	1-3/4	4	3/4	ASABA-6	190101
ASA-6	O-RING, FKM/FPM	3.500	1/8	1	1/4	ASAOR-6	540018
ASA-7	HEX HEAD BOLT	.625-11	1-3/4	4	3/4	ASABA-7	190101
ASA-7	O-RING, FKM/FPM	4.625	1/8	1	1/4	ASAOR-7	540020
ASA-9	HEX HEAD BOLT	.625-11	1-3/4	8	1-1/2	ASABA-9	190102
ASA-9	O-RING, FKM/FPM	6.168	1/8	1	1/4	ASAOR-9	540022
ASA-11	HEX HEAD BOLT	.750-10	2-1/2	8	2	ASABA-11	190103
ASA-11	O-RING, FKM/FPM	8.000	1/8	1	1/4	ASAOR-11	540024
ASA-16	HEX HEAD BOLT	.750-10	3	12	2-1/2	ASABA-16	190104
ASA-16	O-RING, FKM/FPM	12.000	1/8	1	1/4	ASAOR-16	540027
ASA-19	HEX HEAD BOLT	.750-10	3	12	2-1/2	ASABA-19	190104
ASA-19	O-RING, FKM/FPM	15.000	3/16	1	1/4	ASAOR-19	540028



Vacuum Tubing

page 133



High Conductance Elbows

page 139



Conical Reducers

page 134



Six-Way Crosses

page 145

Features

- Mating Del-Seal™, ISO and ASA flanges available
- UHV rated to 1×10^{-10} Torr
- High temperature rated to 450°C
- Standard matte finish

Description

MDC Del-Weld™ Tube Fittings are convenient “building-block” components offering great flexibility in the design and construction of vacuum systems. All fittings are fabricated from type 304 stainless steel tubing.

Del-Weld™ Tube Fittings include elbows, tees and multiple crosses which are supplied without flanges. The vacuum connection is made by welding, brazing, or soldering to the vacuum system.

MDC Del-Weld™ fittings are supplied in vacuum shrink wrapped packages, ready for high vacuum service. Interior surfaces of components should not be touched with bare hands when opening packages.

Vacuum tubing is welded and drawn over a mandrel when hot. A slight seam is visible.

Vacuum tubing is specified by tube O.D. and wall thickness. The I.D. of vacuum tubing is theoretical, calculated as the tube O.D. less twice the wall thickness. Vacuum tubing does not have tolerances relating to concentricity, ovality, triangulation or other specifications.

Tubing or fittings requiring a machined length, an electropolished or special finish must be specified and quoted as a special order.

Specifications

Material

Tubing	304ss, ASTM-269
Finish	Up to 4" O.D., bright annealed
	Over 4" O.D., white pickled annealed

Vacuum

Range	1×10^{-13} Torr
Fittings Leak Test	2×10^{-10} cc/sec of He

Temperature Range	-200°C to 450°C
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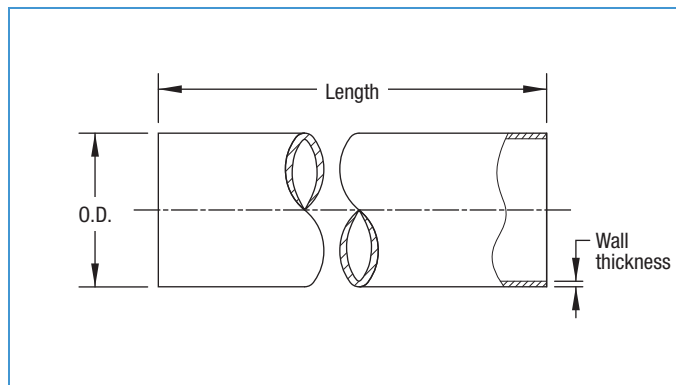
Weight and Dimensions	See table
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All dimensions in this catalog are given in inches unless specified otherwise.

Vacuum Tubing



- Contact factory for quotes on machined lengths, bead blast or electropolished finishes
- Lengths are saw cut at $\pm 1/8"$ and deburred
- Lengths greater than 18-ft are random length $\pm 6"$
- Price is per foot or any fraction of a foot

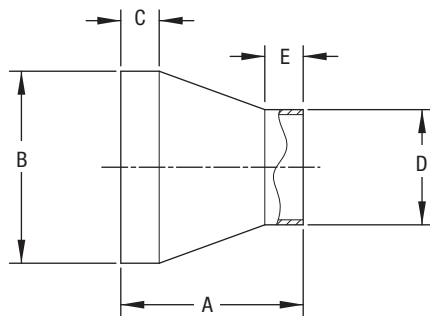


- 304 stainless steel
- 1/4" through 10-3/4" O.D. sizes
- Saw cut and deburred
- Custom lengths available

NOMINAL SIZE	TUBE O.D.	TUBE WALL	THEORETICAL I.D.	WT PER FT LB	REFERENCE	PART NUMBER
1/4	.25	.035	.18	1/8	ST-025	480000
3/8	.37	.035	.30	1/8	ST-037	480001
1/2	.50	.035	.43	1/8	ST-050	480002
3/4	.75	.035	.68	1/8	ST-075	480003
1	1.00	.065	.87	1/2	ST-100	480004
1-1/4	1.25	.065	1.12	3/4	ST-125	480005
1-1/2	1.50	.065	1.37	1	ST-150	480006
2	2.00	.065	1.87	1-1/2	ST-200	480007
2-1/2	2.50	.065	2.37	1-3/4	ST-250	480008
3	3.00	.065	2.87	2	ST-300	480009
4	4.00	.083	3.83	3-1/2	ST-400	480010
5	5.00	.083	4.83	4-1/2	ST-500	480011
6	6.00	.120	5.76	5	ST-600	480012
8	8.00	.120	7.76	10-1/2	ST-800	480013
10	10.00	.120	9.76	12-1/2	ST-1000	480014
10-3/4	10.75	.134	10.48	15	ST-1075	480015

Note: There is no cutting charge

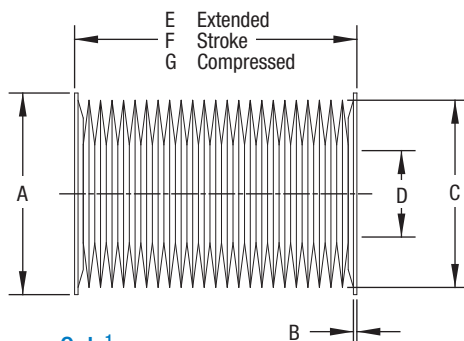
Conical Reducer



- 304 stainless steel
- Main end 1" through 6" O.D. sizes

NOMINAL SIZE	A	B	C	D	E	WALL	WT LB	REFERENCE	PART NUMBER
1.0 - .75	1.375	1.00	.44	.75	.62	.065	1/4	100-075CRNF	402500
1.5 - .75	2.375	1.50	.50	.75	.50	.065	1/4	150-075CRNF	402501
1.5 - 1.0	2.375	1.50	.50	1.00	.50	.065	1/4	150-100CRNF	402502
2.0 - 1.0	2.375	2.00	.50	1.00	.50	.065	1/2	200-100CRNF	402503
2.0 - 1.5	2.375	2.00	.50	1.50	.50	.065	1/2	200-150CRNF	402504
2.5 - 1.5	2.375	2.50	.38	1.50	.50	.065	1/2	250-150CRNF	402505
2.5 - 2.0	2.375	2.50	.38	2.00	.56	.065	1/2	250-200CRNF	402506
3.0 - 1.5	3.625	3.00	.50	1.50	.56	.065	1	300-150CRNF	402507
3.0 - 2.0	3.625	3.00	.38	2.00	.56	.065	1	300-200CRNF	402508
3.0 - 2.5	3.625	3.00	.50	2.50	.56	.065	1	300-250CRNF	402509
4.0 - 2.0	3.625	4.00	.38	2.00	.56	.065	2	400-200CRNF	402510
4.0 - 2.5	3.625	4.00	.38	2.50	.56	.065	2	400-250CRNF	402511
4.0 - 3.0	3.625	4.00	.50	3.00	.38	.065	2	400-300CRNF	402512
6.0 - 3.0	8.850	6.00	1.00	3.00	1.25	.120	4	600-300CRNF	402513
6.0 - 4.0	8.850	6.00	1.06	4.00	1.12	.120	4	600-400CRNF	402514

Welded Bellows



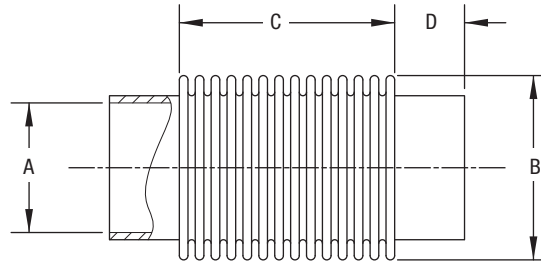
For Reference Only¹

- AM-350 bellows material
- 304ss end plate material

A	B	C	D	LENGTH				WT LB	REFERENCE	PART NUMBER
				Extended	Stroke	Compr.	Free			
.500	.008	.396	.200	.58	.42	.16	.44	1/2	WB-817	471017
.500	.008	.396	.200	1.16	.84	.32	.87	1/2	WB-815	471015
.500	.008	.396	.200	2.32	1.68	.64	1.69	1/2	WB-816	471016
.750	.010	.638	.338	.68	.46	.23	.63	1/2	WB-812	471012
1.070	.015	1.030	.540	1.05	.75	.30	1.00	1/2	WB-800	471000
1.070	.015	1.030	.540	1.38	1.00	.38	1.10	1/2	WB-801	471001
1.070	.020	1.030	.550	.50	.36	.14	.44	1/2	WB-811	471011
1.375	.012	1.250	.750	1.15	.74	.41	.87	1/2	WB-814	471014
1.750	.015	1.625	.750	1.89	1.50	.39	1.88	1/2	WB-802	471002
1.750	.015	1.625	.750	2.19	1.90	.29	2.13	1/2	WB-803	471003
1.750	.015	1.625	.750	3.16	2.50	.66	3.06	1/2	WB-804	471004
1.750	.015	1.625	.750	3.78	3.00	.78	3.63	1/2	WB-805	471005
1.750	.015	1.625	.750	5.02	4.00	1.02	4.88	1/2	WB-806	471006
1.500	.012	1.375	.830	7.80	6.20	1.60	6.38	1/2	WB-823	471023
1.820	.015	1.625	.937	3.30	2.50	.80	3.00	1/2	WB-809	471009
1.750	.015	1.625	.937	7.62	6.00	1.62	5.75	3/4	WB-808	471008
1.750	.015	1.625	.937	10.12	8.38	1.75	9.75	3/4	WB-807	471007
2.250	.015	2.200	1.040	2.54	2.00	.54	1.88	3/4	WB-824	471024
2.125	.015	1.992	1.250	7.53	6.00	1.53	5.13	3/4	WB-820	471020
2.250	.018	2.250	1.500	1.57		.57	1.00	3/4	WB-821	471021
2.250	.018	2.250	1.500	2.98	2.00	.98	2.50	3/4	WB-822	471022
3.687	.015	3.500	2.500	2.59	1.92	.67	1.94	3/4	WB-825	471025

¹ Some units may be constructed of two or more segments.

Standard Cuffs



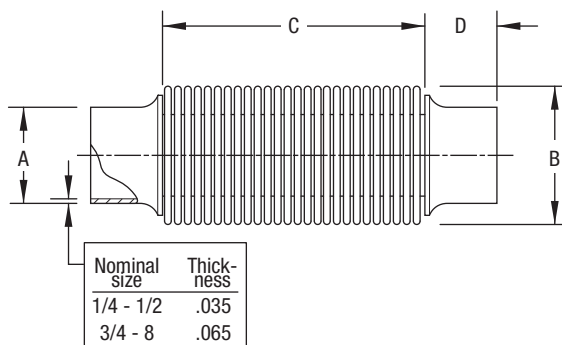
- Type 321 stainless steel
- 1/4" through 12" sizes
- Highly flexible short length bellows for alignment

NOMINAL SIZE	WALL	A ¹	B	C	D	AXIAL DEFLECTION ²	WT LB	REFERENCE	PART NUMBER
1/4	.005	.25	.37	1.00	.50	+ .10 / - .25	1/4	FB-6502	470000
5/16	.005	.31	.46	1.00	.50	+ .10 / - .25	1/4	FB-6503	470001
3/8	.005	.37	.57	1.50	.50	+ .15 / - .37	1/4	FB-6504	470002
1/2	.006	.50	.75	1.50	.50	+ .15 / - .37	1/4	FB-6506	470003
5/8	.006	.62	.87	1.50	.50	+ .15 / - .37	1/4	FB-6508	470004
3/4	.006	.75	1.04	1.50	.50	+ .15 / - .37	1/4	FB-6510	470005
7/8	.006	.87	1.25	2.00	.50	+ .20 / - .50	1/2	FB-6512	470006
1	.006	1.00	1.37	2.00	.75	+ .20 / - .50	1/2	FB-6513	470007
1-1/8	.006	1.12	1.46	2.00	.75	+ .20 / - .50	1/2	FB-6516	470008
1-1/4	.006	1.25	1.60	2.00	.75	+ .20 / - .50	1/2	FB-6518	470009
1-3/8	.006	1.37	1.81	2.00	.75	+ .20 / - .50	1/2	FB-6520	470010
1-1/2	.006	1.50	1.90	2.00	.75	+ .20 / - .50	1/2	FB-6522	470011
1-5/8	.006	1.62	2.05	2.00	.75	+ .20 / - .50	1/2	FB-6523	470012
1-3/4	.006	1.75	2.24	2.00	.75	+ .20 / - .50	1/2	FB-6525	470013
2	.006	2.00	2.49	2.50	.75	+ .25 / - .62	1	FB-6528	470014
2-1/4	.006	2.25	2.81	2.50	.75	+ .25 / - .62	1	FB-6530	470015
2-1/2	.006	2.50	2.98	2.50	.75	+ .25 / - .62	1	FB-6532	470016
3	.008	3.00	3.77	3.00	1.00	+ .30 / - .75	1	FB-6536	470017
3-1/2	.008	3.50	4.30	3.50	1.00	+ .35 / - .87	1	FB-6540	470018
4	.008	4.00	4.78	4.00	1.00	+ .40 / - 1.00	2	FB-6544	470019
4-1/2	.008	4.50	5.28	4.00	1.00	+ .40 / - 1.00	2	FB-6548	470020
5	.008	5.00	5.75	5.00	1.00	+ .50 / - 1.25	2	FB-6552	470021
6	.010	6.00	6.85	5.00	1.25	+ .50 / - 1.25	2	FB-6557	470022
8	.020	8.00	9.25	6.00	1.25	+ .60 / - 1.50	3	FB-6564	470023
10	.020	10.00	11.31	6.00	1.25	+ .60 / - 1.50	3	FB-6571	470024
12	.020	12.00	13.88	6.00	1.25	+ .60 / - 1.50	3	FB-6577	470025

¹ Through I.D. approximately 95% of cuff I.D. due to roll-in of bellows.

² Axial deflection approximately +10% and -25% of live length. Lateral deflection approximately 10% of live length.

Weld Cuffs



- Type 300 stainless steel bellows
- Type 316 stainless steel weldable tube end cuffs
- 1/4" through 8" sizes
- Highly flexible short length bellows for alignment

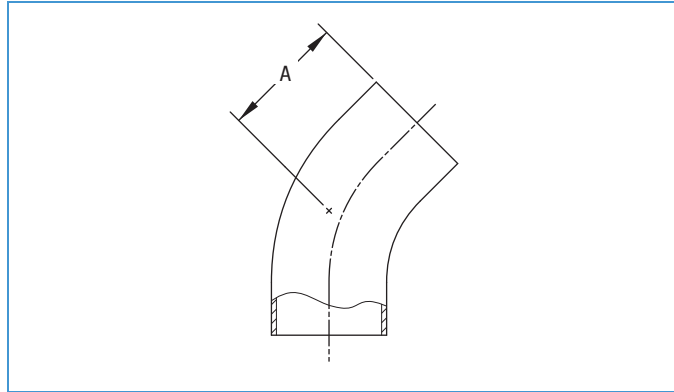
NOMINAL SIZE	WALL	A	B	C	D	AXIAL DEFLECTION ¹	WT LB	REFERENCE	PART NUMBER
1/4	.006	.25	.39	1.0	.50	+.10 / -.25	1/4	FBW-6502	470500
1/2	.005	.50	.78	1.5	.50	+.15 / -.37	1/4	FBW-6506	470501
3/4	.005	.75	1.14	1.5	.50	+.15 / -.37	1/4	FBW-6510	470502
1	.005	1.00	1.44	2.0	.75	+.20 / -.50	1/2	FBW-6513	470503
1-1/4	.006	1.25	1.77	2.0	.75	+.20 / -.50	1/2	FBW-6518	470504
1-1/2	.006	1.50	2.16	2.0	.75	+.20 / -.50	1/2	FBW-6522	470505
2	.006	2.00	2.60	2.0	.75	+.20 / -.50	1/2	FBW-6528	470506
2-1/2	.006	2.50	3.14	2.5	.75	+.25 / -.62	1	FBW-6532	470507
3	.008	3.00	3.74	3.0	1.00	+.30 / -.75	1	FBW-6536	470508
3-1/2	.008	3.50	4.32	3.5	1.00	+.35 / -.87	1	FBW-6540	470509
4	.008	4.00	4.91	4.0	1.00	+.40 / -1.00	2	FBW-6544	470510
4-1/2	.008	4.50	5.52	4.0	1.00	+.40 / -1.00	2	FBW-6548	470511
5	.008	5.00	6.03	5.0	1.00	+.50 / -1.25	2	FBW-6552	470512
6	.010	6.00	7.03	5.0	1.25	+.50 / -1.25	2	FBW-6557	470513
8	.012	8.00	9.29	6.0	1.25	+.60 / -1.50	3	FBW-6564	470514

¹ Axial deflection approximately +10% and -25% of live length. Lateral deflection approximately 10% of live length.

Note:

- Longer length flexible hose available in Section 3, Roughing Components

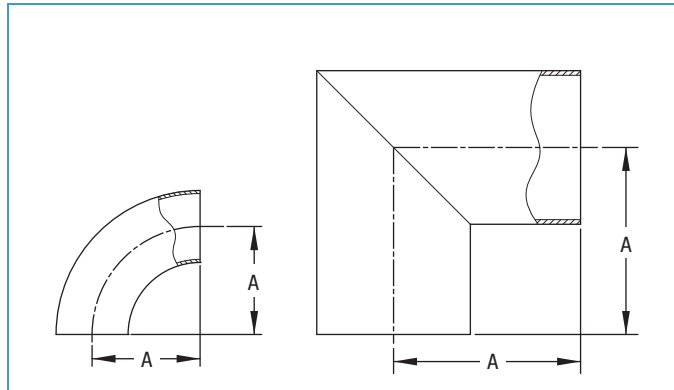
45° with Tangents



- 3/4" through 4" sizes
- Radiussed tube

NOMINAL SIZE	A	TUBE O.D.	TUBE WALL	WT LB	REFERENCE	PART NUMBER
3/4	.76	.75	.035	1/4	075-45L-NF	403515
1	1.19	1.00	.065	1/4	100-45L-NF	403516
1-1/2	1.62	1.50	.065	1/4	150-45L-NF	403521
2	2.31	2.00	.065	3/4	200-45L-NF	403517
2-1/2	3.00	2.50	.065	1	250-45L-NF	403523
3	3.68	3.00	.065	2	300-45L-NF	403524
4	4.81	4.00	.083	3	400-45L-NF	403525

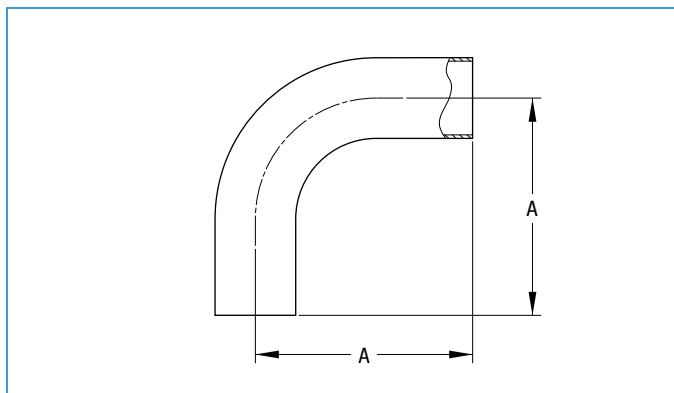
90 Degree



- 3/4" through 10" sizes
- Radiussed or mitered tube

NOMINAL SIZE	BEND TYPE	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
3/4	RADIUS	.75	.035	1.13	1/4	075-2L-NF	403500
1	RADIUS	1.00	.065	1.50	1/4	100-2L-NF	403511
1-1/2	RADIUS	1.50	.065	2.25	1/2	150-2L-NF	403502
2	RADIUS	2.00	.065	3.00	1/2	200-2L-NF	403503
2-1/2	RADIUS	2.50	.065	3.75	3/4	250-2L-NF	403504
3	RADIUS	3.00	.065	4.50	1-1/2	300-2LR-NF	403512
3	MITER	3.00	.120	3.15	2	300-2LM-NF	403505
4	RADIUS	4.00	.083	6.00	4	400-2LR-NF	403513
4	MITER	4.00	.120	4.87	4-1/2	400-2LM-NF	403506
5	MITER	5.00	.120	4.47	5	500-2LM-NF	403507
6	RADIUS	6.00	.109	9.00	8	600-2LR-NF	403514
6	MITER	6.00	.120	6.06	8	600-2LM-NF	403508
8	MITER	8.00	.120	7.50	13	800-2LM-NF	403509
10	MITER	10.00	.120	9.50	19	1000-2LM-NF	403510

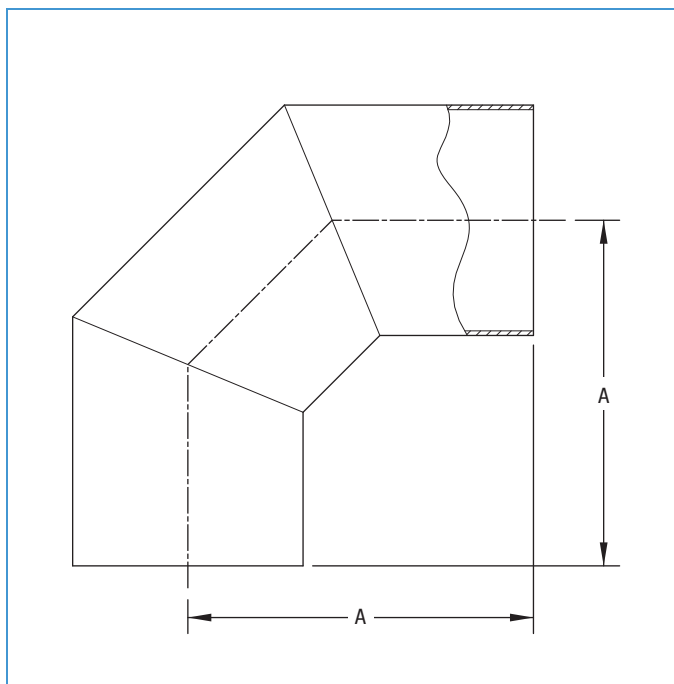
90° with Tangents



- 3/4" through 4" sizes
- Radiussed tube

NOMINAL SIZE	A	TUBE O.D.	TUBE WALL	WT LB	REFERENCE	PART NUMBER
3/4	1.42	.75	.035	1/4	075-2LL-NF	403540
1	2.06	1.00	.065	1/2	100-2LL-NF	403541
1-1/2	2.94	1.50	.065	3/4	150-2LL-NF	403542
2	4.06	2.00	.065	3/4	200-2LL-NF	403543
2-1/2	5.19	2.50	.065	1	250-2LL-NF	403544
3	6.31	3.00	.065	2	300-2LL-NF	403545
4	8.31	4.00	.083	4-1/2	400-2LL-NF	403546

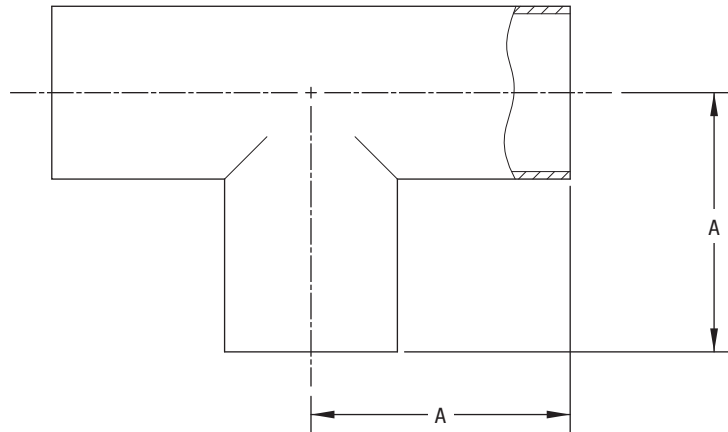
High Conductance



- 6" through 10" sizes
- Mitered tube

NOMINAL SIZE	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
6	6.00	.120	9.00	9-1/2	600-2LHCNF	403530
8	8.00	.120	12.00	11	800-2LHCNF	403531
10	10.00	.120	15.00	15	1000-2LHCNF	403532

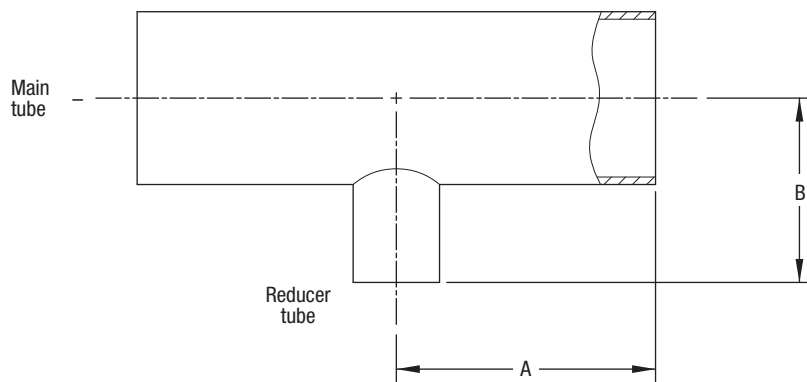
Tee



■ 3/4" through 10" sizes

NOMINAL SIZE	TUBE O.D.	TUBE WALL	A	WT LB	REFERENCE	PART NUMBER
3/4	.75	.035	1.00	1/4	075-3-NF	404500
1	1.00	.065	1.87	1/4	100-3-NF	404501
1-1/2	1.50	.065	2.25	1/2	150-3-NF	404502
2	2.00	.065	3.00	1	200-3-NF	404503
2-1/2	2.50	.065	3.00	3	250-3-NF	404539
3	3.00	.065	3.25	2	300-3-NF	404540
4	4.00	.083	3.87	5	400-3-NF	404541
5	5.00	.120	4.47	5-1/4	500-3-NF	404507
6	6.00	.109	5.62	7	600-3-NF	404542
8	8.00	.109	7.00	15	800-3-NF	404543
10	10.00	.120	9.50	23-1/2	1000-3-NF	404510

Reducing Tees



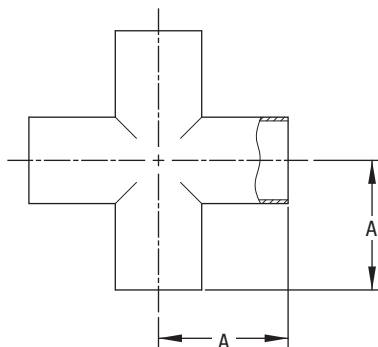
■ Main tube 1" through 6" sizes

MAIN TUBE NOM.	O.D.	WALL	A	REDUCER TUBE NOM.	O.D.	WALL	B	WT LB	REFERENCE	PART NUMBER
1	1.00	.065	1.87	3/4	.75	.035	2.00	1/2	100-3-075NF	404544
1-1/2	1.50	.065	2.25	3/4	.75	.035	2.25	1/2	150-3-075NF	404545
1-1/2	1.50	.065	2.25	1	1.00	.065	2.12	1/2	150-3-100NF	404546
2	2.00	.065	3.00	1	1.00	.065	2.37	1	200-3-100NF	404547
2	2.00	.065	3.00	1-1/2	1.50	.065	2.50	1	200-3-150NF	404548
2-1/2	2.50	.065	3.00	1-1/2	1.50	.065	2.25	2-3/4	250-3-150NF	404549
2-1/2	2.50	.065	3.00	2	2.00	.065	3.25	2-3/4	250-3-200NF	404550
3	3.00	.065	3.25	1-1/2	1.50	.065	3.00	2	300-3-150NF	404551
3	3.00	.065	3.25	2	2.00	.065	3.25	2	300-3-200NF	404552
3	3.00	.065	3.25	2-1/2	2.50	.065	3.25	2	300-3-250NF	404553
4	4.00	.083	3.87	2	2.00	.065	4.00	4	400-3-200NF	404554
4	4.00	.083	3.87	2-1/2	2.50	.065	3.75	4	400-3-250NF	404555
4	4.00	.083	3.87	3	3.00	.065	3.75	4	400-3-300NF	404556
6	6.00	.109	5.00	3	3.00	.065	4.75	8	600-3-300NF	404557
6	6.00	.109	5.00	4	4.00	.083	4.87	8	600-3-400NF	404558

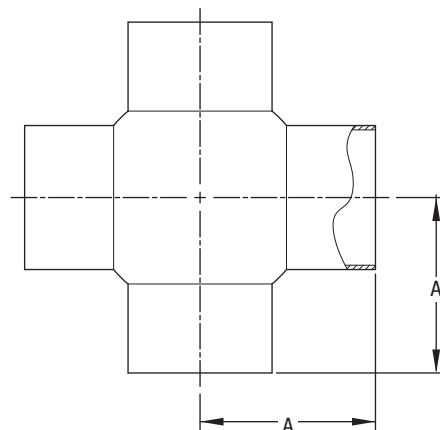
Four-Way Crosses



Tube body



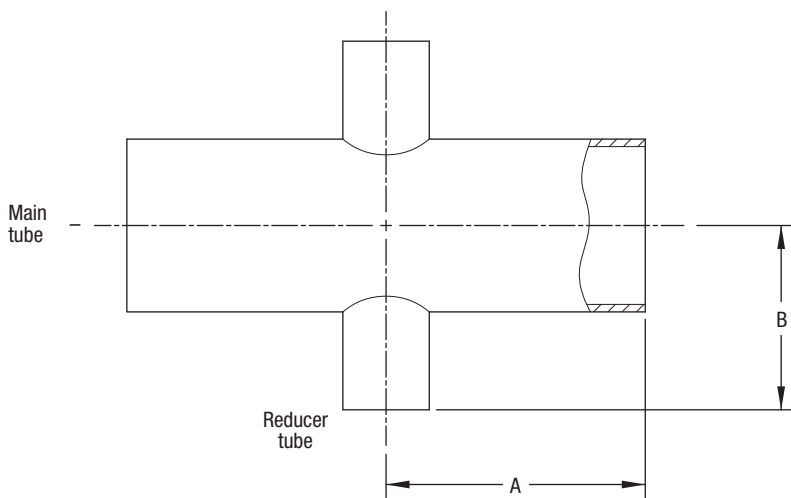
Spherical body



- 3/4" through 10" sizes
- Tube or spherical main body

NOMINAL SIZE	TUBE O.D.	TUBE WALL	BODY TYPE	SPHERE O.D.	SPHERE WALL	A	WT LB	REFERENCE	PART NUMBER
3/4	.75	.035	TUBE	-	-	1.00	1/4	075-4-NF	405500
1	1.00	.065	TUBE	-	-	1.87	1/4	100-4-NF	405501
1-1/2	1.50	.065	TUBE	-	-	2.25	3/4	150-4-NF	405502
2	2.00	.065	TUBE	-	-	3.00	1	200-4-NF	405503
2-1/2	2.50	.065	TUBE	-	-	3.00	3	250-4-NF	405539
3	3.00	.065	TUBE	-	-	3.25	4	300-4-NF	405540
4	4.00	.083	TUBE	-	-	3.87	6	400-4T-NF	405541
4	4.00	.120	SPHERE	6-1/4	.120	4.87	6	400-4S-NFS	405506
5	5.00	.120	SPHERE	9	.120	4.47	6	500-4S-NFS	405507
6	6.00	.109	TUBE	-	-	5.62	10-1/2	600-4T-NF	405542
6	6.00	.120	SPHERE	9	.120	6.06	10-1/2	600-4S-NFS	405508
8	8.00	.109	TUBE	-	-	7.00	16-3/4	800-4T-NF	405543
8	8.00	.120	SPHERE	12	.120	7.50	16-3/4	800-4S-NFS	405509
10	10.00	.120	SPHERE	16	.120	9.50	20	1000-4S-NFS	405510

Reducing Crosses



■ Main tube 1" through 6" sizes

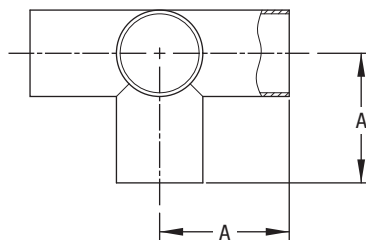
MAIN TUBE NOM.	O.D.	WALL	A	REDUCER TUBE NOM.	O.D.	WALL	B	WT LB	REFERENCE	PART NUMBER
1	1.00	.065	1.87	3/4	.75	.035	2.00	3/4	100-4-075NF	405544
1-1/2	1.50	.065	2.25	3/4	.75	.035	2.25	3/4	150-4-075NF	405545
1-1/2	1.50	.065	2.25	1	1.00	.065	2.13	3/4	150-4-100NF	405546
2	2.00	.065	3.00	1	1.00	.065	2.38	1	200-4-100NF	405547
2	2.00	.065	3.00	1-1/2	1.50	.065	2.50	1	200-4-150NF	405548
2-1/2	2.50	.065	3.00	1-1/2	1.50	.065	2.75	3	250-4-150NF	405549
2-1/2	2.50	.065	3.00	2	2.00	.065	3.25	3	250-4-200NF	405550
3	3.00	.065	3.25	1-1/2	1.50	.065	3.00	2-1/2	300-4-150NF	405551
3	3.00	.065	3.25	2	2.00	.065	3.50	2-1/2	300-4-200NF	405552
3	3.00	.065	3.25	2-1/2	2.50	.065	3.25	2-1/2	300-4-250NF	405553
4	4.00	.083	3.87	2	2.00	.065	4.00	5	400-4-200NF	405554
4	4.00	.083	3.87	2-1/2	2.50	.065	3.75	5	400-4-250NF	405555
4	4.00	.083	3.87	3	3.00	.065	3.75	5	400-4-300NF	405556
6	6.00	.109	5.00	3	3.00	.065	4.75	9	600-4-300NF	405557
6	6.00	.109	5.00	4	4.00	.083	4.87	9	600-4-400NF	405558

Five-Way Crosses



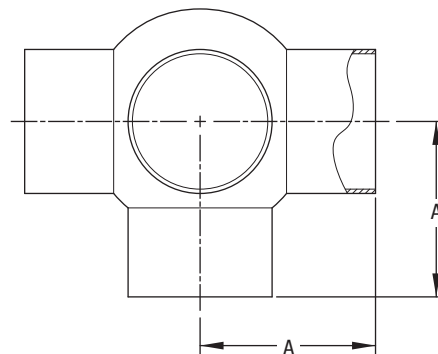
Tube body

3/4" to 3" tube



Spherical body

4" to 10" tube



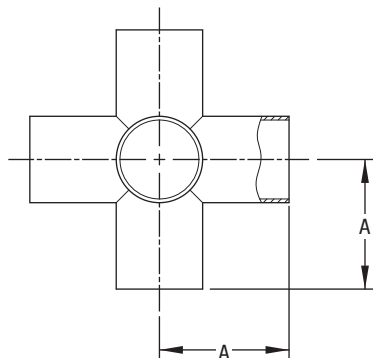
- 3/4" through 10" sizes
- Body type dependent on tube size

NOMINAL SIZE	TUBE O.D.	WALL	BODY TYPE	BODY DIMEN.		A	WT LB	REFERENCE	PART NUMBER
3/4	.75	.035	TUBE	-	-	1.00	1/4	075-5-NF	406500
1	1.00	.065	TUBE	-	-	1.87	1/2	100-5-NF	406501
1-1/2	1.50	.065	TUBE	-	-	2.25	3/4	150-5-NF	406502
2	2.00	.065	TUBE	-	-	2.98	1-1/4	200-5-NF	406503
2-1/2	2.50	.120	TUBE	-	-	3.74	3-1/2	250-5-NF	406504
3	3.00	.120	TUBE	-	-	3.15	3	300-5-NF	406505
4	4.00	.120	SPHERE	6-1/4	.120	4.87	6-3/4	400-5S-NFS	406506
5	5.00	.120	SPHERE	9	.120	4.47	6-1/2	500-5S-NFS	406507
6	6.00	.120	SPHERE	9	.120	6.06	12-1/2	600-5S-NFS	406508
8	8.00	.120	SPHERE	12	.120	7.50	18-1/4	800-5S-NFS	406509
10	10.00	.120	SPHERE	16	.120	9.50	24	1000-5S-NFS	406510

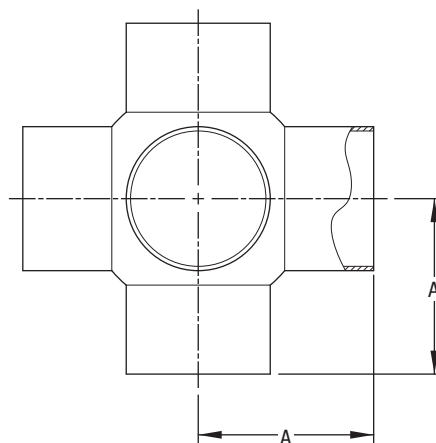
Six-Way Crosses



Tube body
3/4" to 3" tube



Spherical body
4" to 10" tube



- 3/4" through 10" sizes
- Body type dependent on tube size

NOMINAL SIZE	TUBE O.D.	WALL	BODY TYPE	BODY DIMEN.		A	WT LB	REFERENCE	PART NUMBER
3/4	.75	.035	TUBE	-	-	1.00	1/4	075-6-NF	407500
1	1.00	.065	TUBE	-	-	1.87	1/2	100-6-NF	407501
1-1/2	1.50	.065	TUBE	-	-	2.25	3/4	150-6-NF	407502
2	2.00	.065	TUBE	-	-	2.98	1-1/2	200-6-NF	407503
2-1/2	2.50	.120	TUBE	-	-	3.74	4	250-6-NF	407504
3	3.00	.120	TUBE	-	-	3.15	3	300-6-NF	407505
4	4.00	.120	SPHERE	6-1/4	.120	4.87	7-3/4	400-6S-NFS	407506
5	5.00	.120	SPHERE	9	.120	4.47	7	500-6S-NFS	407507
6	6.00	.120	SPHERE	9	.120	6.06	14	600-6S-NFS	407508
8	8.00	.120	SPHERE	12	.120	7.50	20	800-6S-NFS	407509
10	10.00	.120	SPHERE	16	.120	9.50	28	1000-6S-NFS	407510



Description

MDC Quick-Disconnects provide a fast and convenient method for coupling and uncoupling metal and glass tubing. They can be welded, brazed, or soldered to flanges, manifolds, chambers, and other vacuum equipment. Quick-Disconnects are ideal for mounting ion gauges, thermocouple gauges, special test ports, and feed-throughs.

Components are fabricated from type 304 stainless steel or brass with a surface finish of 32 micro-inches. Assemblies are useable to 10^{-8} Torr and can be baked to 200°C. The maximum temperature for sustained use is 150°C. Note that repeated bakeout to 200°C can cause deterioration of O-rings and require their periodic replacement.

The compression of a FKM / FPM fluoroelastomer O-ring can accommodate variations in a tube up to .005 inch. It is essential that all inserted tubes have accurate fractional inch diameters. Quick-Disconnects have a bore clear through the body and do not restrict a tube from entering as far as desired into a chamber. Care must be taken when loosening the knurled compression seal nut for adjustment while the unit is under vacuum.

These fittings are also supplied mounted on Del-Seal™ CF and Kwik-Flange™ ISO KF for use on flanged ports. Refer to Section 1.5 for Hybrid Adapters, page 148.

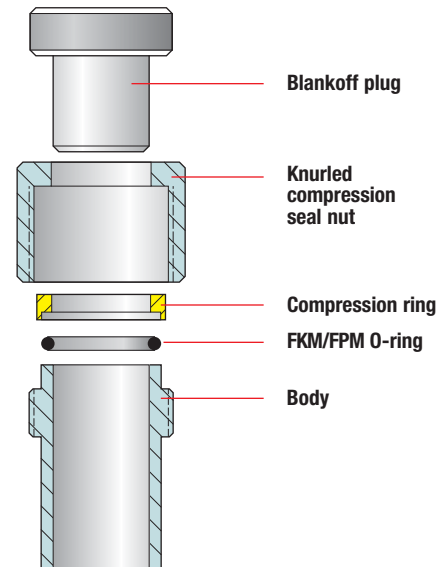
Specifications

Material	
Fittings	304ss or brass
O-rings	FKM / FPM fluoroelastomer
Flanges	304ss
Fastening	
Thread Size	See table
Torque	Finger-tight
Vacuum Range	1×10^{-8} Torr
Temperature Range	-20°C to 150°C
Weight and Dimensions	See table

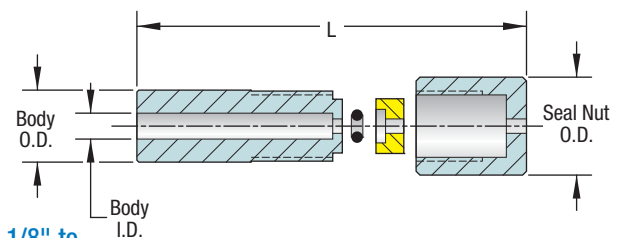
Features

- High vacuum rated to 1×10^{-8} Torr
- Temperature rated to 200°C maximum
- Symmetric, nonrotatable geometries
- FKM / FPM fluoroelastomer O-rings
- Fast coupling
- Seventeen fractional tube sizes
- Weldable, Conflat® and ISO compatible designs
- Flanged versions available, see pages 156-157

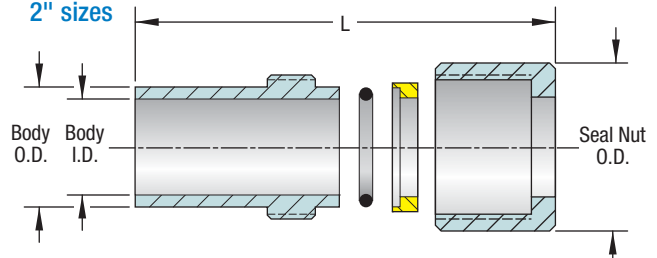
Parts Identification



1/16" size



1/8" to 2" sizes



Stainless Steel



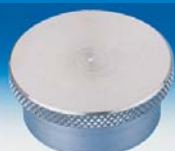
Brass



Dimensions given in the table below apply to both the stainless steel fittings on the left and the brass fittings on the right.

PART NUMBER	REFERENCE	ACCEPTS TUBE SIZE	BODY I.D.	BODY O.D.	NUT O.D.	THREAD	NOM. L	WT LB	REFERENCE	PART NUMBER
410000	DS-06	1/16	.07	3/8	1/2	.375-20	1-5/16	1	DB-06	411000
410001	DS-12	1/8	.13	3/8	1/2	.375-20	1-5/16	1	DB-12	411001
410002	DS-18	3/16	.19	3/8	5/8	.500-20	1-5/16	1	DB-18	411002
410003	DS-25	1/4	.26	3/8	5/8	.500-20	1-5/16	1	DB-25	411003
410004	DS-31	5/16	.32	1/2	7/8	.688-20	1-5/16	1	DB-31	411004
410005	DS-38	3/8	.38	1/2	7/8	.688-20	1-5/16	1	DB-38	411005
410006	DS-50	1/2	.51	5/8	7/8	.750-20	1-3/8	1	DB-50	411006
410007	DS-62	5/8	.63	3/4	1-3/16	1-20	1-1/2	1	DB-62	411007
410008	DS-75	3/4	.76	7/8	1-3/8	1.188-20	1-5/8	1	DB-75	411008
410009	DS-87	7/8	.88	1	1-3/8	1.250-20	1-5/8	1	DB-87	411009
410010	DS-100	1	1.01	1-1/8	1-5/8	1.375-20	1-7/8	1	DB-100	411010
410011	DS-112	1-1/8	1.13	1-1/4	1-7/8	1.625-20	1-7/8	2	DB-112	411011
410012	DS-125	1-1/4	1.26	1-1/2	1-7/8	1.688-20	2	2	DB-125	411012
410013	DS-138	1-3/8	1.39	1-5/8	2	1.812-20	2-1/8	2	DB-138	411013
410014	DS-150	1-1/2	1.51	1-3/4	2-1/4	2-20	2-1/4	2	DB-150	411014
410015	DS-162	1-5/8	1.63	1-7/8	2-3/8	2.125-20	2-1/4	2	DB-162	411015
410016	DS-200	2	2.01	2-1/4	2-3/4	2.500-20	2-1/4	2	DB-200	411016

Blankoff, Stainless Steel



O-rings



Blankoff, Brass



NOMINAL SIZE	REFERENCE	PART NUMBER
1/16	S-06	410100
1/8	S-12	410101
3/16	S-18	410102
1/4	S-25	410103
5/16	S-31	410104
3/8	S-38	410105
1/2	S-50	410106
5/8	S-62	410107
3/4	S-75	410108
7/8	S-87	410109
1	S-100	410110
1-1/8	S-112	410111
1-1/4	S-125	410112
1-3/8	S-138	410113
1-1/2	S-150	410114
1-5/8	S-162	410115
2	S-200	410116

NOMINAL SIZE	PART NUMBER
1/16	041003
1/8	041006
3/16	041008
1/4	041010
5/16	041011
3/8	041012
1/2	041014
5/8	041114
3/4	041116
7/8	041118
1	041120
1-1/8	041216
1-1/4	041218
1-3/8	041220
1-1/2	041222
1-5/8	041223
2	041226

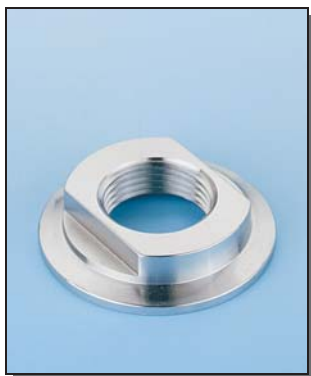
NOMINAL SIZE	REFERENCE	PART NUMBER
1/16	B-06	411100
1/8	B-12	411101
3/16	B-18	411102
1/4	B-25	411103
5/16	B-31	411104
3/8	B-38	411105
1/2	B-50	411106
5/8	B-62	411107
3/4	B-75	411108
7/8	B-87	411109
1	B-100	411110
1-1/8	B-112	411111
1-1/4	B-125	411112
1-3/8	B-138	411113
1-1/2	B-150	411114
1-5/8	B-162	411115
2	B-200	411116



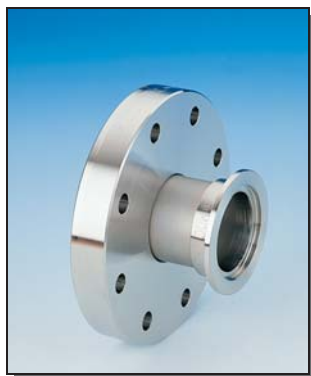
Quick-Disconnect to Del-Seal page 156



Baseplate to Kwik-Flange page 161



Female NPT to Kwik-Flangepage 158



Del-Seal CF to Kwik Flange page 150



Swagelok to Del-Seal CF page 154



Kwik-Flange to Welch Pump page 160

ULTRAHIGH & HIGH VACUUM SERIES

Features

- High vacuum rated to 1×10^{-8} Torr
- Temperature rated to 200°C maximum
- Del-Seal™ CF to Swagelok® or VCR® provides UHV pressure and temperature ranges
- Nonrotatable and symmetric geometries
- FKM / FPM fluoroelastomer O-rings
- Conflat®, ISO and ANSI compatible flanges
- Custom adapters available upon request

Description

MDC Hybrid Adapters provide a transition from one method of sealing to another. The hybrid feature of these adapters is that the geometries at each end of any component are different. This is more than a change in size within a particular sealing method. They are available in most of the common interface transition pairs.

There are two major categories of adapters: one combines pairs of standard vacuum flanges and the other combines standard fittings with flanges.

A frequent transition is from a metal seal flange to an O-ring sealed flange or fitting. Specifications are generally limited by the introduction of an O-ring seal. All Hybrid Adapters, except the Del-Seal™ CF to Swagelok® or VCR® adapters, include at least one non-metal seal and are therefore limited to high vacuum applications. Refer to individual component sections for specifications.

Reducers are a change in size within a particular flange sealing method, such as metal-seal to metal-seal. Reducers within a specific sealing method can be found in the fittings portion of each flange section. Note that the full range of ISO to ISO reducers are found in Section 1.2 — this includes ISO LF to ISO KF fittings.

Combinations that are not found in the off-the-shelf standard configurations may be discussed with the MDC technical sales engineers.

Specifications

Material

Fittings	304ss & 316ss
Flanges	304ss

Fastening

Method & size	See individual flange specs, Sections 1.1 through 1.3
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Vacuum Range	1×10^{-8} Torr
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Fittings Leak Test	2×10^{-10} cc/sec He
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Temperature Range	-20°C to 150°C
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Weight and Dimensions	See table
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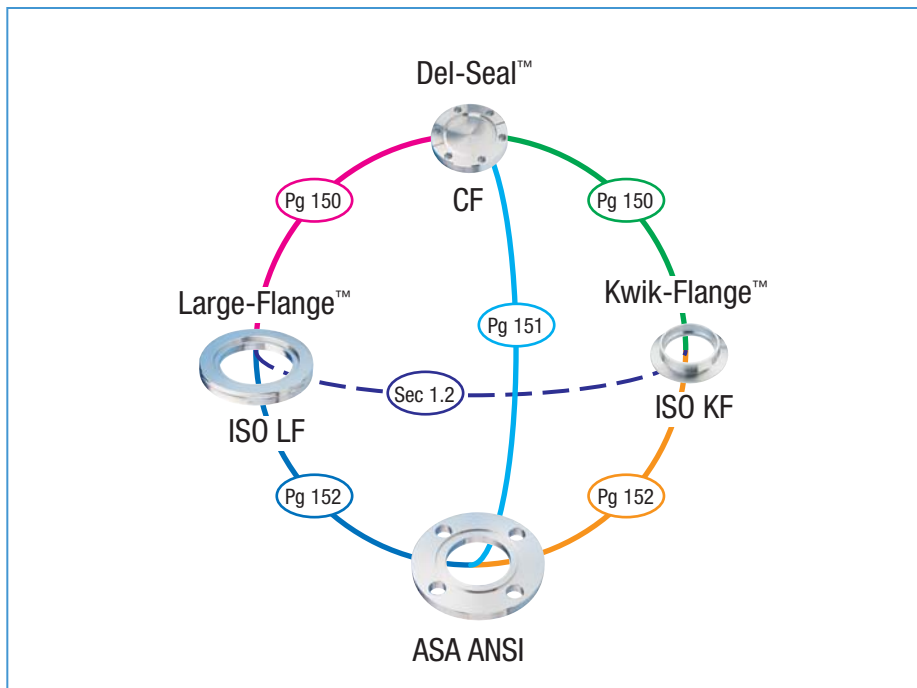
All dimensions in this catalog are given in inches unless specified otherwise.

Flange to Flange

Chambers with existing flanges may sometimes require creative solutions for attaching a desired piece of equipment. If two flanges to be joined are not of the identical mating geometry, an adapter containing the two dissimilar flanges must be used.

The three commonly used flanges in vacuum applications are metal seal flanges, ISO elastomer seal flanges and ASA ANSI elastomer seal flanges. For those geometries, MDC offers a range of adapters to provide connections between most of the standard flange sizes.

The graph at the right pinpoints the catalog location for each pair of adapter flanges. Note that ISO to ISO pairs are reducers and found in the standard ISO fittings section.

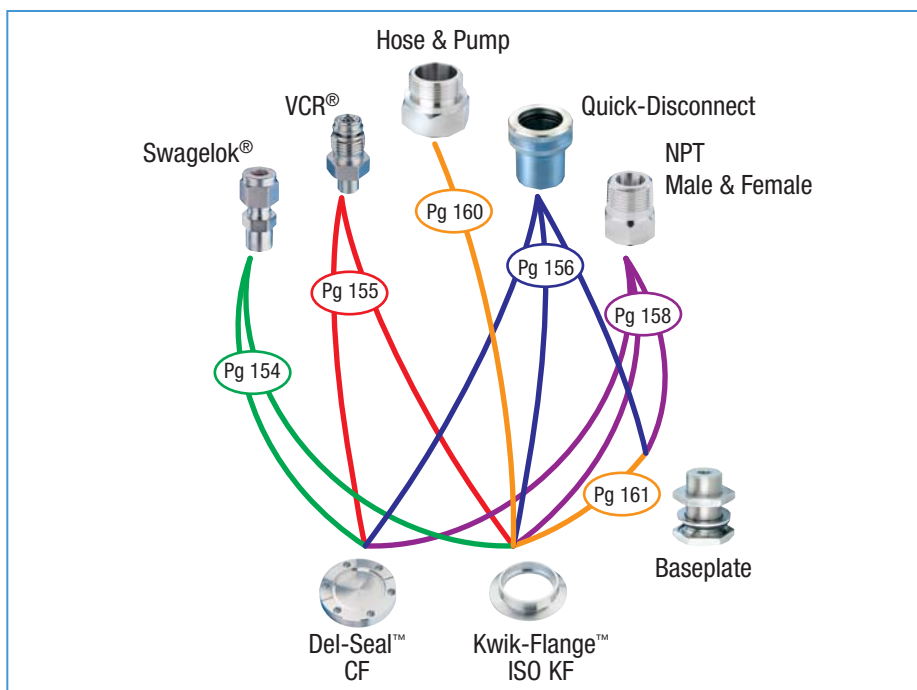


Fitting to Flange

Chambers with flanges frequently require a special fitting for introduction of additional equipment into the vacuum. Since the two end pieces are not of the identical mating geometry, an adapter containing the two dissimilar connections must be used.

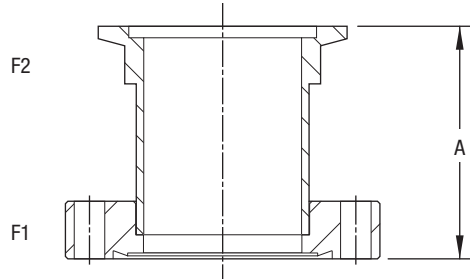
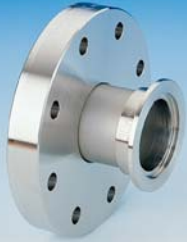
The two most common flanges in vacuum applications are metal seal flanges and ISO elastomer seal flanges. For those geometries, MDC offers a range of adapters to provide connections between most of the standard vacuum fittings and flanges.

The graph at the right pinpoints the catalog location for each pair of fitting and flange. The fittings at the top are combined with the flanges at the bottom.



Del-Seal™ CF to ↗

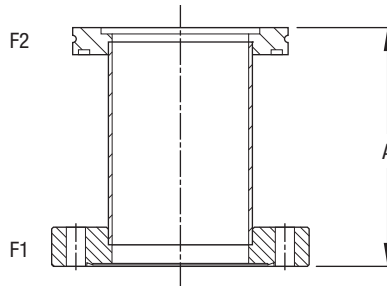
Kwik-Flange™ KF



■ Del-Seal™ CF flange to Kwik-Flange™ ISO KF

FLANGE F1 NOMINAL	O.D.	FLANGE F2 ISO REF	O.D.	TUBE O.D.	WALL	A	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	NW16	1.18	.75	.035	2.00	1/2	K075x133	730000
2-3/4	2.73	NW16	1.18	.75	.035	2.00	1/2	K075x275	730001
2-3/4	2.73	NW25	1.57	1.00	.065	2.00	1	K100x275	730002
2-3/4	2.73	NW40	2.16	1.50	.065	2.00	1	K150x275	730003
3-3/8	3.37	NW40	2.16	1.50	.065	2.00	3	K150x338	730004
4-1/2	4.47	NW40	2.16	1.50	.065	2.00	3	K150x450	730006
4-1/2	4.47	NW50	2.95	2.00	.065	2.00	3	K200x450	730005

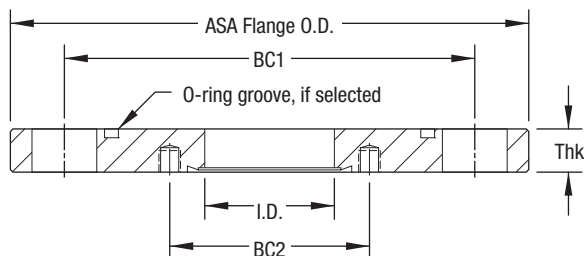
Large-Flange™ LF



■ Del-Seal™ CF flange to Large-Flange™ ISO LF

FLANGE F1 NOMINAL	O.D.	FLANGE F2 ISO REF	O.D.	TUBE O.D.	WALL	A	WT LB	REFERENCE	PART NUMBER
4-1/2	4.47	NW63	3.74	2.50	.065	4.13	3	L250x450	830000
6	5.97	NW80	4.33	3.00	.065	4.19	4	L300x600	830006
6	5.97	NW100	5.12	4.00	.083	4.19	5	L400x600	830001
8	7.97	NW160	7.09	6.00	.120	4.25	9	L600x800	830002
10	9.97	NW200	9.45	8.00	.120	4.25	16	L800x1000	830003
13-1/4	13.25	NW250	11.42	10.00	.120	4.25	20	L1000x1325	830004
14	14.00	NW320	14.57	12.00	.187	4.37	29	L1200x1400	830005

CF to ASA smooth face



Dimensions given in the table below apply to both the smooth face flanges on the left and the O-ring grooved flanges on the right.
Note: O-ring not included, see Section 1.3, page 131.

CF to ASA with groove



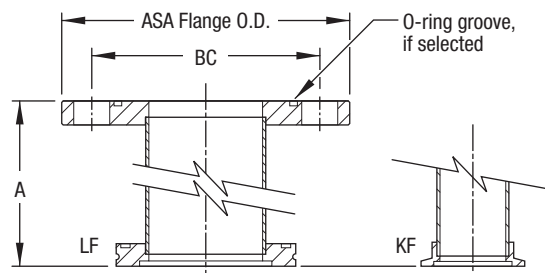
Smooth Face Type

PART NUMBER	REFERENCE	ASA FLANGE ANSI O.D.	BC1	HOLES	DEL-SEAL FLANGE NOM. I.D.	BC2	THREAD	THK	WT LB
170023	ASA4-133	1 4.25	3.125	4	1-1/3 .62	1.062	8-32	.50	1-1/2
170024	ASA4-218	1 4.25	3.125	4	2-1/8 1.00	1.625	.250-28	.50	1-1/2
170000	ASA5-133	1-1/2 5.00	3.875	4	1-1/3 .62	1.062	8-32	.50	3
170001	ASA5-218	1-1/2 5.00	3.875	4	2-1/8 1.00	1.625	.250-28	.50	2-1/2
170002	ASA5-275	1-1/2 5.00	3.875	4	2-3/4 1.50	2.312	.250-28	.50	2
170003	ASA6-133	2 6.00	4.750	4	1-1/3 .62	1.062	8-32	.50	3
170004	ASA6-218	2 6.00	4.750	4	2-1/8 1.00	1.625	.250-28	.50	3-1/2
170005	ASA6-275	2 6.00	4.750	4	2-3/4 1.50	2.312	.250-28	.50	3
170006	ASA6-338	2 6.00	4.750	4	3-3/8 2.00	2.850	.312-24	.50	3
170025	ASA7-133	3 7.50	6.000	4	1-1/3 .62	1.062	8-32	.50	5
170026	ASA7-218	3 7.50	6.000	4	2-1/8 1.00	1.625	.250-28	.50	5
170027	ASA7-275	3 7.50	6.000	4	2-3/4 1.50	2.312	.250-28	.50	4
170028	ASA7-338	3 7.50	6.000	4	3-3/8 2.00	2.850	.312-24	.50	4
170007	ASA9-133	4 9.00	7.500	8	1-1/3 .62	1.062	8-32	.50	9
170008	ASA9-218	4 9.00	7.500	8	2-1/8 1.00	1.625	.250-28	.50	9
170009	ASA9-275	4 9.00	7.500	8	2-3/4 1.50	2.312	.250-28	.50	8
170010	ASA9-338	4 9.00	7.500	8	3-3/8 2.00	2.850	.312-24	.50	8
170011	ASA9-450	4 9.00	7.500	8	4-1/2 2.50	3.628	.312-24	.50	8
170012	ASA9-458	4 9.00	7.500	8	4-5/8 3.00	4.030	.312-24	.50	8
170013	ASA9-600	4 9.00	7.500	8	6 4.00	5.128	.312-24	.50	6-1/2
170014	ASA11-133	6 11.00	9.500	8	1-1/3 .62	1.062	8-32	.75	19
170015	ASA11-218	6 11.00	9.500	8	2-1/8 1.00	1.625	.250-28	.75	19
170016	ASA11-275	6 11.00	9.500	8	2-3/4 1.50	2.312	.250-28	.75	19
170017	ASA11-338	6 11.00	9.500	8	3-3/8 2.00	2.850	.312-24	.75	19
170018	ASA11-450	6 11.00	9.500	8	4-1/2 2.50	3.628	.312-24	.75	18
170019	ASA11-458	6 11.00	9.500	8	4-5/8 3.00	4.030	.312-24	.75	18
170020	ASA11-600	6 11.00	9.500	8	6 4.00	5.128	.312-24	.75	15
170021	ASA11-675	6 11.00	9.500	8	6-3/4 5.00	5.969	.312-24	.75	15
170022	ASA11-800	6 11.00	9.500	8	8 6.00	7.128	.312-24	.75	13
170029	ASA16-133	10 16.00	14.250	12	1-1/3 .62	1.062	8-32	1.00	54
170030	ASA16-218	10 16.00	14.250	12	2-1/8 1.00	1.625	.250-28	1.00	54
170031	ASA16-275	10 16.00	14.250	12	2-3/4 1.50	2.312	.250-28	1.00	54
170032	ASA16-338	10 16.00	14.250	12	3-3/8 2.00	2.850	.312-24	1.00	53
170033	ASA16-450	10 16.00	14.250	12	4-1/2 2.50	3.628	.312-24	1.00	53
170034	ASA16-458	10 16.00	14.250	12	4-5/8 3.00	4.030	.312-24	1.00	52
170035	ASA16-600	10 16.00	14.250	12	6 4.00	5.128	.312-24	1.00	50
170036	ASA16-675	10 16.00	14.250	12	6-3/4 5.00	5.969	.312-24	1.00	45
170037	ASA16-800	10 16.00	14.250	12	8 6.00	7.128	.312-24	1.00	40
170038	ASA16-1000	10 16.00	14.250	12	10 8.00	9.128	.312-24	1.00	37

O-ring Groove Type

REFERENCE	PART NUMBER
ASA4-OR-133	170078
ASA4-OR-218	170079
ASA5-OR-133	170080
ASA5-OR-218	170081
ASA5-OR-275	170082
ASA6-OR-133	170083
ASA6-OR-218	170084
ASA6-OR-275	170085
ASA6-OR-338	170086
ASA7-OR-133	170087
ASA7-OR-218	170088
ASA7-OR-275	170089
ASA7-OR-338	170090
ASA9-OR-133	170091
ASA9-OR-218	170092
ASA9-OR-275	170093
ASA9-OR-338	170094
ASA9-OR-450	170095
ASA9-OR-458	170096
ASA9-OR-600	170097
ASA11-OR-133	170098
ASA11-OR-218	170099
ASA11-OR-275	170100
ASA11-OR-338	170101
ASA11-OR-450	170102
ASA11-OR-458	170103
ASA11-OR-600	170104
ASA11-OR-675	170105
ASA11-OR-800	170106
ASA16-OR-133	170107
ASA16-OR-218	170108
ASA16-OR-275	170109
ASA16-OR-338	170110
ASA16-OR-450	170111
ASA16-OR-458	170112
ASA16-OR-600	170113
ASA16-OR-675	170114
ASA16-OR-800	170115
ASA16-OR-1000	170116

ISO to ASA smooth face



Dimensions given in the table below apply to both the smooth face flanges on the left and the O-ring grooved flanges on the right.
Note: O-ring not included, see Section 1.3, page 131

ISO to ASA with groove



Smooth Face Type

PART NUMBER	REFERENCE	ASA FLANGE ANSI O.D.	HOLES B.C. NO. DIA.				KWIK-FLANGE ISO REF O.D.		TUBE O.D. WALL		A
733000	K075xASA4	1 4.25	3.125	4	.62	NW16	1.18	.75	.035	1.84	
733014	K100xASA4	1 4.25	3.125	4	.62	NW25	1.57	1.00	.065	2.38	
733028	K150xASA4	1 4.25	3.125	4	.62	NW40	2.16	1.50	.065	2.80	
733002	K075xASA5	1-1/2 5.00	3.875	4	.62	NW16	1.18	.75	.035	1.84	
733016	K100xASA5	1-1/2 5.00	3.875	4	.62	NW25	1.57	1.00	.065	2.38	
733030	K150xASA5	1-1/2 5.00	3.875	4	.62	NW40	2.16	1.50	.065	2.80	
733042	K200xASA5	1-1/2 5.00	3.875	4	.62	NW50	2.95	2.00	.065	3.55	
733004	K075xASA6	2 6.00	4.750	4	.75	NW16	1.18	.75	.035	1.84	
733018	K100xASA6	2 6.00	4.750	4	.75	NW25	1.57	1.00	.065	2.38	
733032	K150xASA6	2 6.00	4.750	4	.75	NW40	2.16	1.50	.065	2.80	
733044	K200xASA6	2 6.00	4.750	4	.75	NW50	2.95	2.00	.065	3.55	
733006	K075xASA7	3 7.50	6.000	4	.75	NW16	1.18	.75	.035	1.84	
733020	K100xASA7	3 7.50	6.000	4	.75	NW25	1.57	1.00	.065	2.38	
733034	K150xASA7	3 7.50	6.000	4	.75	NW40	2.16	1.50	.065	2.80	
733046	K200xASA7	3 7.50	6.000	4	.75	NW50	2.95	2.00	.065	3.55	
733008	K075xASA9	4 9.00	7.500	8	.75	NW16	1.18	.75	.035	1.84	
733022	K100xASA9	4 9.00	7.500	8	.75	NW25	1.57	1.00	.065	2.38	
733036	K150xASA9	4 9.00	7.500	8	.75	NW40	2.16	1.50	.065	2.80	
733048	K200xASA9	4 9.00	7.500	8	.75	NW50	2.95	2.00	.065	3.55	
733010	K075xASA11	6 11.00	9.500	8	.81	NW16	1.18	.75	.035	1.84	
733024	K100xASA11	6 11.00	9.500	8	.81	NW25	1.57	1.00	.065	2.38	
733038	K150xASA11	6 11.00	9.500	8	.81	NW40	2.16	1.50	.065	2.80	
733050	K200xASA11	6 11.00	9.500	8	.81	NW50	2.95	2.00	.065	3.55	
733012	K075xASA16	10 16.00	14.250	12	.81	NW16	1.18	.75	.035	1.84	
733026	K100xASA16	10 16.00	14.250	12	.81	NW25	1.57	1.00	.065	2.38	
733040	K150xASA16	10 16.00	14.250	12	.81	NW40	2.16	1.50	.065	2.80	
733052	K200xASA16	10 16.00	14.250	12	.81	NW50	2.95	2.00	.065	3.55	

O-ring Groove Type

REFERENCE	PART NUMBER
K075xASA4-OR	733001
K100xASA4-OR	733015
K150xASA4-OR	733029
K075xASA5-OR	733003
K100xASA5-OR	733017
K150xASA5-OR	733031
K200xASA5-OR	733043
K075xASA6-OR	733005
K100xASA6-OR	733019
K150xASA6-OR	733033
K200xASA6-OR	733045
K075xASA7-OR	733007
K100xASA7-OR	733021
K150xASA7-OR	733035
K200xASA7-OR	733047
K075xASA9-OR	733009
K100xASA9-OR	733023
K150xASA9-OR	733037
K200xASA9-OR	733049
K075xASA11-OR	733011
K100xASA11-OR	733025
K150xASA11-OR	733039
K200xASA11-OR	733051
K075xASA16-OR	733013
K100xASA16-OR	733027
K150xASA16-OR	733041
K200xASA16-OR	733053

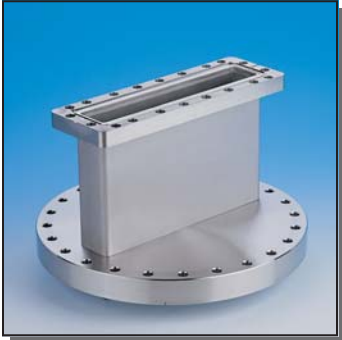
Smooth Face Type

PART NUMBER	REFERENCE	ASA FLANGE		HOLES			LARGE-FLANGE		TUBE		A
		ANSI	O.D.	B.C.	NO.	DIA.	ISO REF	O.D.	O.D.	WALL	
833000	L250xASA6	2	6.00	4.750	4	.75	NW63	3.74	2.50	.065	4.09
833001	L250xASA9	4	9.00	7.500	8	.75	NW63	3.74	2.50	.065	4.09
833012	L300xASA9	4	9.00	7.500	8	.75	NW80	4.33	3.00	.065	4.09
833002	L400xASA9	4	9.00	7.500	8	.75	NW100	5.12	4.00	.083	4.09
833003	L600xASA9	4	9.00	7.500	8	.75	NW160	7.09	6.00	.120	4.09
833004	L600xASA11	6	11.00	9.500	8	.81	NW160	7.09	6.00	.120	4.09
833005	L800xASA11	6	11.00	9.500	8	.81	NW200	9.45	8.00	.120	4.09

O-Ring Type

REFERENCE	PART NUMBER
L250xASA6-OR	833006
L250xASA9-OR	833007
L300xASA9-OR	833013
L400xASA9-OR	833008
L600xASA9-OR	833009
L600xASA11-OR	833010
L800xASA11-OR	833011

Custom Interfaces



Rectangular flange adapter page 435



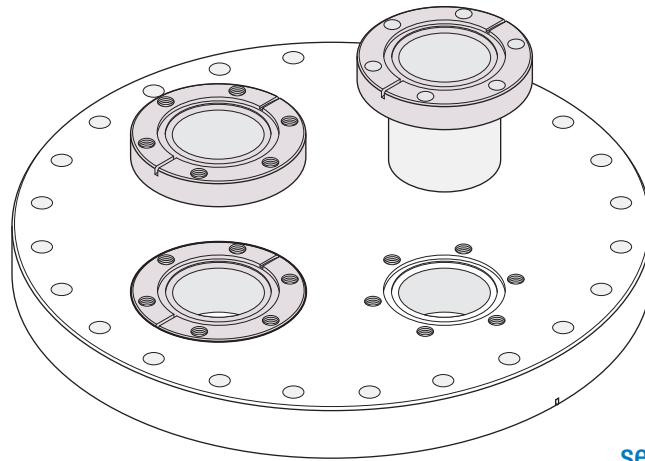
Multiport adapter page 74



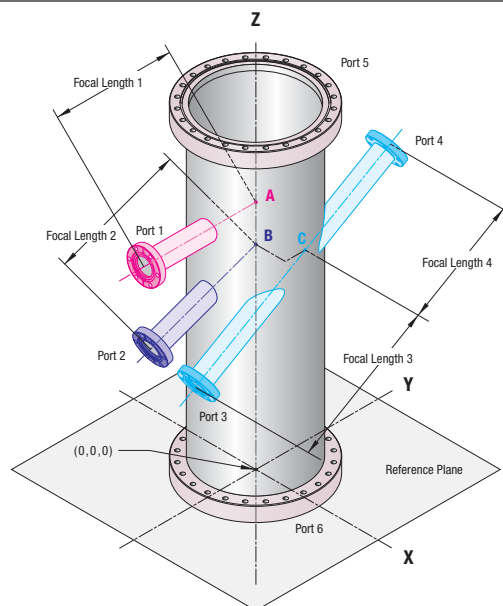
Quick-Disconnect adapter page 156

MDC manufactures a wide range of custom parts, including half nipples and adapters between custom size gate valves and chambers. Section 10 of this catalog provides additional custom fabrication information. Contact MDC's technical sales staff to discuss your design requirements.

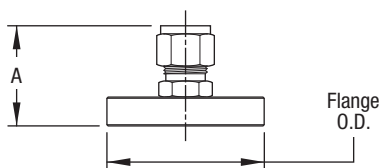
Specifying Custom Interfaces...



...see Section 10



Swagelok® to ↗



- 304ss flange material
- 316ss Swagelok® material

Del-Seal™ CF



• 450°C maximum

SWAGelok® NOM. SIZE	TUBE O.D.	FLANGE NOM.	FLANGE O.D.	A NOM.	WT LB	REFERENCE	PART NUMBER
1/4	.25	1-1/3	1.33	1.33	1/4	SWG25-133	414000
1/4	.25	2-3/4	2.73	1.41	1	SWG25-275	414001
1/2	.50	1-1/3	1.33	1.70	1/4	SWG50-133	414002
1/2	.50	2-3/4	2.73	1.70	1	SWG50-275	414003
3/4	.75	2-3/4	2.73	2.04	1	SWG75-275	414004
1	1.00	2-3/4	2.73	2.38	1	SWG100-275	414005

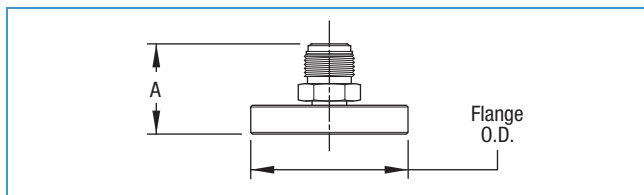
Kwik-Flange™ KF



• 150°C maximum

SWAGelok® NOM. SIZE	TUBE O.D.	NOMINAL REF ISO	FLANGE O.D.	A NOM.	WT LB	REFERENCE	PART NUMBER
1/4	.25	NW16	1.18	1.28	1/4	K075-SWG25	414012
1/4	.25	NW25	1.57	1.28	1/4	K100-SWG25	414013
1/4	.25	NW40	2.16	1.28	1/4	K150-SWG25	414014
1/4	.25	NW50	2.95	1.28	1/4	K200-SWG25	414015
1/2	.50	NW25	1.57	1.72	1/4	K100-SWG50	414016
1/2	.50	NW40	2.16	1.65	1/4	K150-SWG50	414017
1/2	.50	NW50	2.95	1.65	1/4	K200-SWG50	414018
3/4	.75	NW40	2.16	1.91	1/2	K150-SWG75	414019
3/4	.75	NW50	2.95	1.91	1/2	K200-SWG75	414020
1	1.00	NW40	2.16	2.33	1/2	K150-SWG100	414021
1	1.00	NW50	2.95	2.33	1/2	K200-SWG100	414022

Male VCR® to ↗



- 304ss flange material
- 316ss VCR® material

Del-Seal™ CF



• 450°C maximum

MALE VCR® NOM. SIZE	TUBE O.D.	FLANGE NOM.	FLANGE O.D.	A NOM.	WT LB	REFERENCE	PART NUMBER
1/4	.25	1-1/3	1.33	1.36	1/4	VCR25-133	414006
1/4	.25	2-3/4	2.73	1.50	1	VCR25-275	414007
1/2	.50	1-1/3	1.33	1.55	1/4	VCR50-133	414008
1/2	.50	2-3/4	2.73	1.55	1	VCR50-275	414009
3/4	.75	2-3/4	2.73	2.05	1	VCR75-275	414010
1	1.00	2-3/4	2.73	2.27	1	VCR100-275	414011

Kwik-Flange™ KF



• 150°C maximum

MALE VCR® NOM. SIZE	TUBE O.D.	NOMINAL REF ISO	FLANGE O.D.	A NOM.	WT LB	REFERENCE	PART NUMBER
1/4	.25	NW16	1.18	1.31	1/4	K075-VCR25	414055
1/4	.25	NW25	1.57	1.31	1/4	K100-VCR25	414056
1/4	.25	NW40	2.16	1.31	1/4	K150-VCR25	414057
1/4	.25	NW50	2.95	1.31	1/4	K200-VCR25	414058
1/2	.50	NW25	1.57	1.50	1/4	K100-VCR50	414059
1/2	.50	NW40	2.16	1.50	1/4	K150-VCR50	414060
1/2	.50	NW50	2.95	1.50	1/4	K200-VCR50	414061
3/4	.75	NW40	2.16	2.00	1/2	K150-VCR75	414062
3/4	.75	NW50	2.95	2.00	1/2	K200-VCR75	414063
1	1.00	NW40	2.16	2.22	1/2	K150-VCR100	414064
1	1.00	NW50	2.95	2.22	1/2	K200-VCR100	414065

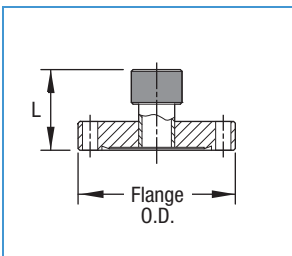
Quick-Disconnect to

MDC Flanged Quick-Disconnects provide rapid access into vacuum chambers through flanged ports. They offer all the convenience and flexibility of standard Quick-Disconnects when mated with Del-Seal™ CF, Baseplate or Kwik-Flange™ KF ports on a vacuum system. Quick-Disconnects are a fast and convenient method for coupling and uncoupling metal and glass tubing. They permit the speedy interchange of feedthroughs, adapters, thermocouple gauges and a variety of other special purpose devices. A positive seal is provided by O-ring compression. Fractional tubing O.D. must be circular within .005". Note that I.D.s are through and do not include a stop to restrict tubing insertion. Material is 300 series stainless steel. Maximum bakeout temperature is 200°C. Quick-Disconnects are easily sealed with blankoffs when not in use. Blankoffs are not included unless stated otherwise. Stainless steel and brass blankoffs are detailed on page 146.

Del-Seal™ CF



- Blankoff plug not included
- For weldable, brass and blankoff components, see Section 1.4, page 146



TUBE DIA.	FLANGE NOM.	FLANGE O.D.	NOM. L	NUT THREAD	WT LB	REFERENCE	PART NUMBER
1/16	1-1/3	1.33	1-3/8	.375-20	1	MFDS-06	413000
1/8	1-1/3	1.33	1-3/8	.375-20	1	MFDS-12	413001
3/16	1-1/3	1.33	1-3/8	.500-20	1	MFDS-18	413002
1/4	1-1/3	1.33	1-3/8	.500-20	1	MFDS-25	413003
5/16	1-1/3	1.33	1-3/8	.688-20	1	MFDS-31	413004
3/8	1-1/3	1.33	1-3/8	.688-20	1	MFDS-38	413005
1/2	1-1/3	1.33	1-7/16	.750-20	2	MFDS-50	413006
5/8	1-1/3	1.33	1-11/16	1-20	2	MFDS-62	413007
1/16	2-3/4	2.73	1-3/8	.375-20	1	FDS-06	412000
1/8	2-3/4	2.73	1-3/8	.375-20	1	FDS-12	412001
3/16	2-3/4	2.73	1-3/8	.500-20	1	FDS-18	412002
1/4	2-3/4	2.73	1-3/8	.500-20	1	FDS-25	412003
5/16	2-3/4	2.73	1-3/8	.688-20	1	FDS-31	412004
3/8	2-3/4	2.73	1-3/8	.688-20	1	FDS-38	412005
1/2	2-3/4	2.73	1-7/16	.750-20	2	FDS-50	412006
5/8	2-3/4	2.73	1-3/4	1-20	2	FDS-62	412007
3/4	2-3/4	2.73	1-7/8	1.188-20	2	FDS-75	412008
7/8	2-3/4	2.73	1-3/4	1.250-20	2	FDS-87	412009
1	2-3/4	2.73	2-1/8	1.375-20	2	FDS-100	412010
1-1/8	2-3/4	2.73	2-1/8	1.625-20	2	FDS-112	412011
1-1/4	2-3/4	2.73	2-1/4	1.688-20	2	FDS-125	412012
1-3/8	2-3/4	2.73	2-3/8	1.812-20	2	FDS-138	412013
1-1/2	2-3/4	2.73	2-1/2	2-20	2	FDS-150	412014

Baseplate



- Blankoff plug included

TUBE DIA.	FIGURE	BODY I.D.	SEAL NUT NOM. O.D.	SEAL NUT THREAD	WT LB	REFERENCE	PART NUMBER
1/8	1	.135	1-3/16	1-20	2	DBF-12	650000
1/4	1	.265	1-3/16	1-20	2	DBF-25	650001
3/8	1	.382	1-3/16	1-20	2	DBF-38	650002
1/2	1	.520	1-3/16	1-20	2	DBF-50	650003
5/8	1	.656	1-3/16	1-20	2	DBF-62	650004
3/4	1	.769	1-3/16	1-20	2	DBF-75	650005
1	2	.760	1-5/8	1.375-20	2	DBF-100	650006

Figure 1: 1/8" to 3/4" sizes

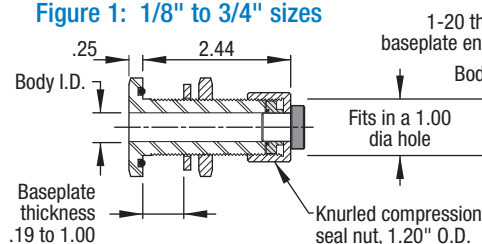
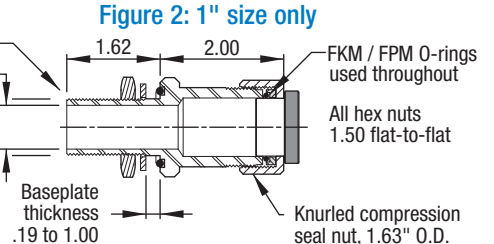
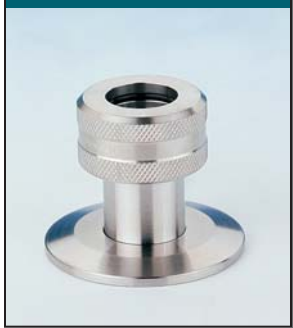


Figure 2: 1" size only

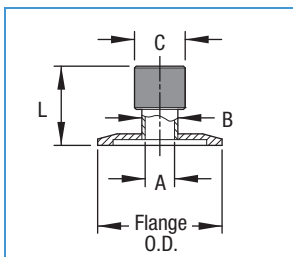


Quick-Disconnect to

Kwik-Flange™ KF



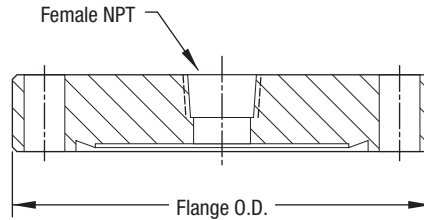
- Blankoff plug not included
- For weldable, brass and blankoff components, see Section 1.4, page 146



TUBE SIZE	NOMINAL REF ISO	FLANGE O.D.	A	B	C	NOM. L	WT LB	REFERENCE	PART NUMBER
1/16	NW16	1.18	.07	.37	.51	1-5/16	1/2	K075xDS-06	734000
1/16	NW25	1.57	.07	.37	.51	1-5/16	1/2	K100xDS-06	734008
1/16	NW40	2.16	.07	.37	.51	1-5/16	1/2	K150xDS-06	734019
1/16	NW50	2.95	.07	.37	.51	1-5/16	1/2	K200xDS-06	734034
1/8	NW16	1.18	.13	.37	.51	1-5/16	1/2	K075xDS-12	734001
1/8	NW25	1.57	.13	.37	.51	1-5/16	1/2	K100xDS-12	734009
1/8	NW40	2.16	.13	.37	.51	1-5/16	1/2	K150xDS-12	734020
1/8	NW50	2.95	.13	.37	.51	1-5/16	1/2	K200xDS-12	734035
3/16	NW16	1.18	.19	.37	.63	1-5/16	1/2	K075xDS-18	734002
3/16	NW25	1.57	.19	.37	.63	1-5/16	1/2	K100xDS-18	734010
3/16	NW40	2.16	.19	.37	.63	1-5/16	1/2	K150xDS-18	734021
3/16	NW50	2.95	.19	.37	.63	1-5/16	1/2	K200xDS-18	734036
1/4	NW16	1.18	.26	.37	.64	1-5/16	1/2	K075xDS-25	734003
1/4	NW25	1.57	.26	.37	.64	1-5/16	1/2	K100xDS-25	734011
1/4	NW40	2.16	.26	.37	.64	1-5/16	1/2	K150xDS-25	734022
1/4	NW50	2.95	.26	.37	.64	1-5/16	1/2	K200xDS-25	734037
5/16	NW16	1.18	.32	.50	.88	1-7/16	1/2	K075xDS-31	734004
5/16	NW25	1.57	.32	.50	.88	1-5/16	1/2	K100xDS-31	734012
5/16	NW40	2.16	.32	.50	.88	1-5/16	1/2	K150xDS-31	734023
5/16	NW50	2.95	.32	.50	.88	1-5/16	1/2	K200xDS-31	734038
3/8	NW16	1.18	.38	.50	.88	1-7/16	1/2	K075xDS-38	734005
3/8	NW25	1.57	.38	.50	.88	1-7/16	1/2	K100xDS-38	734013
3/8	NW40	2.16	.38	.50	.88	1-7/16	1/2	K150xDS-38	734024
3/8	NW50	2.95	.38	.50	.88	1-7/16	1/2	K200xDS-38	734039
1/2	NW16	1.18	.51	.62	.88	1-1/2	1/2	K075xDS-50	734006
1/2	NW25	1.57	.51	.62	.88	1-3/8	1/2	K100xDS-50	734014
1/2	NW40	2.16	.51	.62	.88	1-3/8	1/2	K150xDS-50	734025
1/2	NW50	2.95	.51	.62	.88	1-3/8	1/2	K200xDS-50	734040
5/8	NW16	1.18	.63	.75	1.20	1-5/8	1/2	K075xDS-62	734007
5/8	NW25	1.57	.63	.75	1.20	1-5/8	1/2	K100xDS-62	734015
5/8	NW40	2.16	.63	.75	1.20	1-5/8	1/2	K150xDS-62	734026
5/8	NW50	2.95	.63	.75	1.20	1-5/8	1/2	K200xDS-62	734041
3/4	NW25	1.57	.76	.87	1.39	1-3/4	1/2	K100xDS-75	734016
3/4	NW40	2.16	.76	.87	1.39	1-3/4	1/2	K150xDS-75	734027
3/4	NW50	2.95	.76	.87	1.39	1-3/4	1/2	K200xDS-75	734042
7/8	NW25	1.57	.88	1.00	1.39	1-3/4	1	K100xDS-87	734017
7/8	NW40	2.16	.88	1.00	1.39	1-3/4	1	K150xDS-87	734028
7/8	NW50	2.95	.88	1.00	1.39	1-3/4	1	K200xDS-87	734043
1	NW25	1.57	1.01	1.12	1.63	2	1	K100xDS-100	734018
1	NW40	2.16	1.01	1.12	1.63	2	1	K150xDS-100	734029
1	NW50	2.95	1.01	1.12	1.63	2	1	K200xDS-100	734044
1-1/8	NW40	2.16	1.13	1.25	1.88	2	1	K150xDS-112	734030
1-1/8	NW50	2.95	1.13	1.25	1.88	2	1	K200xDS-112	734045
1-1/4	NW40	2.16	1.26	1.50	1.88	2-1/8	1	K150xDS-125	734031
1-1/4	NW50	2.95	1.26	1.50	1.88	2-1/8	1	K200xDS-125	734046
1-3/8	NW40	2.16	1.39	1.62	2.01	2-1/4	1	K150xDS-138	734032
1-3/8	NW50	2.95	1.39	1.62	2.01	2-1/4	1	K200xDS-138	734047
1-1/2	NW40	2.16	1.51	1.75	2.26	2-3/8	1	K150xDS-150	734033
1-1/2	NW50	2.95	1.51	1.75	2.26	2-3/8	1	K200xDS-150	734048
1-5/8	NW50	2.95	1.63	1.87	2.38	2-1/2	1	K200xDS-162	734049
2	NW50	2.95	2.01	2.25	2.76	2-1/2	1	K200xDS-200	734050

Female NPT to

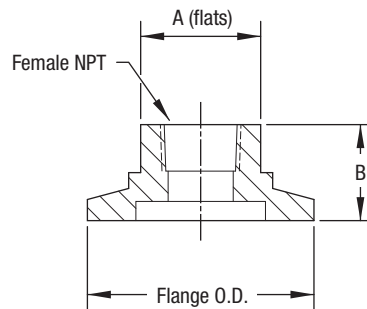
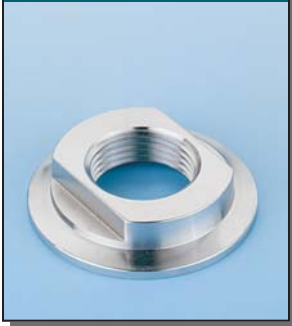
Del-Seal™ CF



- Use with Bourdon type pressure gauge, part number 432020, page 290
- Use with thermocouple gauge tubes, page 293
- Stainless steel
- Use Teflon tape on threads

FEMALE NPT SIZE	FLANGE NOM.	FLANGE O.D.	WT LB	REFERENCE	PART NUMBER
1/8	1-1/3	1.33	1/4	1/8FPT-133	432041
1/8	2-1/8	2.11	1/2	1/8FPT-218	432042
1/8	2-3/4	2.73	1	1/8FPT-275	432043
1/4	1-1/3	1.33	1/4	1/4FPT-133	432044
1/4	2-1/8	2.11	1/2	1/4FPT-218	432045
1/4	2-3/4	2.73	1	1/4FPT-275	432046

Kwik-Flange™ KF



- Use with Bourdon type pressure gauge, part number 432020, page 290
- Use with thermocouple gauge tubes, page 293
- Stainless steel
- Use Teflon tape on threads

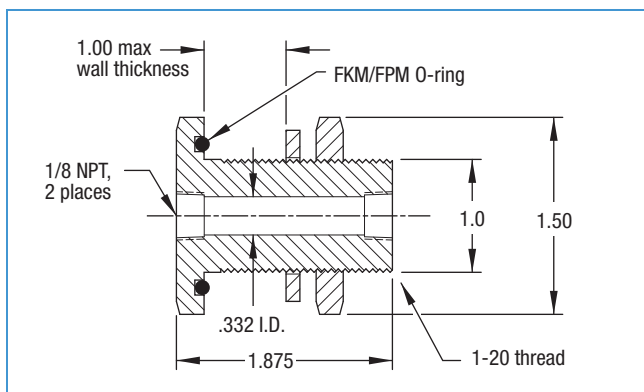
FEMALE NPT SIZE	NOMINAL REF ISO	FLANGE O.D.	A	B	WT LB	REFERENCE	PART NUMBER
1/8	NW16	1.18	.62	.50	1/4	K075x1/8FPT	731000
1/8	NW25	1.57	.88	.50	1/4	K100x1/8FPT	731001
1/8	NW40	2.16	1.25	.50	1/4	K150x1/8FPT	731002
1/8	NW50	2.95	1.75	.62	1/2	K200x1/8FPT	731034
1/4	NW16	1.18	.62	.50	1/4	K075x1/4FPT	731004
1/4	NW25	1.57	.88	.50	1/4	K100x1/4FPT	731005
1/4	NW40	2.16	1.25	.50	1/4	K150x1/4FPT	731008
1/4	NW50	2.95	1.75	.62	1/2	K200x1/4FPT	731003
1/2	NW25	1.57	.88	.50	1/4	K100x1/2FPT	731006
1/2	NW40	2.16	1.25	.50	1/4	K150x1/2FPT	731009
1/2	NW50	2.95	1.75	.62	1/2	K200x1/2FPT	731011
3/4	NW40	2.16	1.25	.50	1/4	K150x3/4FPT	731010
3/4	NW50	2.95	1.75	.62	1/2	K200x3/4FPT	731012

Female NPT to ↗

Baseplate



- O-ring, washer and nut included
- Replacement O-ring MDC part number 041216



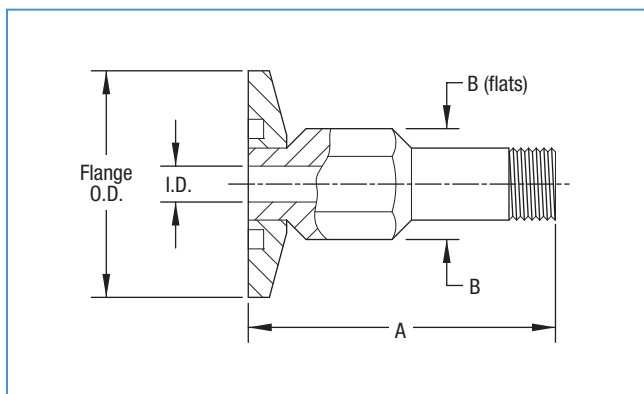
- Use with thermocouple gauge or for gas backfilling
- 1/8" NPT accommodates gauges or tubing
- Fits standard 1" diameter mounting hole
- Seal is by FKM / FPM fluoroelastomer O-ring
- Stainless steel
- Use Teflon tape on threads

DESCRIPTION
GAS BACKFILL FEEDTHROUGH

REFERENCE	PART NUMBER
FGT-1125	653000

Male NPT to ↗

Kwik-Flange™ KF

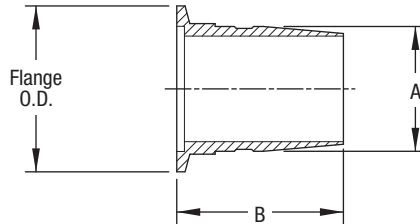


- Stainless steel
- Use Teflon tape on threads

MALE NPT SIZE	NOMINAL REF ISO	FLANGE O.D.	I.D.	A	B	WT LB	REFERENCE	PART NUMBER
1/8	NW16	1.18	.19	1.6	.50	1/4	K075x1/8MPT	731020
1/8	NW25	1.57	.19	1.6	.50	1/4	K100x1/8MPT	731022
1/8	NW40	2.16	.19	1.6	.50	1/4	K150x1/8MPT	731026
1/8	NW50	2.95	.19	1.6	.50	1/2	K200x1/8MPT	731035
1/4	NW16	1.18	.28	1.6	.62	1/4	K075x1/4MPT	731021
1/4	NW25	1.57	.28	1.6	.62	1/4	K100x1/4MPT	731023
1/4	NW40	2.16	.28	1.6	.62	1/4	K150x1/4MPT	731027
1/4	NW50	2.95	.28	1.6	.62	1/2	K200x1/4MPT	731030
1/2	NW25	1.57	.47	1.7	.88	1/4	K100x1/2MPT	731024
1/2	NW40	2.16	.47	1.6	.88	1/4	K150x1/2MPT	731028
1/2	NW50	2.95	.47	1.6	.88	1/2	K200x1/2MPT	731031
3/4	NW25	1.57	.62	1.6	1.12	1/4	K100x3/4MPT	731025
3/4	NW40	2.16	.62	1.6	1.12	1/4	K150x3/4MPT	731029
3/4	NW50	2.95	.62	1.6	1.12	1/2	K200x3/4MPT	731032
1	NW50	2.95	.87	1.6	1.38	1/2	K200x1MPT	731033

Kwik-Flange™ KF to ↗

Rubber Hose

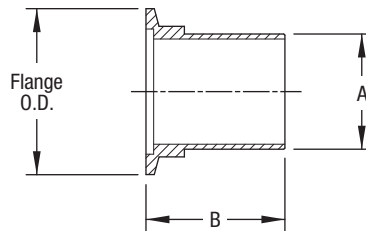


- Each adapter fits a range of hose sizes
- Hose clamp recommended Aluminum 2011-T3

HOSE SIZE	NOMINAL REF ISO	FLANGE O.D.	A	B	WT LB
1/2 OR 5/8	NW16	1.18	.62	1.65	1/4
5/8 OR 3/4	NW16	1.18	.75	1.65	1/4
3/4 OR 7/8	NW25	1.57	.87	1.73	1/4
1-1/2 OR 1-5/8	NW40	2.16	1.63	2.17	1/4
1-1/2 OR 1-5/8	NW50	2.95	1.63	2.17	1/4

REFERENCE	PART NUMBER
K050-RHA	735000
K075-RHA	735001
K100-RHA	735002
K150-RHA	735003
K200-RHA	735004

PVC Hose



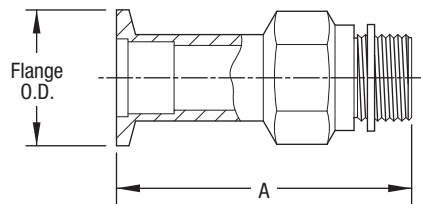
- Shown with hose clamp, which is sold separately
- PVC hose and hose clamps in Section 3.3, page 262

- Beveled edge for use with MDC reinforced PVC flexible hose, Roughing Components, Section 3.3

HOSE SIZE	NOMINAL REF ISO	FLANGE O.D.	A	B	WT LB
1/2	NW16	1.18	.50	1.25	1/4
3/4	NW16	1.18	.75	1.25	1/4
1	NW25	1.57	1.00	1.67	1/4
1-1/2	NW40	2.16	1.50	1.81	1/4
2	NW50	2.95	2.00	2.00	1/4

REFERENCE	PART NUMBER
K050-HPV	736000
K075-HPV	736001
K100-HPV	736002
K150-HPV	736003
K200-HPV	736004

Welch Pump



- Refer to pump manufacturer for current thread sizes
- Check threads before ordering

- Adapts straight pipe thread to Kwik-Flange™ KF flanges
- Use with standard Welch mechanical pumps
- Includes aluminum washer

STRAIGHT PIPE THREAD	USE WITH WELCH PUMP NO.	NOMINAL REF ISO	FLANGE O.D.	A	WT LB
.375-18	1410	NW16	1.18	1.77	1
.750-20	1399, 1400, 1403	NW16	1.18	2.56	1
1-20	1373, 1376, 1380, 1402	NW25	1.57	2.76	1
1.500-12	-	NW40	2.16	2.56	2
1.750-20	1374, 1397	NW40	2.16	2.56	2

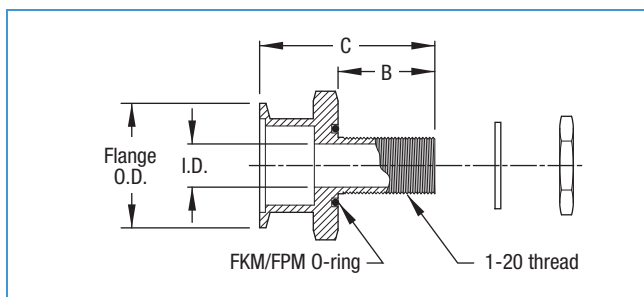
REFERENCE	PART NUMBER
K075-1399	737000
K075-1405	737001
K100-1402	737002
K150-1376	737003
K150-1397	737004

Baseplate to ↗

Kwik-Flange™ KF



- O-ring, washer and nut included
- Replacement O-ring MDC part number 041216



- For use with plates up to 1" thick
- Fits through standard 1" diameter holes
- Seal is by FKM / FPM fluoroelastomer O-ring
- Stainless steel body, washer and nut

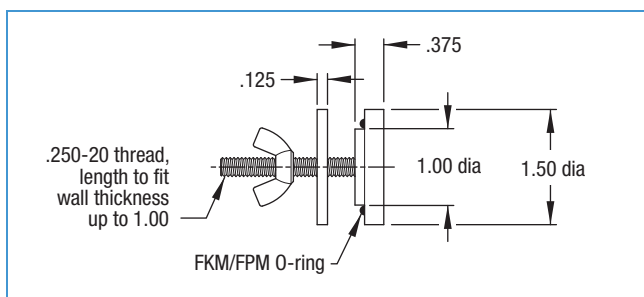
NOMINAL REF ISO	FLANGE O.D.	REQUIRED HOLE DIA.	I.D. A	B	C	WT LB
NW25	1.57	1	.75	1.62	2.88	1/2
NW40	2.16	1	.75	1.62	3.23	1

REFERENCE	PART NUMBER
K100-BPFT	650007
K150-BPFT	650008

Blank Plug



- O-ring, washer and wing nut included
- Replacement O-ring MDC part number 041216



- For sealing standard 1" diameter mounting holes when not in use
- Seal is by FKM / FPM fluoroelastomer O-ring
- Stainless steel or brass plug

DESCRIPTION
BRASS BLANK PLUG
STAINLESS STEEL BLANK PLUG

REFERENCE	PART NUMBER
FBB-101	654000
FBS-101	654002

Del-Base™ Baseplate Mounts

Baseplate fittings mount through one inch diameter ports and require a flat, scratch-free sealing surface of at least 1-3/4 inches diameter. A vacuum seal is achieved by uniform compression of an elastomer gasket on the vacuum side of the chamber. A sealing nut and washer are typically fastened on the atmosphere side of the chamber. Hand tightening will usually provide adequate seal compression.

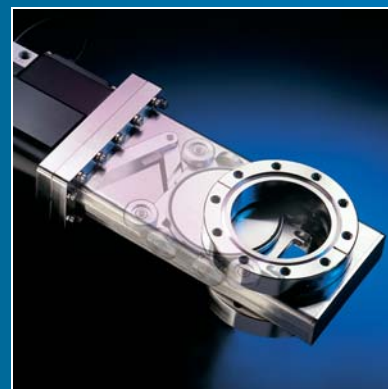
Elastomer seals limit the operating temperature range and bakeout temperature. For fluorocarbon-based fluoroelastomer (FKM / FPM) O-rings, the maximum intermittent bakeout temperature is 200°C with a sustained use to 150°C. Repeated bakeout cycling can result in the deterioration of the O-ring and require its periodic replacement.

Other fittings with baseplate style mounting...

- Quick-Disconnect Hybrid Adapters. page 156-157
- NPT Hybrid Adapters. page 158-159
- High Current Electrical Feedthroughs. page 334-335
- Liquid Feedthroughs. page 357-365
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2

Gate Valves



Gate Valves

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In the simplest of terms, vacuum gate valves are devices that regulate the flow of gases, fluids or materials through a structure or aperture by opening, closing or obstructing a port or passageway. Gate valve assemblies consist of three key components: an actuator, a carriage/gate and a valve body. The actuator provides the power to position or transport the valve's carriage/gate. The actuator is attached to the valve's body via a rectangular bonnet flange. The gate closes or opens one of the valve's body ports. The valve body is a vacuum tight chamber that is screwed, flanged or welded into a larger vacuum vessel or system. It is worth noting that reliable vacuum valves were not commercially available until the late 1940s with the advent of O-ring elastomer seals. The elastomer O-ring was developed during WWII for use in aircraft hydraulic systems, and was soon thereafter adopted by the vacuum community as the standard means

of making vacuum seals. Prior to this it was common practice, even in large research establishments, to upgrade general service valves for vacuum use by winding actuator shaft gaskets from string soaked in an Apiezon grease. MDC stainless steel vacuum gate valves incorporate patented C-Loc® and Uni-Loc™ gate valve locking mechanisms. No contact is made between a valve's body and the locking mechanism, a feature which markedly decreases vibration and insures smooth valve operation. MDC gate valves require about half the number of moving parts found in comparable competitor valves. This reduction in moving components minimizes wear and particulate generation which in turn provides valves of superior performance and reliability. The valves' low outgassing characteristics can be attributed to a fusion welded 300 series stainless steel body, welded AM-350 stainless steel nesting bellows as well as small cross-section O-rings and the elimination of blind internal cavities. MDC circular gate valves are offered in various sizes ranging from .625" to 12" port diameters. Standard port mounts include: Del-Seal™ CF metal seal flanges, which are recommended for ultrahigh vacuum service; ISO Kwik-Flange™ and ISO Large-Flange™ fast make and break elastomer sealed flanges, ideal for high vacuum applications requiring frequent assembly and disassembly; and ANSI ASA elastomer seal port flanges for use in high vacuum applications where ANSI standards are specified. Gate valve actuation is available in both manual and electropneumatic configurations. Custom designed valves are available on request.

All dimensions in this catalog are given in inches unless specified otherwise.

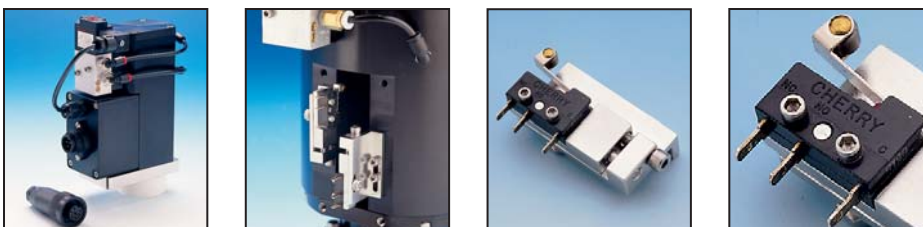
Gate Valve Standard Features

- UHV and HV series
- Ports with circular or rect angular apertures
- Del-Seal™ CF, ISO Kwik-Flange™, ISO Large-Flange™ or ANSI ASA port flanges
- Manual and Electropneumatic actuators
- Patented C-Loc® and Uni-Loc™ locking mechanism
- 120VAC air control solenoid valve (Circular gate valves)
- 24VDC air control solenoid valve (Rectangular gate valves)
- OFE copper metal and FKM / FPM fluoroelastomer elastomer bonnet seals
- Welded bellows actuator seal
- TIG welded internal body joints
- Electropolished interior and exterior surfaces
- Dry film lubricated bearings

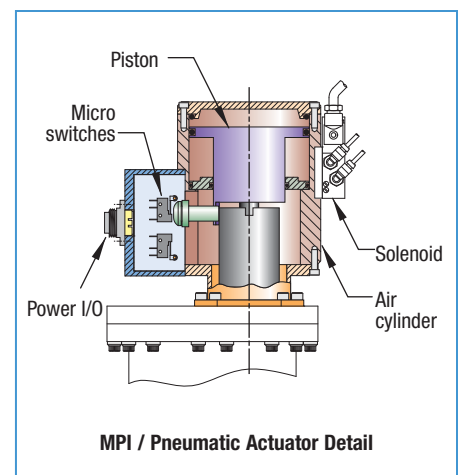
Gate Valve Optional Features

- Modular Electromechanical position indicators
- Air control solenoid valves for 240VAC and 24VDC service
- Valve body roughing ports
- High temperature 250°C Kalrez® elastomer gate seal

Mechanical Position Indicator Option -01



MDC circular C-Loc® gate valves can be fitted with optional high precision, modular mechanical position indicators (MPI). This new MPI system consists of two single pole double throw micro switches fitted with integral hinged lever and roller actuators. Each micro switch is wired in a normally open position. Normally closed switches are available on request, and easily modified by reversing standard factory wiring. Precise positioning of each micro switch is possible by a patented vernier mechanism found only on MDC gate valves. MPI connections are made via industry standard seven pin circular threaded connectors supplied with mating female cable connectors. All pneumatic valves include solenoids pre-wired through MPI connector box.



Air Control Solenoid Valve Option -03 and -09



MDC circular gate valves fitted with standard electropneumatic actuators are equipped with Humphrey 410 series 120VAC 50/60Hz air control solenoid valves. AC/DC power consumption is 4.0 watts. Optional 24VDC or 240VAC solenoid valves are available on request. All solenoid valves are fitted with DIN type connectors that conform to international standards. DIN connectors provide simplicity, convenience and fast, easy electrical installation. Solenoid valves come standard with push button/spring return manual override. Manual override is located at top of

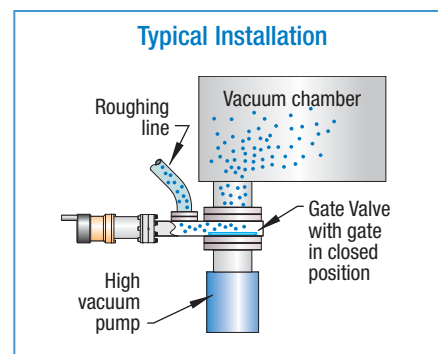
solenoid and identified by a prominent red push button. Solenoid valves are designed for use with compressed air from 0 to 100psig. Air should be clean and uncontaminated. When in doubt, install a filter with filtering capacity of 40 microns. Periodically remove and clean or replace filter element. All solenoid electrical leads are pre-wired to MPI box connector.

Caution: Check voltage label on solenoid before connecting power. Do not separate coil portion (black) from body (aluminum).

Roughing Port Option -04, -05 and -06

With the exception of the .625 inch gate valve, all valves can be fitted with roughing ports. Valves with Del-Seal™ CF and ANSI ASA port flanges are supplied with Del-Seal™ CF roughing port flanges. All Del-Seal™ CF roughing ports are tapped. Valves with metric port flanges have Del-Seal™ CF roughing port flanges with metric tapped holes. Gate valves fitted with ISO Kwik and ISO Large port flanges are supplied with ISO Kwik roughing port flanges. Roughing ports will be installed on the side opposite the

gate seal (the carriage side of the valve). Although the location of the roughing port does not affect its function, the positioning of the gate is important. A roughing port provides a path to a vacuum chamber through the gate valve body. With the gate closed, the valve body and chamber may be evacuated by a vacuum roughing pump.



Standard gate valve roughing ports include:

Option-04	1.5" to 3.0" valves	.75" port	1.33 Del-Seal™ CF or ISO-NW16 Kwik-Flange™
Option-05	4.0" to 8.0" valves	1.5" port	2.75 Del-Seal™ CF or ISO-NW40 Kwik-Flange™
Option-06	10" and 12" valves	2.0" port	3.37 Del-Seal™ CF or ISO-NW50 Kwik-Flange™

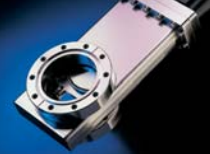
High Temperature Gate Seal Option -11

Gate valves are supplied standard with FKM / FPM fluoroelastomer gate seals. UHV series valves, which have metal sealed bonnet flanges, can be ordered with the high temperature Kalrez® compound 4079 gate seal gasket option. Kalrez® compound 4079 O-rings are suitable for vacuum bakeout to 250°C (with gate in an open position). Kalrez®

compound 4079 offers excellent chemical resistance and good mechanical properties. When compared to FKM/FPM elastomers, Kalrez® has lower outgassing characteristics for any given temperature from ambient to 250°C. Other special seal materials may be discussed with the MDC technical sales engineers.



- When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number

**Sealing**

Valves will seal against 15 psi differential atmospheric pressure in either direction.

Orientation

Valves can be installed in either a vertical or horizontal orientation.

Leak Tightness

Each valve is tested using a helium mass spectrometer leak detector calibrated for a minimum sensitivity of 2×10^{-10} Std. Atm. cc/sec of He. Internal welds are inspected for pits, cracks, and other irregularities which may cause virtual leaks.

Maintenance

Carriage and gate mechanism may be removed through the bonnet flange for seal replacement, cleaning or retrofitting without removing the valve body from the system.

Manual Actuation

Actuators are constructed with non-rising Acme threads for smooth and quick operation. Visual open position indicators are standard on all manual valves.

CIRCULAR GATE VALVES**Specifications****Material**

Body, Carriage & Gate	300 Series ss
Bellows	AM-350 ss
Air Cylinder	Teflon® coated Aluminum
Bolts	300 Series ss, silver plated

Gaskets

Bonnet UHV / HV	OFE Copper / FKM / FPM fluoroelastomer elastomer
Gate	FKM / FPM fluoroelastomer or optional Kalrez® 4079
Piston	elastomer FKM / FPM fluoroelastomer elastomer

Electropneumatic Actuator

Air Pressure	70 to 100 psig
Air Control Valve	410 Series Humphrey solenoid valve
Solenoid Power	120VAC, 50/60Hz, 4W
Power Loss	Valve closes
Position Indicators	Mechanical, vernier adjustable, hinged-roller type micro switches suitable for 5A, 120/240VAC

Vacuum

Range	1×10^{-11} Torr
Leak Test	2×10^{-10} cc/sec of He

Temperature Range Bakeability under vacuum in Open-Closed positions, with the following Bonnet-Gate seal combinations

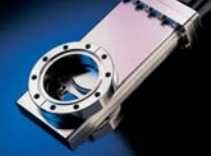
Series	Open	Closed	Bonnet	Gate
UHV	200°C	150°C	Copper	FKM/FPM
UHV	250°C	200°C	Copper	Kalrez®
HV	150°C	150°C	FKM/FPM	FKM/FPM
			FKM/FPM	

Weight

See table

Dimensions

See table



RECTANGULAR GATE VALVES

Specifications

Material

Body, Carriage & Gate	300 Series ss
Bellows	AM-350 ss
Air Cylinder	Teflon® coated Aluminum
Bolts	300 Series ss, silver plated

Gaskets

Bonnet	FKM / FPM fluoroelastomer elastomer
Gate	FKM / FPM fluoroelastomer elastomer
Piston	FKM / FPM fluoroelastomer elastomer

Electropneumatic Actuator

Air Pressure	70 to 100 psig
Air Control Valve	Herion, double impulse solenoid valve
Solenoid Power	24VDC
Power Loss	Valve remains in position during air or power failure
Position Indicators	Mechanical, vernier adjustable, hinged-roller type micro switches suitable for 5A, 120/240VAC

Vacuum

Range	1x10 ⁻⁸ Torr
Leak Test	2x10 ⁻¹⁰ cc/sec of He

Temperature Range

Bakeability under vacuum in Open-Closed positions, with the following Bonnet-Gate seal combination

Series	Open	Closed	Bonnet	Gate
HV	150°C	150°C	FKM/FPM	FKM/FPM

Weight

See table

Dimensions

See table

Sealing

Valves will seal against 15 psi differential atmospheric pressure in either direction.

Orientation

Valves can be installed in either a vertical or horizontal orientation.

Leak Tightness

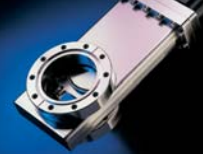
Each valve is tested using a helium mass spectrometer leak detector calibrated for a minimum sensitivity of 2x10⁻¹⁰ Std. Atm. cc/sec of He. Internal welds are inspected for pits, cracks, and other irregularities which may cause virtual leaks.

Maintenance

Carriage and gate mechanism may be removed through the bonnet flange for seal replacement, cleaning or retrofitting without removing the valve body from the system.

Manual Actuation

Actuators are constructed with non-rising Acme threads for smooth and quick operation. Visual open position indicators are standard on all manual valves.



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnets

HIGH VACUUM SERIES 150°C FKM / FPM fluoroelastomer O-Ring Sealed Bonnets

Features

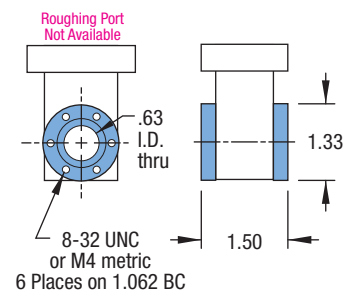
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS

Del-Seal™ CF



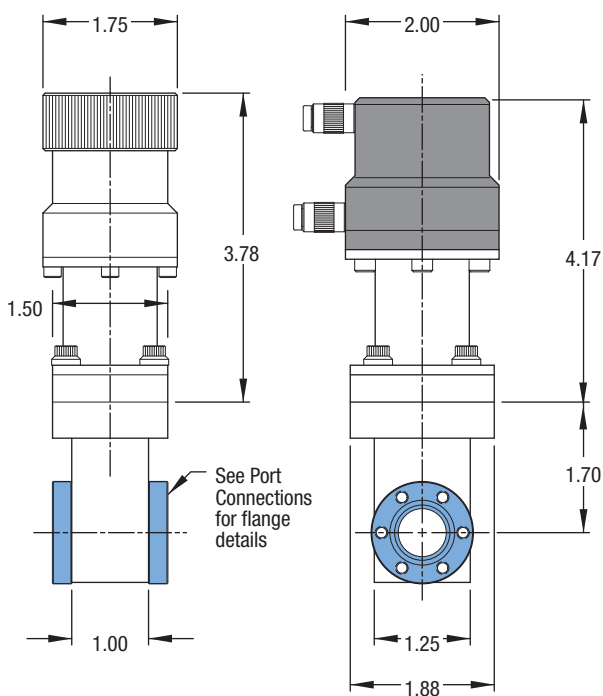
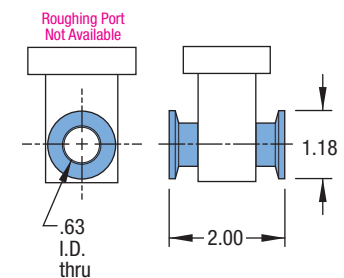
1-1/3" Del-Seal CF



Kwik-Flange™ KF



ISO NW16



Solenoid included (not shown)

Gate Valves

5/8" Ports



Section 2.1

ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNC	METAL	2	GV-625M	302000
MANUAL	DEL-SEAL	METRIC	METAL	2	E-GV-625M	302011
PNEUMATIC	DEL-SEAL	UNC	METAL	2	GV-625M-P	303000
PNEUMATIC	DEL-SEAL	METRIC	METAL	2	E-GV-625M-P	303011

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNC	FKM/FPM	2	GV-625V	300000
MANUAL	DEL-SEAL	METRIC	FKM/FPM	2	E-GV-625V	300011
MANUAL	ISO	-	FKM/FPM	2	KGV-625V	306000
PNEUMATIC	DEL-SEAL	UNC	FKM/FPM	2	GV-625V-P	301000
PNEUMATIC	DEL-SEAL	METRIC	FKM/FPM	2	E-GV-625V-P	301011
PNEUMATIC	ISO	-	FKM/FPM	2	KGV-625V-P	307000

¹ See page 166 for detailed bakeout specification

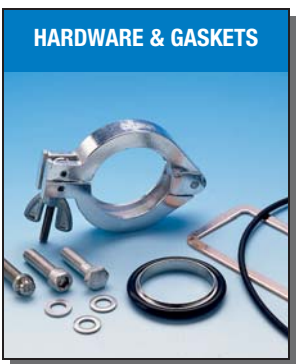
VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

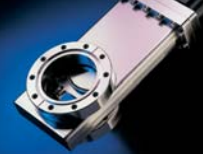
ACCESSORIES



GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL	FKM/FPM	1 ²	GVG-625	354000
GATE & BONNET SEAL	FKM/FPM & COPPER	1 ²	GVG-625M	355000

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
SOCKET HEAD	8-32 x 1/2"	DEL-SEAL	25	BA-050-SP	190055
METRIC SOCKET HEAD	M4, 12mm LONG	DEL-SEAL	25	M4-12-SP	190167
CLAMP	-	ISO	1	K075-C	701000
CENTERING RING	-	ISO	1	K075-CR	710000

² Each gasket kit contains one Bonnet and one Gate seal



GV-1500M

GV-1500M-P

ULTRAHIGH VACUUM SERIES
250°C Metal Sealed Bonnets

HIGH VACUUM SERIES
150°C FKM / FPM fluoroelastomer
O-Ring Sealed Bonnets

Features

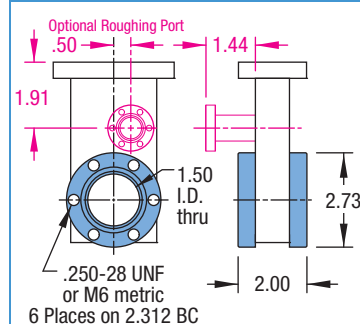
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS

Del-Seal™ CF



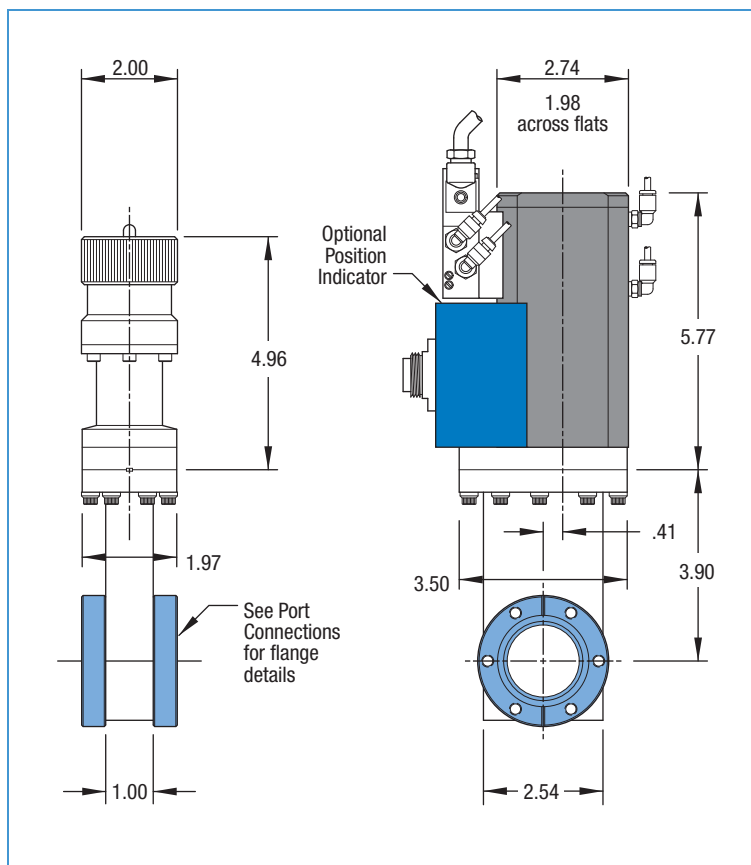
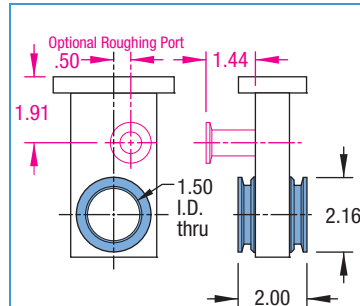
2-3/4" Del-Seal CF



Kwik-Flange™ KF



ISO NW40



Gate Valves

1-1/2" Ports



Section 2.1

ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	METAL	6	GV-1500M	302001
MANUAL	DEL-SEAL	METRIC	METAL	6	E-GV-1500M	302012
PNEUMATIC	DEL-SEAL	UNF	METAL	6	GV-1500M-P	303001
PNEUMATIC	DEL-SEAL	METRIC	METAL	6	E-GV-1500M-P	303012

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	FKM/FPM	6	GV-1500V	300001
MANUAL	DEL-SEAL	METRIC	FKM/FPM	6	E-GV-1500V	300012
MANUAL	ISO	-	FKM/FPM	5	KGV-1500V	306001
PNEUMATIC	DEL-SEAL	UNF	FKM/FPM	6	GV-1500V-P	301001
PNEUMATIC	DEL-SEAL	METRIC	FKM/FPM	6	E-GV-1500V-P	301012
PNEUMATIC	ISO	-	FKM/FPM	5	KGV-1500V-P	307001

¹ See page 166 for detailed bakeout specification

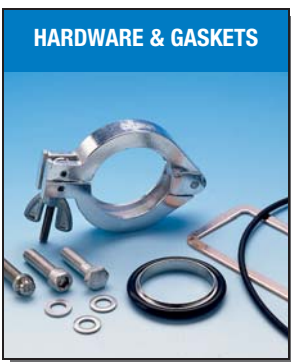
VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
3/4" ROUGHING PORT	-04
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

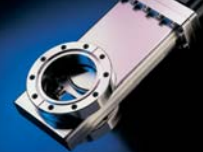
ACCESSORIES



GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL	FKM/FPM	1 ²	GVG-1500	354001
GATE & BONNET SEAL	FKM/FPM & COPPER	1 ²	GVG-1500M	355001

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.250-28 x 7/8"	DEL-SEAL	25	BA-085-12-SP	190057
METRIC HEX HEAD SET	M6, 20mm LONG	DEL-SEAL	25	M6-20-SP	190168
CLAMP	-	ISO	1	K150-C	701002
CENTERING RING	-	ISO	1	K150-CR	710002

² Each gasket kit contains one Bonnet and one Gate seal



ULTRAHIGH VACUUM SERIES

250°C Metal Sealed Bonnets

HIGH VACUUM SERIES

150°C FKM / FPM fluoroelastomer
O-Ring Sealed Bonnets

Features

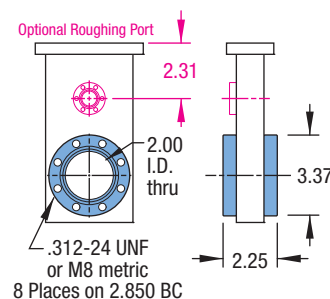
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS

Del-Seal™ CF



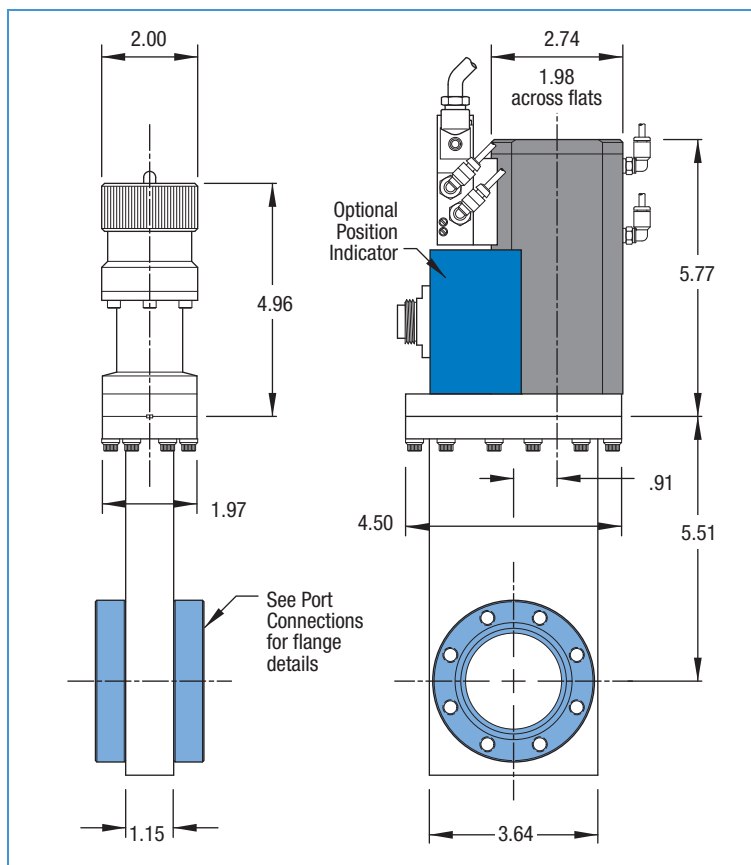
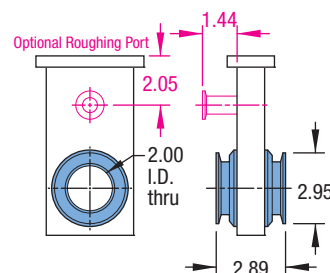
3-3/8" Del-Seal CF



Kwik-Flange™ KF



ISO NW50





ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	METAL	11	GV-2000M	302010
MANUAL	DEL-SEAL	METRIC	METAL	11	E-GV-2000M	302013
PNEUMATIC	DEL-SEAL	UNF	METAL	11	GV-2000M-P	303010
PNEUMATIC	DEL-SEAL	METRIC	METAL	11	E-GV-2000M-P	303013

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	FKM/FPM	11	GV-2000V	300010
MANUAL	DEL-SEAL	METRIC	FKM/FPM	11	E-GV-2000V	300013
MANUAL	ISO	-	FKM/FPM	7	KGV-2000V	306002
PNEUMATIC	DEL-SEAL	UNF	FKM/FPM	11	GV-2000V-P	301010
PNEUMATIC	DEL-SEAL	METRIC	FKM/FPM	11	E-GV-2000V-P	301013
PNEUMATIC	ISO	-	FKM/FPM	7	KGV-2000V-P	307002

¹ See page 166 for detailed bakeout specification

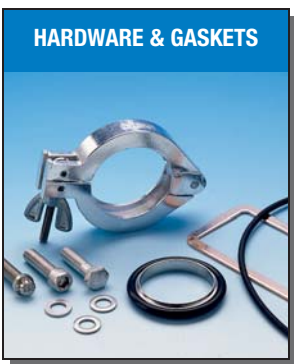
VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
3/4" ROUGHING PORT	-04
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

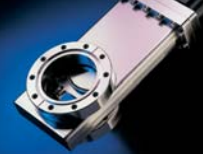
ACCESSORIES



GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL	FKM/FPM	1 ²	GVG-2000	354002
GATE & BONNET SEAL	FKM/FPM & COPPER	1 ²	GVG-2000M	355002

HARDWARE	THREAD LENGTH	USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 1"	DEL-SEAL	25	BA-100-12-SP	190146
METRIC HEX HEAD SET	M8, 25mm LONG	DEL-SEAL	25	M8-25-SP	190169
CLAMP	-	ISO	1	K200-C	701003
CENTERING RING	-	ISO	1	K200-CR	710003

² Each gasket kit contains one Bonnet and one Gate seal



ULTRAHIGH VACUUM SERIES

250°C Metal Sealed Bonnets

HIGH VACUUM SERIES

150°C FKM / FPM fluoroelastomer
O-Ring Sealed Bonnets

Features

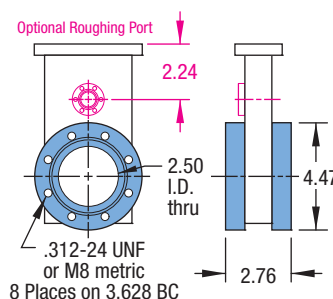
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS

Del-Seal™ CF



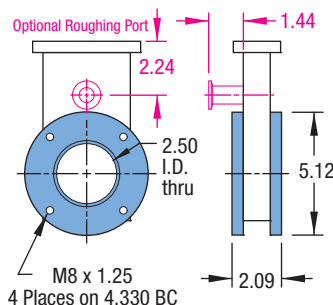
4-1/2" Del-Seal CF



Large-Flange™ LF



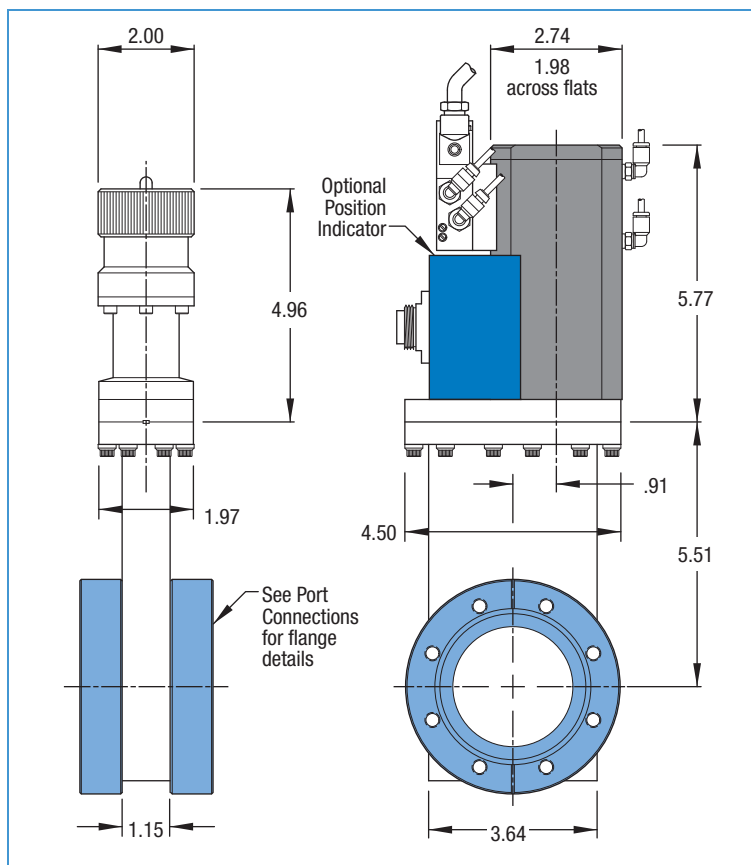
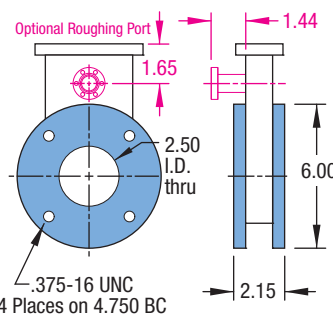
ISO NW63



ANSI ASA



ANSI ASA2



Gate Valves

2-1/2" Ports



Section 2.1

ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	METAL	11	GV-2500M	302002
MANUAL	DEL-SEAL	METRIC	METAL	11	E-GV-2500M	302014
PNEUMATIC	DEL-SEAL	UNF	METAL	11	GV-2500M-P	303002
PNEUMATIC	DEL-SEAL	METRIC	METAL	11	E-GV-2500M-P	303014

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	FKM/FPM	11	GV-2500V	300002
MANUAL	DEL-SEAL	METRIC	FKM/FPM	11	E-GV-2500V	300014
MANUAL	ISO	METRIC	FKM/FPM	10	LGV-2500V	306003
MANUAL	ASA	UNC	FKM/FPM	11	GV-2500V-ASA	304000
PNEUMATIC	DEL-SEAL	UNF	FKM/FPM	11	GV-2500V-P	301002
PNEUMATIC	DEL-SEAL	METRIC	FKM/FPM	11	E-GV-2500V-P	301014
PNEUMATIC	ISO	METRIC	FKM/FPM	10	LGV-2500V-P	307003
PNEUMATIC	ASA	UNC	FKM/FPM	11	GV-2500V-ASA-P	305000

¹ See page 166 for detailed bakeout specification

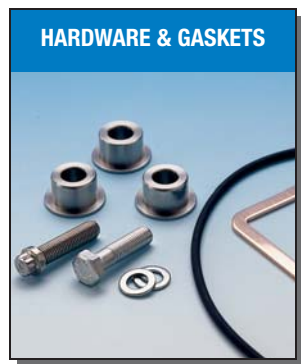
VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
3/4" ROUGHING PORT	-04
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

ACCESSORIES

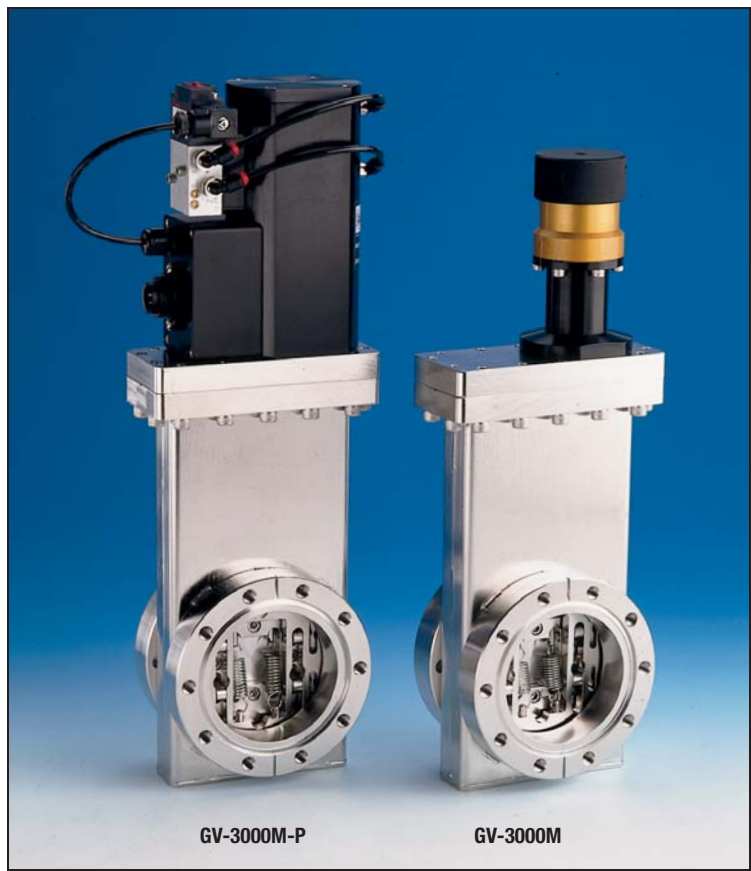
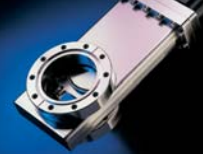


GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL	FKM/FPM	1 ²	GVG-2500	354002
GATE & BONNET SEAL	FKM/FPM & COPPER	1 ²	GVG-2500M	355002

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 1-1/4"	DEL-SEAL	25	BA-125-12-SP	190058
METRIC HEX HEAD SET	M8, 35mm LONG	DEL-SEAL	25	M8-35-SP	190170
METRIC HEX HEAD SET	M8, 25mm LONG	ISO	25	M8-25-SP	190169
HEX HEAD SET ³	.375-16 x 1"	ASA	8	GVBA-250-SP	190175
BOLT HOLE BUSHING	3/4" TO 3/8" REDUCER	ASA	8	GVBHB	190110

² Each gasket kit contains one Bonnet and one Gate seal

³ Includes bolt hole bushings



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnets

HIGH VACUUM SERIES 150°C FKM / FPM fluoroelastomer O-Ring Sealed Bonnets

Features

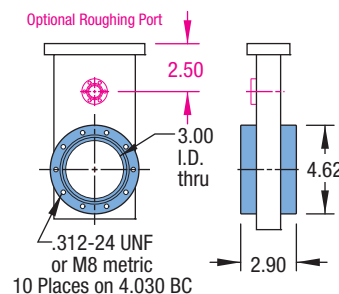
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS

Del-Seal™ CF



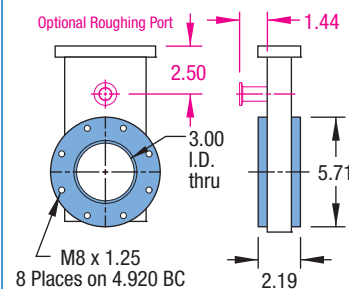
4-5/8" Del-Seal CF



Large-Flange™ LF



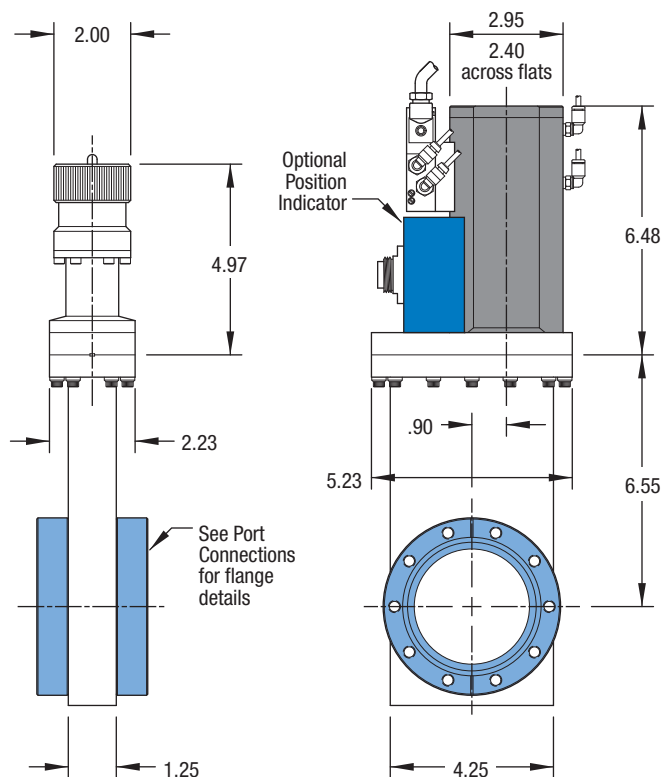
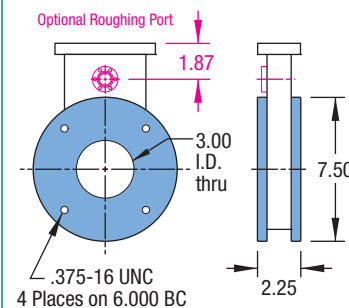
ISO NW80



ANSI ASA



ANSI ASA3



Gate Valves

3" Ports

Section 2.1



ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	METAL	22	GV-3000M	302003
MANUAL	DEL-SEAL	METRIC	METAL	22	E-GV-3000M	302015
PNEUMATIC	DEL-SEAL	UNF	METAL	22	GV-3000M-P	303003
PNEUMATIC	DEL-SEAL	METRIC	METAL	22	E-GV-3000M-P	303015

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	FKM/FPM	22	GV-3000V	300003
MANUAL	DEL-SEAL	METRIC	FKM/FPM	22	E-GV-3000V	300015
MANUAL	ISO	METRIC	FKM/FPM	20	LGV-3000V	306004
MANUAL	ASA	UNC	FKM/FPM	22	GV-3000V-ASA	304001
PNEUMATIC	DEL-SEAL	UNF	FKM/FPM	22	GV-3000V-P	301003
PNEUMATIC	DEL-SEAL	METRIC	FKM/FPM	22	E-GV-3000V-P	301015
PNEUMATIC	ISO	METRIC	FKM/FPM	20	LGV-3000V-P	307004
PNEUMATIC	ASA	UNC	FKM/FPM	22	GV-3000V-ASA-P	305001

¹ See page 166 for detailed bakeout specification

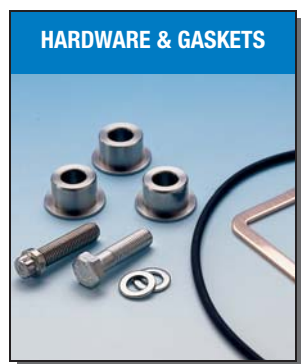
VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
3/4" ROUGHING PORT	-04
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

ACCESSORIES

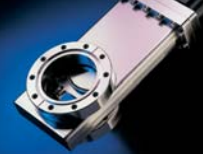


GASKET KIT		MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL		FKM/FPM	1 ²	GVG-3000	354003
GATE & BONNET SEAL		FKM/FPM & COPPER	1 ²	GVG-3000M	355003

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 1-1/4"	DEL-SEAL	25	BA-125-12-SP	190058
METRIC HEX HEAD SET	M8, 35mm LONG	DEL-SEAL	25	M8-35-SP	190170
METRIC HEX HEAD SET	M8, 25mm LONG	ISO	25	M8-25-SP	190169
HEX HEAD SET ³	.375-16 x 1"	ASA	8	GVBA-300-SP	190175
BOLT HOLE BUSHING	3/4" TO 3/8" REDUCER	ASA	8	GVBHB	190110

² Each gasket kit contains one Bonnet and one Gate seal

³ Includes bolt hole bushings



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnets

HIGH VACUUM SERIES 150°C FKM / FPM fluoroelastomer O-Ring Sealed Bonnets

Features

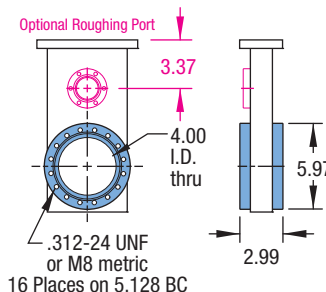
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS

Del-Seal™ CF



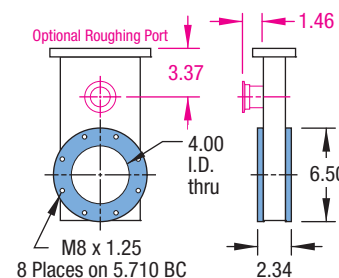
6" Del-Seal CF



Large-Flange™ LF



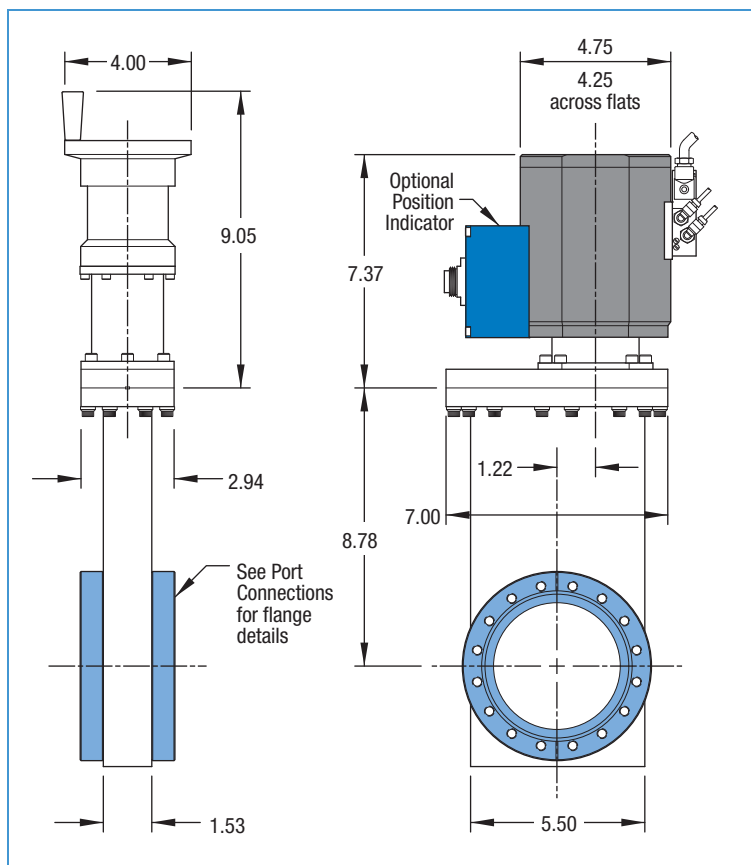
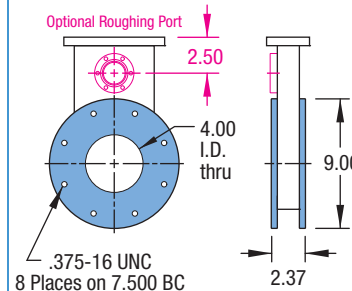
ISO NW100



ANSI ASA



ANSI ASA4





ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	METAL	25	GV-4000M	302004
MANUAL	DEL-SEAL	METRIC	METAL	25	E-GV-4000M	302016
PNEUMATIC	DEL-SEAL	UNF	METAL	25	GV-4000M-P	303004
PNEUMATIC	DEL-SEAL	METRIC	METAL	25	E-GV-4000M-P	303016

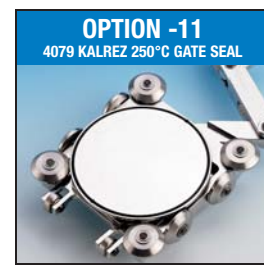
HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	FKM/FPM	25	GV-4000V	300004
MANUAL	DEL-SEAL	METRIC	FKM/FPM	25	E-GV-4000V	300016
MANUAL	ISO	METRIC	FKM/FPM	25	LGV-4000V	306005
MANUAL	ASA	UNC	FKM/FPM	25	GV-4000V-ASA	304002
PNEUMATIC	DEL-SEAL	UNF	FKM/FPM	25	GV-4000V-P	301004
PNEUMATIC	DEL-SEAL	METRIC	FKM/FPM	25	E-GV-4000V-P	301016
PNEUMATIC	ISO	METRIC	FKM/FPM	25	LGV-4000V-P	307005
PNEUMATIC	ASA	UNC	FKM/FPM	25	GV-4000V-ASA-P	305002

¹ See page 166 for detailed bakeout specification

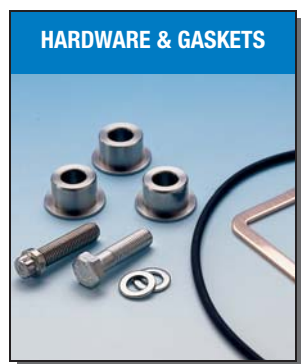
VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
1-1/2" ROUGHING PORT	-05
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

ACCESSORIES

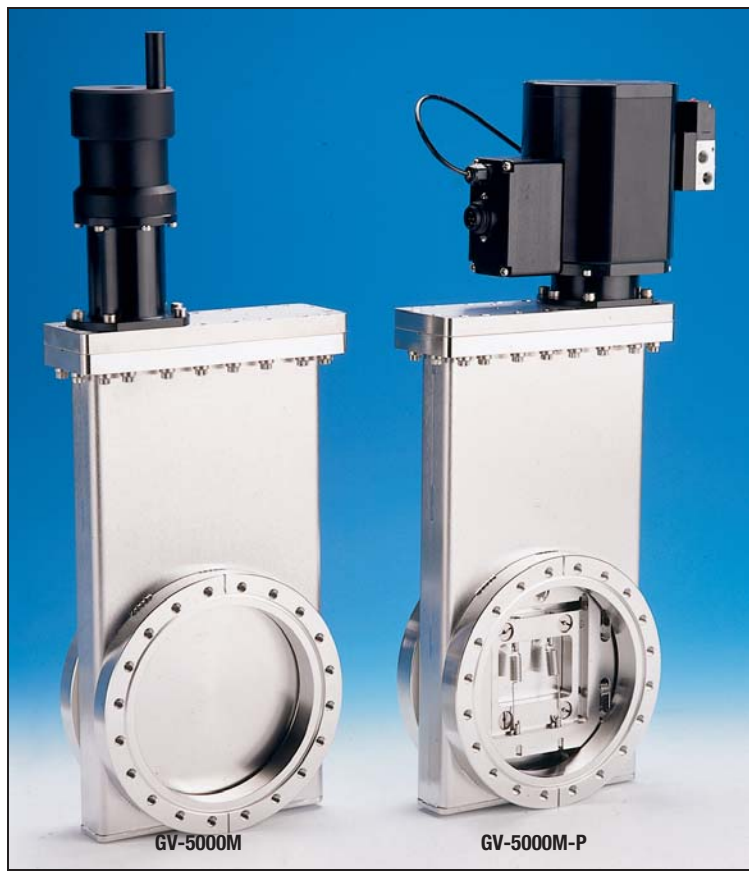
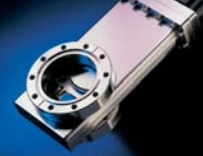


GASKET KIT		MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL		FKM/FPM	1 ²	GVG-4000	354004
GATE & BONNET SEAL		FKM/FPM & COPPER	1 ²	GVG-4000M	355004

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 1-1/4"	DEL-SEAL	25	BA-125-12-SP	190058
METRIC HEX HEAD SET	M8, 35mm LONG	DEL-SEAL	25	M8-35-SP	190170
METRIC HEX HEAD SET	M8, 25mm LONG	ISO	25	M8-25-SP	190169
HEX HEAD SET ³	.375-16 x 1"	ASA	16	GVBA-400-SP	190176
BOLT HOLE BUSHING	3/4" TO 3/8" REDUCER	ASA	8	GVBHB	190110

² Each gasket kit contains one Bonnet and one Gate seal

³ Includes bolt hole bushings



ULTRAHIGH VACUUM SERIES
250°C Metal Sealed Bonnets

HIGH VACUUM SERIES
150°C FKM / FPM fluoroelastomer
O-Ring Sealed Bonnets

Features

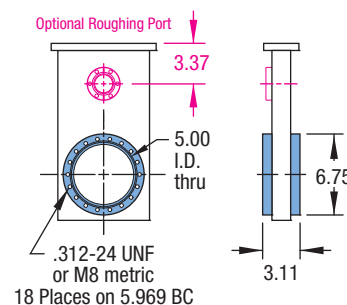
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS

Del-Seal™ CF



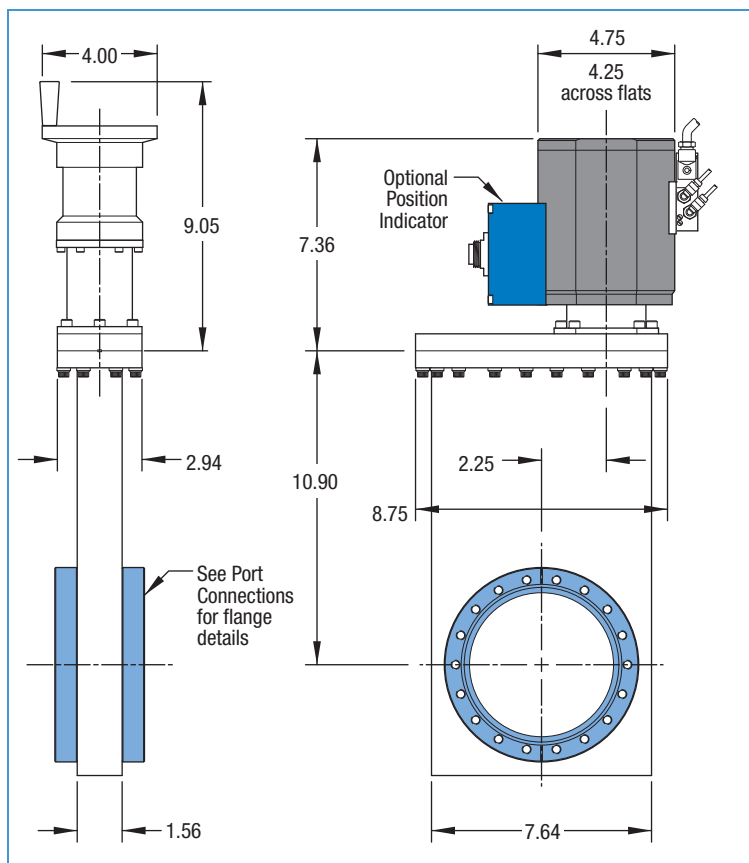
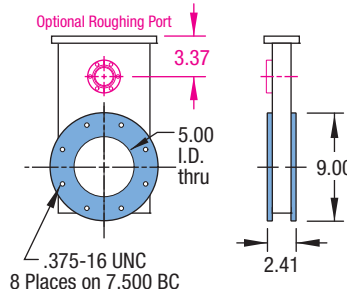
6-3/4" Del-Seal CF



ANSI ASA



ANSI ASA4



ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	METAL	35	GV-5000M	302005
MANUAL	DEL-SEAL	METRIC	METAL	35	E-GV-5000M	302017
PNEUMATIC	DEL-SEAL	UNF	METAL	36	GV-5000M-P	303005
PNEUMATIC	DEL-SEAL	METRIC	METAL	35	E-GV-5000M-P	303017

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	FKM/FPM	35	GV-5000V	300005
MANUAL	DEL-SEAL	METRIC	FKM/FPM	35	E-GV-5000V	300017
MANUAL	ASA	UNC	FKM/FPM	35	GV-5000V-ASA	304003
PNEUMATIC	DEL-SEAL	UNF	FKM/FPM	35	GV-5000V-P	301005
PNEUMATIC	DEL-SEAL	METRIC	FKM/FPM	35	E-GV-5000V-P	301017
PNEUMATIC	ASA	UNC	FKM/FPM	35	GV-5000V-ASA-P	305003

¹ See page 166 for detailed bakeout specification

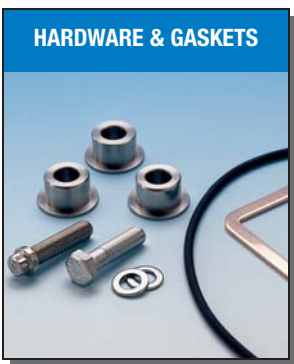
VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
1-1/2" ROUGHING PORT	-05
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

ACCESSORIES

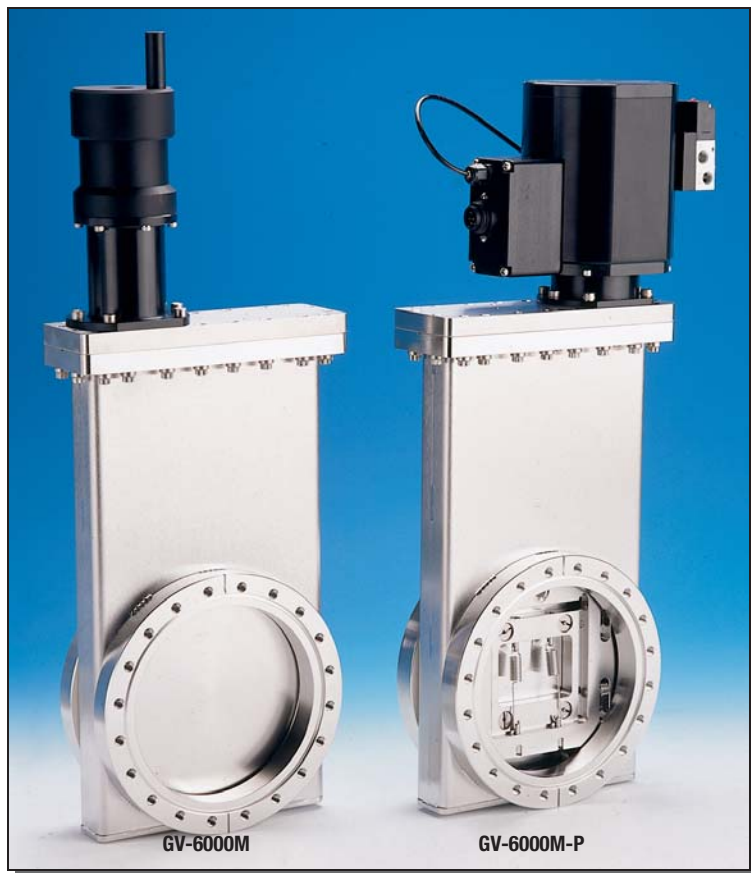
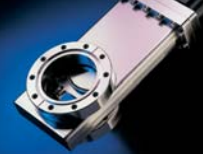


GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL	FKM/FPM	1 ²	GVG-5000	354006
GATE & BONNET SEAL	FKM/FPM & COPPER	1 ²	GVG-5000M	355006

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 1-1/4"	DEL-SEAL	25	BA-125-12-SP	190058
METRIC HEX HEAD SET	M8, 35mm LONG	DEL-SEAL	25	M8-35-SP	190170
HEX HEAD SET ³	.375-16 x 1"	ASA	16	GVBA-500-SP	190176
BOLT HOLE BUSHING	3/4" TO 3/8" REDUCER	ASA	8	GVBBH	190110

² Each gasket kit contains one Bonnet and one Gate seal

³ Includes bolt hole bushings



ULTRAHIGH VACUUM SERIES

250°C Metal Sealed Bonnets

HIGH VACUUM SERIES

150°C FKM / FPM fluoroelastomer O-Ring Sealed Bonnets

Features

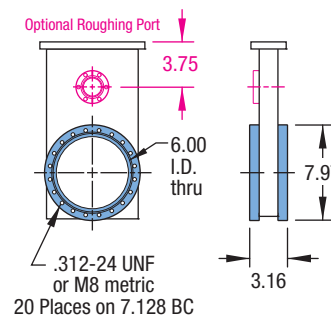
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS

Del-Seal™ CF



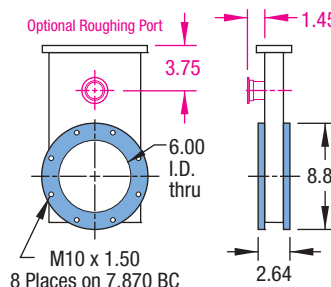
8" Del-Seal CF



Large-Flange™ LF



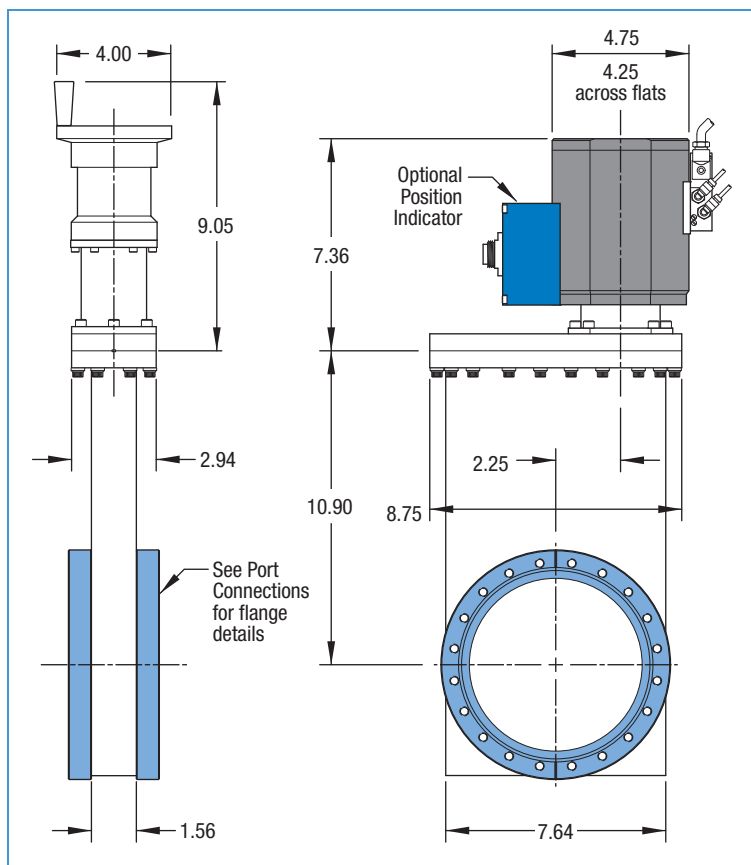
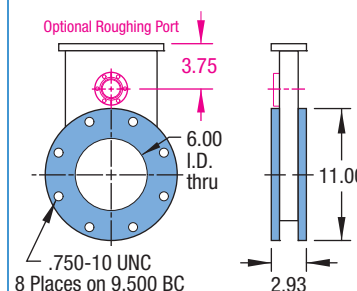
ISO NW160



ANSI ASA



ANSI ASA6





ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	METAL	37	GV-6000M	302006
MANUAL	DEL-SEAL	METRIC	METAL	37	E-GV-6000M	302018
PNEUMATIC	DEL-SEAL	UNF	METAL	37	GV-6000M-P	303006
PNEUMATIC	DEL-SEAL	METRIC	METAL	37	E-GV-6000M-P	303018

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	FKM/FPM	37	GV-6000V	300006
MANUAL	DEL-SEAL	METRIC	FKM/FPM	37	E-GV-6000V	300018
MANUAL	ISO	METRIC	FKM/FPM	35	LGV-6000V	306006
MANUAL	ASA	UNC	FKM/FPM	37	GV-6000V-ASA	304004
PNEUMATIC	DEL-SEAL	UNF	FKM/FPM	37	GV-6000V-P	301006
PNEUMATIC	DEL-SEAL	METRIC	FKM/FPM	37	E-GV-6000V-P	301018
PNEUMATIC	ISO	METRIC	FKM/FPM	35	LGV-6000V-P	307006
PNEUMATIC	ASA	UNC	FKM/FPM	37	GV-6000V-ASA-P	305004

¹ See page 166 for detailed bakeout specification

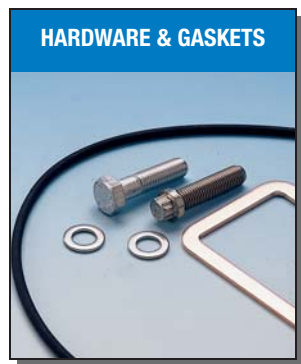
VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
1-1/2" ROUGHING PORT	-05
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

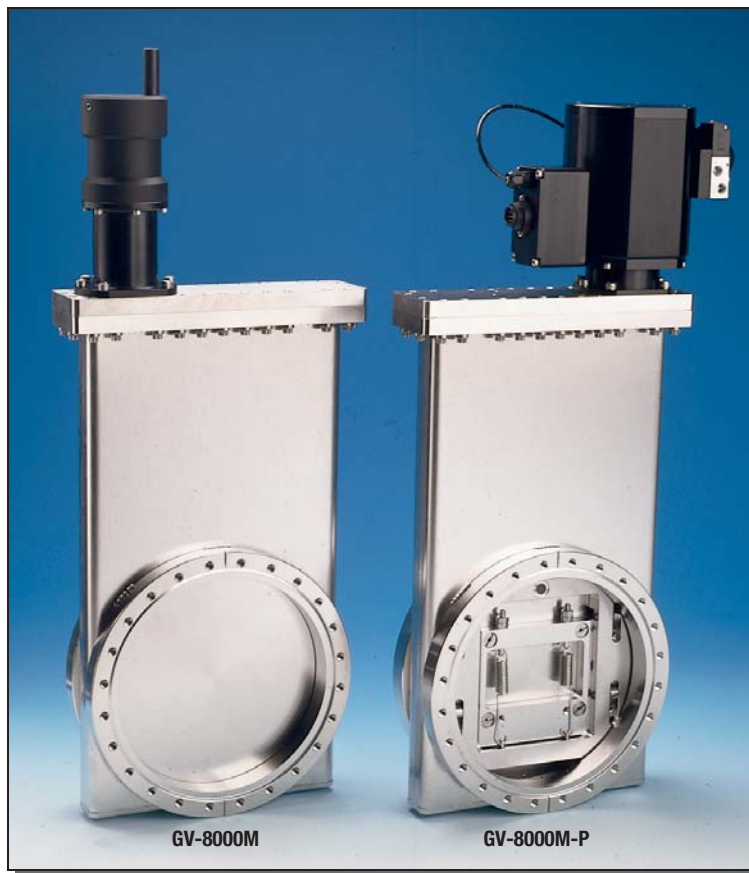
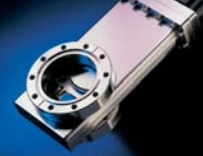
ACCESSORIES



GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL	FKM/FPM	1 ²	GVG-6000	354006
GATE & BONNET SEAL	FKM/FPM & COPPER	1 ²	GVG-6000M	355006

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 1-3/4"	DEL-SEAL	25	BA-600-12-SP	190059
METRIC HEX HEAD SET	M8, 40mm LONG	DEL-SEAL	25	M8-40-SP	190171
METRIC HEX HEAD SET	M10, 30mm LONG	ISO	25	M10-30-SP	190172
HEX HEAD SET	.750-10 x 1-1/2"	ASA	16	GVBA-600-SP	190177

² Each gasket kit contains one Bonnet and one Gate seal



ULTRAHIGH VACUUM SERIES

250°C Metal Sealed Bonnets

HIGH VACUUM SERIES

150°C FKM / FPM fluoroelastomer
O-Ring Sealed Bonnets

Features

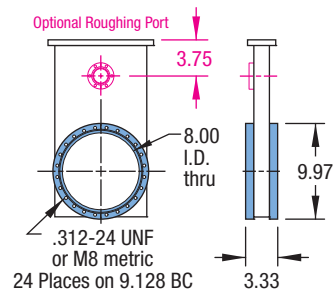
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS

Del-Seal™ CF



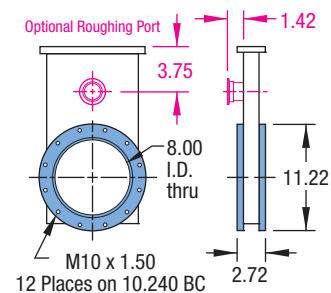
10" Del-Seal CF



Large-Flange™ LF



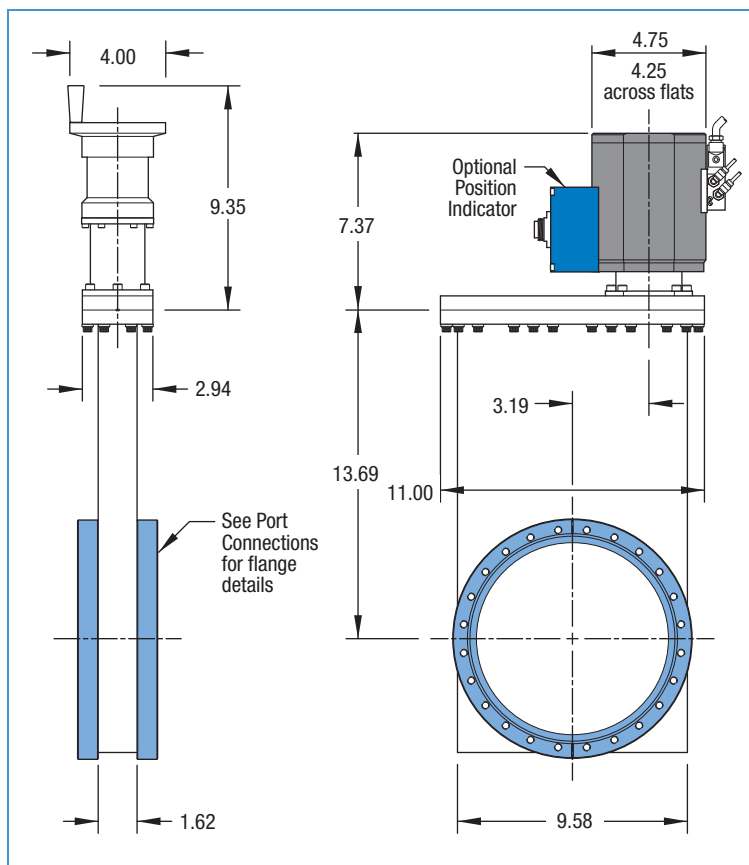
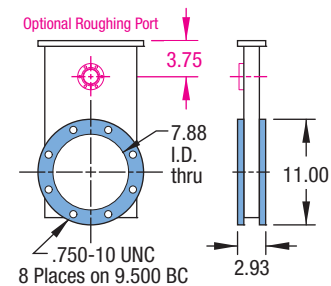
ISO NW200



ANSI ASA



ANSI ASA6



ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	METAL	55	GV-8000M	302007
MANUAL	DEL-SEAL	METRIC	METAL	55	E-GV-8000M	302019
PNEUMATIC	DEL-SEAL	UNF	METAL	55	GV-8000M-P	303007
PNEUMATIC	DEL-SEAL	METRIC	METAL	55	E-GV-8000M-P	303019

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	FKM/FPM	55	GV-8000V	300007
MANUAL	DEL-SEAL	METRIC	FKM/FPM	55	E-GV-8000V	300019
MANUAL	ISO	METRIC	FKM/FPM	50	LGV-8000V	306007
MANUAL	ASA	UNC	FKM/FPM	55	GV-8000V-ASA	304005
PNEUMATIC	DEL-SEAL	UNF	FKM/FPM	55	GV-8000V-P	301007
PNEUMATIC	DEL-SEAL	METRIC	FKM/FPM	55	E-GV-8000V-P	301019
PNEUMATIC	ISO	METRIC	FKM/FPM	50	LGV-8000V-P	307007
PNEUMATIC	ASA	UNC	FKM/FPM	55	GV-8000V-ASA-P	305005

¹ See page 166 for detailed bakeout specification

VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
1-1/2" ROUGHING PORT	-05
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

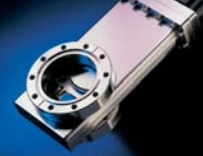
ACCESSORIES



GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL	FKM/FPM	1 ²	GVG-8000	354007
GATE & BONNET SEAL	FKM/FPM & COPPER	1 ²	GVG-8000M	355007

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 X 1-3/4"	DEL-SEAL	25	BA-600-12-SP	190059
METRIC HEX HEAD SET	M8, 40mm LONG	DEL-SEAL	25	M8-40-SP	190171
METRIC HEX HEAD SET	M10, 30mm LONG	ISO	25	M10-30-SP	190172
HEX HEAD SET	.750-10 X 1-1/2"	ASA	16	GVBA-800-SP	190177

² Each gasket kit contains one Bonnet and one Gate seal



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnets

HIGH VACUUM SERIES 150°C FKM / FPM fluoroelastomer O-Ring Sealed Bonnets

Features

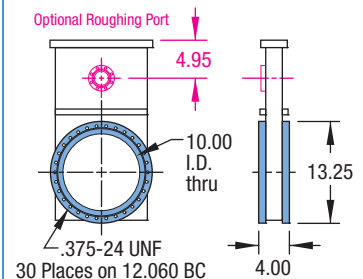
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS

Del-Seal™ CF



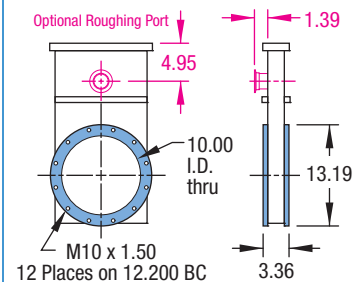
13-1/4" Del-Seal CF



Large-Flange™ LF



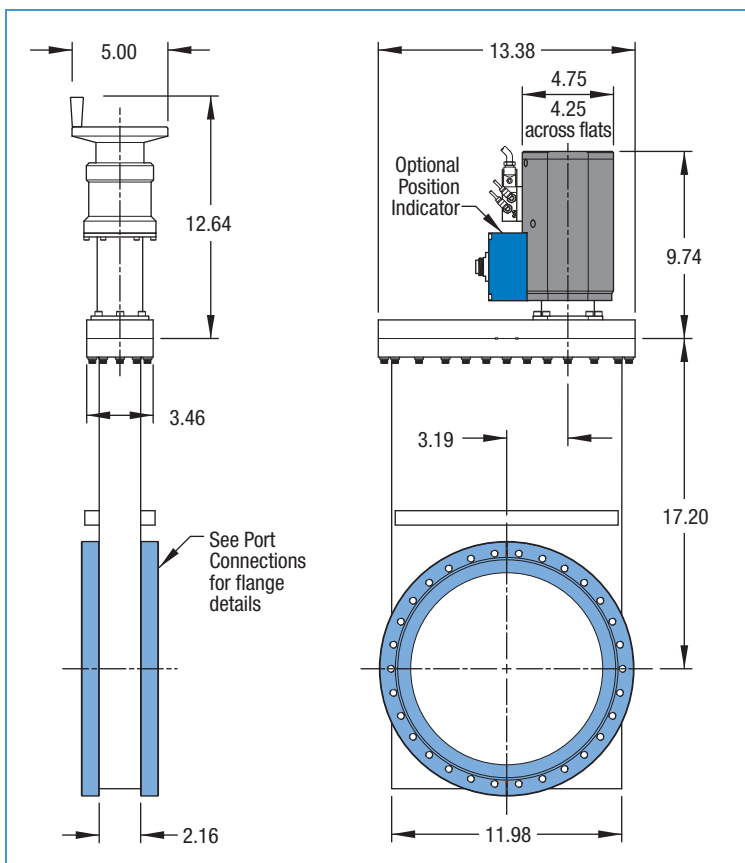
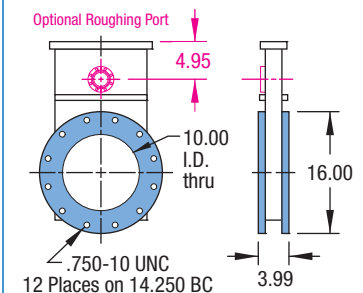
ISO NW250



ANSI ASA



ANSI ASA10



Gate Valves

10" Ports



Section 2.1

ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	METAL	110	GV-10000M	302008
PNEUMATIC	DEL-SEAL	UNF	METAL	110	GV-10000M-P	303008

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	FKM/FPM	110	GV-10000V	300008
MANUAL	ISO	METRIC	FKM/FPM	105	LGV-10000V	306008
MANUAL	ASA	UNC	FKM/FPM	110	GV-10000V-ASA	304006
PNEUMATIC	DEL-SEAL	UNF	FKM/FPM	110	GV-10000V-P	301008
PNEUMATIC	ISO	METRIC	FKM/FPM	105	LGV-10000V-P	307008
PNEUMATIC	ASA	UNC	FKM/FPM	110	GV-10000V-ASA-P	305006

¹ See page 166 for detailed bakeout specification

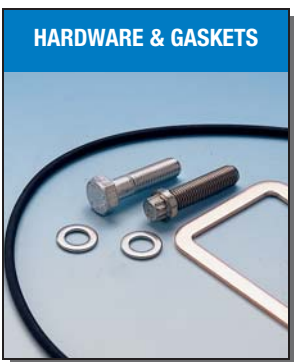
VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
2" ROUGHING PORT	-06
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

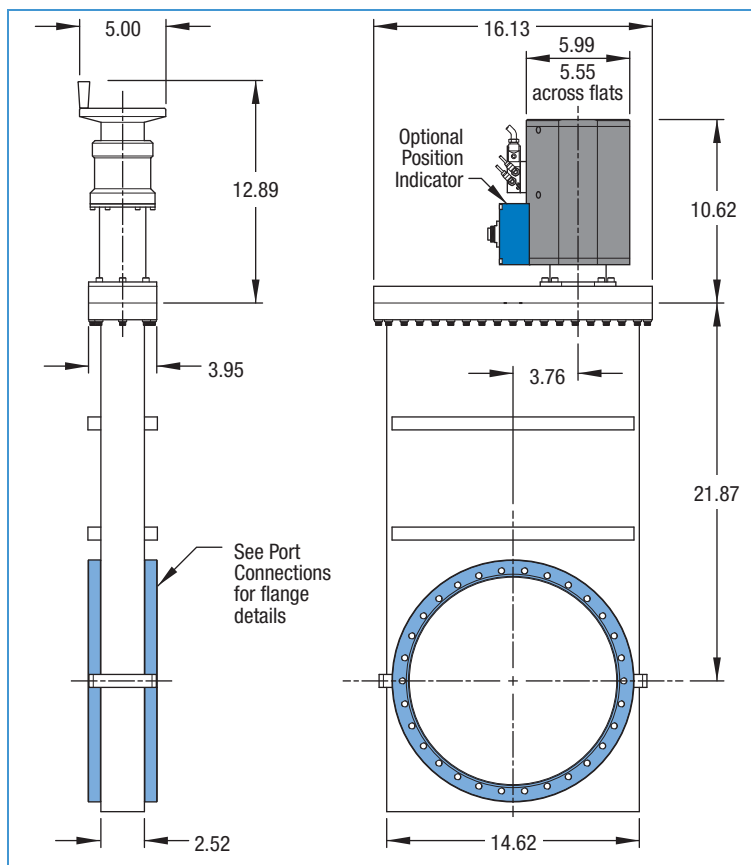
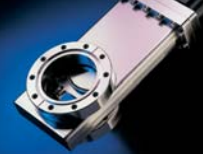
ACCESSORIES



GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL	FKM/FPM	1 ²	GVG-10000	354008
GATE & BONNET SEAL	FKM/FPM & COPPER	1 ²	GVG-10000M	355008

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
HEX HEAD SET	.375-24 x 1-3/4"	DEL-SEAL	30	BA-1003-SP	190506
METRIC HEX HEAD SET	M10, 30mm LONG	ISO	25	M10-30-SP	190172
HEX HEAD SET	.750-10 x 1-3/4"	ASA	24	GVBA-1000-SP	190178

² Each gasket kit contains one Bonnet and one Gate seal



ULTRAHIGH VACUUM SERIES

250°C Metal Sealed Bonnets

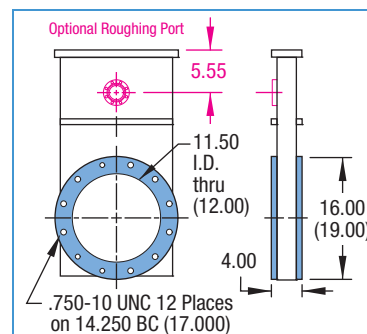
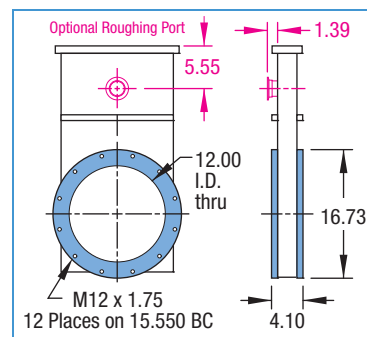
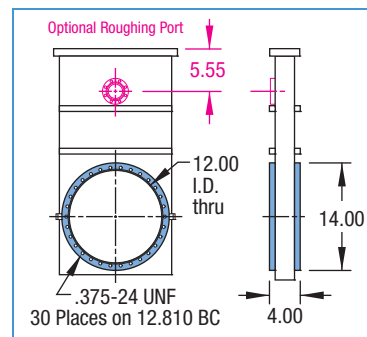
HIGH VACUUM SERIES

150°C FKM / FPM fluoroelastomer O-Ring Sealed Bonnets

Features

- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation

PORT CONNECTIONS



Gate Valves

12" Ports

Section 2.1

ULTRAHIGH VACUUM SERIES

METAL SEAL BONNET 250°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	METAL	153	GV-12000M	302009
PNEUMATIC	DEL-SEAL	UNF	METAL	153	GV-12000M-P	303009

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET 150°C¹

ACTUATOR	PORT FLANGE	FLANGE THREAD	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	DEL-SEAL	UNF	FKM/FPM	153	GV-12000V	300009
MANUAL	ISO	METRIC	FKM/FPM	148	LGV-12000V	306009
MANUAL	ASA10	UNC	FKM/FPM	153	GV-12000V-ASA	304007
MANUAL	ASA12	UNC	FKM/FPM	200	GV-12001V-ASA	304008
PNEUMATIC	DEL-SEAL	UNF	FKM/FPM	153	GV-12000V-P	301009
PNEUMATIC	ISO	METRIC	FKM/FPM	148	LGV-12000V-P	307009
PNEUMATIC	ASA10	UNC	FKM/FPM	153	GV-12000V-ASA-P	305007
PNEUMATIC	ASA12	UNC	FKM/FPM	200	GV-12001V-ASA-P	305008

¹ See page 166 for detailed bakeout specification

VALVE OPTIONS



DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
2" ROUGHING PORT	-06
KALREZ HIGH TEMP O-RING	-11

When ordering Gate Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Gate Valve Part Number listed above. For example 303016-09
Detailed descriptions of each option begin on page 164.

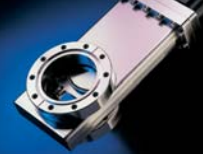
ACCESSORIES



GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL	FKM/FPM	1 ²	GVG-12000	354009
GATE & BONNET SEAL	FKM/FPM & COPPER	1 ²	GVG-12000M	355009

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
HEX HEAD SET	.375-24 x 1-3/4"	DEL-SEAL	30	BA-1003-SP	190506
METRIC HEX HEAD SET	M12, 40mm LONG	ISO	25	M12-40-SP	190173
HEX HEAD SET	.750-10 x 1-3/4"	ASA	24	GVBA-1200-SP	190178

² Each gasket kit contains one Bonnet and one Gate seal



HIGH VACUUM SERIES 150°C FKM / FPM fluoroelastomer O-Ring Sealed Bonnets

Features

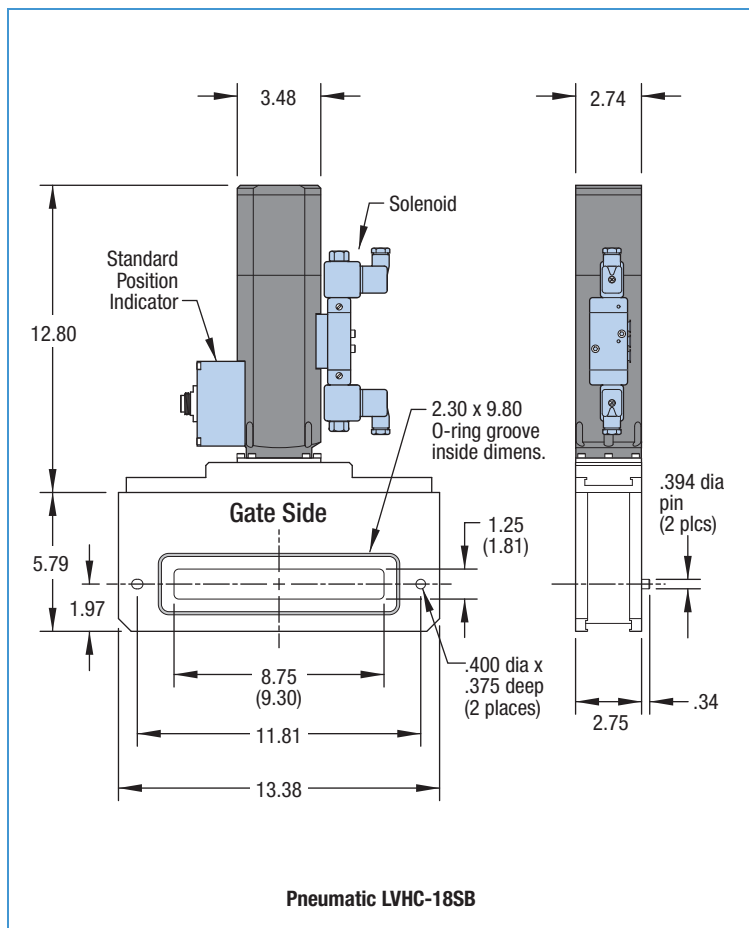
- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Electropneumatic Operation
- Mechanical Position Indicator
- Patented Uni-Loc™ Locking Mechanism
- Double Impulse 24VDC Air Control Solenoid

SEMI short for 'Semiconductor Equipment & Materials International' developed the 'Modular Equipment Standards Committee', better known as MESC, to establish global interchangeability and modularity between products from the numerous sources in the semiconductor manufacturing equipment and components industry.

MDC LVHC series rectangular gate valves meet or exceed all applicable MESC standards. LVHC valves incorporate a patented one piece gate and carriage design that virtually eliminates vibration and particle generation. O-ring scuffing and wear are non-existent because of a floating driver bar design. The one piece gate and carriage can be removed through the valve's bonnet flange for gate seal replacement, cleaning, etc., without disassembling the valve body from the system.

LVHC valves are available in either 2.75" (70mm) or 1.97" (50mm) flange-to-flange thicknesses, with rectangular ports of 1.25 x 8.75" (32 x 222mm) or 1.81 x 9.30" (46 x 236mm) dimensions. These valves are designed for use in high vacuum load-lock systems used in semiconductor processing, where low vibration and low particle generation are imperative. The valves' low outgassing characteristics can be attributed to a fusion welded 300 series stainless steel body, welded AM-350 stainless steel nesting bellows as well as small cross section O-rings and the elimination of blind internal cavities. Custom design valves are available on request.

Pneumatic actuators are fitted with mechanical position indicators which indicate fully open and fully closed positions. This MPI system consists of two single pole, double throw micro switches fitted with integral hinged lever and roller actuators. Each micro switch is wired in a normally open position via a seven pin circular threaded connector. Mating female cable connectors are included.

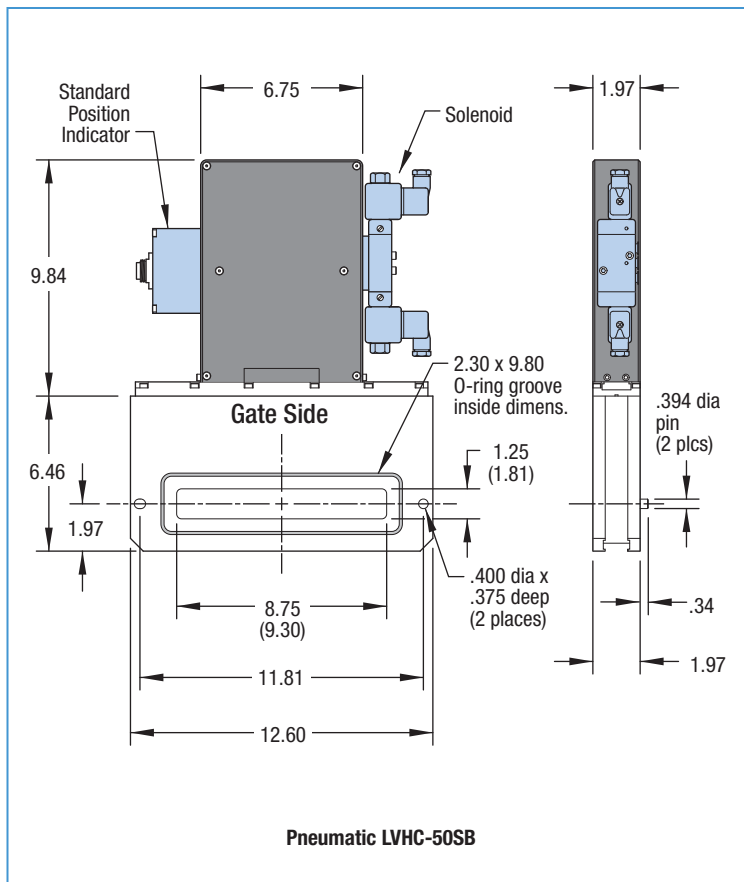


Normally closed switch wiring is available on request. Precise positioning of micro switches is made possible by a patented vernier adjustment mechanism only available on MDC gate valves.

Pneumatic actuators are equipped with dual impulse Herion 24 VDC air control solenoid valves. All solenoid valves are fitted with DIN type connectors that conform to international standards. DIN connectors provide simplicity, convenience and fast, easy electrical installation. Solenoid valves are designed for use with compressed air from 0 to 125psig. Air should be clean and uncontaminated. When in doubt, install a filter with filtering capacity of 40 microns. Periodically remove and clean or replace filter element.

Additional Features

- SEMI / MESC port flanges for use with claw type fasteners
- 1.25 x 8.75" (32 x 222mm) and 1.81 x 9.30" (46 x 236mm) inch rectangular port apertures
- 2.75" (70mm) or 1.97" (50mm) flange-to-flange body thickness
- FKM / FPM fluoroelastomer elastomer bonnet and gate seals
- Welded bellows actuator seal
- TIG welded internal body joints
- Electropolished interior and exterior surfaces
- Low vibration and particle generation
- Dry film lubricated bearings



SEMI / MESC

HIGH VACUUM SERIES

FKM / FPM SEAL BONNET

150°C¹

ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
PNEUMATIC	1.25 x 8.75	FKM/FPM	41	LVHC-18SB	330001
PNEUMATIC	1.25 x 9.30	FKM/FPM	41	LVHC-18LB	330004
PNEUMATIC	1.81 x 8.75	FKM/FPM	41	LVHC-50SB	330005
PNEUMATIC	1.81 x 9.30	FKM/FPM	41	LVHC-50LB	330006

¹ See page 167 for detailed bakeout specification

ACCESSORIES

HARDWARE & GASKETS

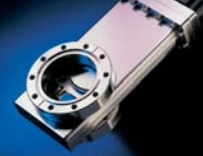


GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
GATE & BONNET SEAL	FKM/FPM	1 ²	LVHCG-18-SB/LB	330101
GATE & BONNET SEAL	FKM/FPM	1 ²	LVHCG-50-SB/LB	330102
BODY FLANGE SEAL	FKM/FPM	2	LVHCG-1850B	330103

HARDWARE ³	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
SINGLE CLAW CLAMP KIT	M8, 35mm LONG	MESC	4	LVHC-SCK	801009
DOUBLE CLAW CLAMP KIT	M8, 35mm LONG	MESC	4	LVHC-DCK	802009

² Each gasket kit contains one Bonnet and one Gate seal

³ Recommended use of 8 to 12 clamps per side



HIGH VACUUM SERIES 150°C FKM / FPM fluoroelastomer O-Ring Sealed Bonnets

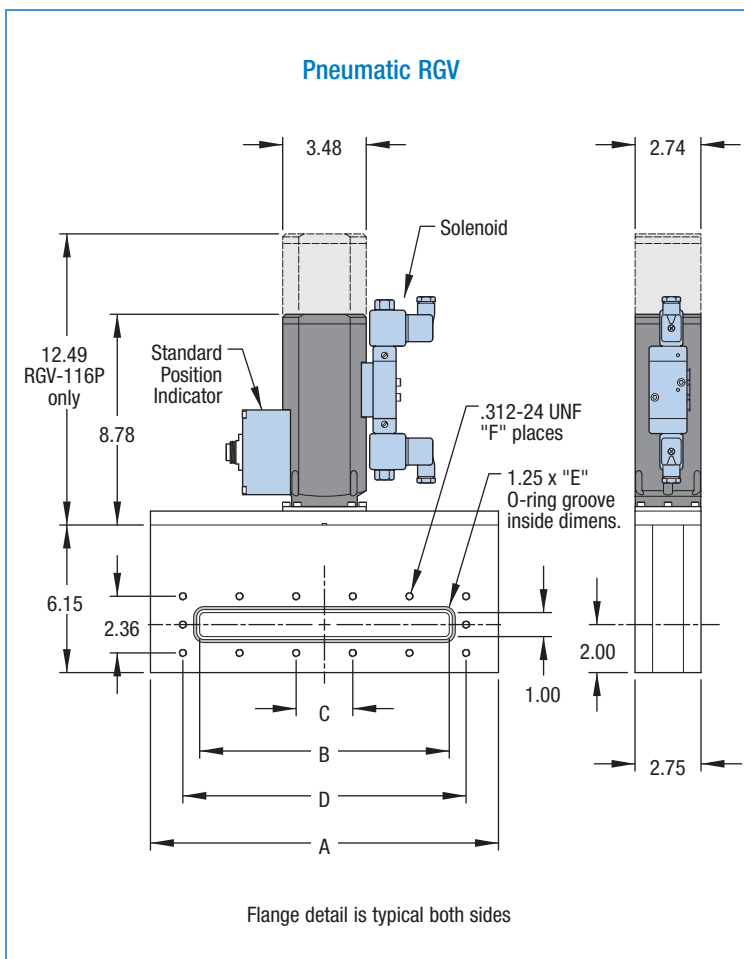
Features

- FKM / FPM fluoroelastomer O-Ring Sealed Gates
- Stainless Steel Construction
- Manual or Electropneumatic Operation
- Mechanical Position Indicator
- Patented C-Loc® Locking Mechanism
- Double Impulse 24VDC Air Control Solenoid

RGV stainless steel vacuum gate valves incorporate patented C-Loc® gate valve locking technology. No contact is made between the valve body and the locking mechanism, a feature which markedly decreases vibration and insures smooth valve operation. RGV valves are designed for use in high vacuum load-lock systems used in semiconductor processing. Low outgassing characteristics can be attributed to fusion welded 300 series stainless steel body and AM-350 stainless steel nesting bellows, small cross-section O-rings and the elimination of blind internal cavities.

MDC RGV gate valves are offered in four standard sizes ranging from 1 x 6.3" (25 x 160mm) to 1 x 16.5" (25 x 420mm) rectangular port dimensions. Flange-to-flange body thickness is 2.75" (70mm). Gate valve actuators are available in both manual and electropneumatic configurations. The gate and carriage can be removed through the valve's bonnet flange for gate seal replacement, cleaning, etc., without disassembling the valve body from the system. Custom design valves are available on request.

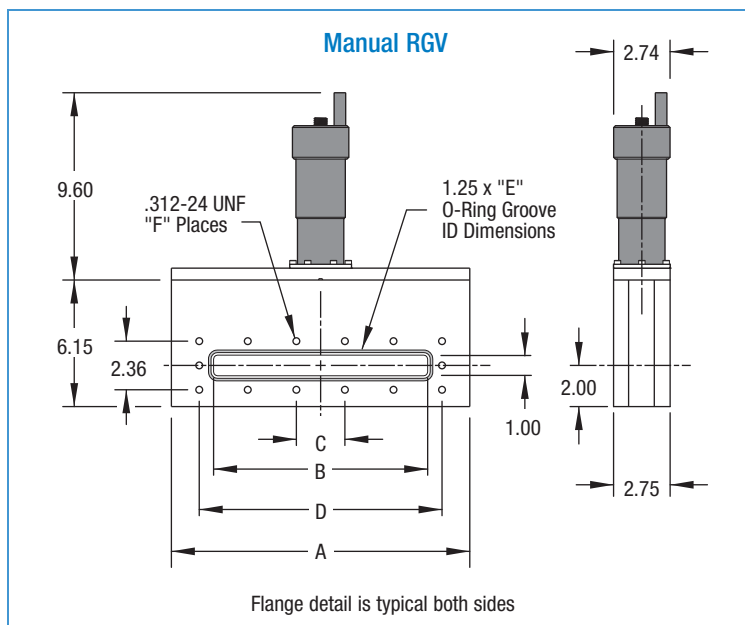
Pneumatic actuators are fitted with mechanical position indicators which indicate fully open and fully closed positions. This MPI system consists of two single pole, double throw micro switches fitted with integral hinged lever and roller actuators.





Each micro switch is wired in a normally open position via a seven pin circular threaded connector. Mating female cable connectors are included. Normally closed switch wiring is available on request. Precise positioning of micro switches is made possible by a patented vernier adjustment mechanism only available on MDC gate valves.

Pneumatic actuators are equipped with dual impulse Herion 24 VDC air control solenoid valves. All solenoid valves are fitted with DIN type connectors that conform to international standards. DIN connectors provide simplicity, convenience and fast, easy electrical installation. Solenoid valves are designed for use with compressed air from 0 to 125psig. Air should be clean and uncontaminated. When in doubt, install a filter with filtering capacity of 40 microns. Periodically remove and clean or replace filter element.



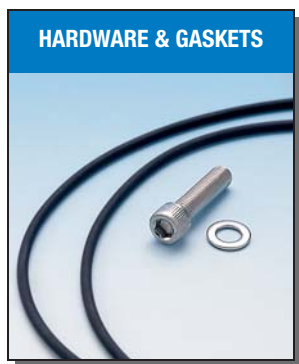
HIGH VACUUM SERIES 150°C¹

ACTUATOR	A	B	C	D	E	F	PORT ² FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
MANUAL	10.50	6.30	2.75	8.25	6.75	10	1 x 6.3	FKM/FPM	60	RGV-16	331000
MANUAL	12.50	8.30	2.36	9.45	8.75	12	1 x 8.3	FKM/FPM	62	RGV-18	331002
MANUAL	14.50	10.40	2.36	11.80	10.65	14	1 x 10.4	FKM/FPM	65	RGV-110	331004
MANUAL	20.00	16.50	2.55	17.85	16.75	18	1 x 16.5	FKM/FPM	75	RGV-116	331013
PNEUMATIC	10.50	6.30	2.75	8.25	6.75	10	1 x 6.3	FKM/FPM	65	RGV-16P	331001
PNEUMATIC	12.50	8.30	2.36	9.45	8.75	12	1 x 8.3	FKM/FPM	68	RGV-18P	331003
PNEUMATIC	14.50	10.40	2.36	11.80	10.65	14	1 x 10.4	FKM/FPM	70	RGV-110P	331005
PNEUMATIC	20.00	16.50	2.55	17.85	16.75	18	1 x 16.5	FKM/FPM	80	RGV-116P	331014

¹ See page 167 for detailed bakeout specifications

² See method of connection, page 435

ACCESSORIES



GASKET KIT	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
1 x 6.3 GATE & BONNET SEAL	FKM/FPM	1 ³	RGVG-16	331101
1 x 8.3 GATE & BONNET SEAL	FKM/FPM	1 ³	RGVG-18	331102
1 x 10.4 GATE & BONNET SEAL	FKM/FPM	1 ³	RGVG-110	331103
1 x 16.5 GATE & BONNET SEAL	FKM/FPM	1 ³	RGVG-116	331104
1 x 6.3 BODY FLANGE SEAL	FKM/FPM	2	RGVG-16B	331105
1 x 8.3 BODY FLANGE SEAL	FKM/FPM	2	RGVG-18B	331106
1 x 10.4 BODY FLANGE SEAL	FKM/FPM	2	RGVG-110B	331107
1 x 16.5 BODY FLANGE SEAL	FKM/FPM	2	RGVG-116B	331108

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
SOCKET HEAD	.312-24 x 1"	RGV	24	BA-RGV-18	331012

³ Each gasket kit contains one Bonnet and one Gate seal

2 Angle, Inline & Butterfly Valves



Angle & Inline Valves

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Angle & Inline Valves



Vacuum angle and inline valves are devices that regulate the flow of gases, fluids or materials through a structure or aperture by opening, closing or obstructing a port or passageway. Angle valve assemblies consist of an actuator, a poppet and a valve body. The actuator provides the power to position or transport the valve's poppet which is attached to the valve's body via a circular bonnet flange. The poppet closes or opens one of the valve's body ports. The valve body is a vacuum tight chamber that is screwed, flanged or welded into a larger vacuum vessel or system.

Reliable vacuum valves were not commercially available until the late 1940s with the advent of O-ring elastomer seals. The elastomer O-ring was developed during WWII for use in aircraft hydraulic systems, and was soon thereafter adopted by the vacuum community as the standard means of making vacuum seals. Prior to this it was common practice, even in large research establishments, to upgrade general service valves for vacuum use by winding actuator shaft gaskets from string soaked in an Apiezon grease.

MDC stainless steel vacuum angle and inline valves have been designed for maximum conductance and minimum size for easy installation. These valves are ideally suited for systems requiring high reliability and low outgassing. The valves' low outgassing characteristics can be attributed to a fusion welded 304 stainless steel body, welded AM-350 stainless steel nesting bellows as well as small cross-section elastomers and the elimination of blind internal cavities. MDC angle and inline valves are offered in various sizes ranging from .25" to 10" port diameters. Standard port mounts include: Del-Seal™ CF metal seal flanges, recommended for ultrahigh vacuum service; ISO Kwik-Flange™ and ISO Large-Flange™ fast-make and fast-break

elastomer seal flanges, ideal for high vacuum applications requiring frequent assembly and disassembly.

Standard Features

- UHV and HV series
- Del-Seal™ CF, ISO KF Kwik-Flange™, ISO LF Large-Flange™ and Tube-Weld port connections.
- Manual and Electropneumatic actuators
- 120VAC air control solenoid valve
- OFE copper metal and FKM / FPM fluor elastomer bonnet seals
- Welded bellows actuator seal
- TIG welded internal body joints
- Electropolished interior and exterior surfaces

Optional Features

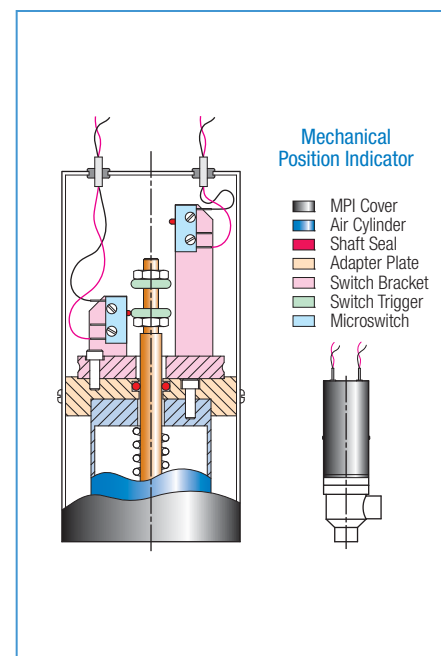
- Electromechanical position indicator
- Magnetic reed switch position indicators
- Air control solenoid valves for 240VAC and 24VDC service
- High temperature 250°C Kalrez® elastomer poppet seal

All dimensions in this catalog are given in inches unless specified otherwise.

Mechanical Position Indicator Option -01



MDC angle and inline valves are available with precision mechanical position indicator (MPI) option. The MPI system consists of two single pole, double-throw micro switches mounted on top of the pneumatic actuator air cylinder. Each micro switch is wired in the normally open position. Wiring in a normally closed position is available on request, and easily modified by reversing standard factory wiring. Precise actuation of each micro switch is factory adjusted by positioning individual switch triggers mounted on the actuator shaft. Field installation of this option is not available. Contact factory for further information.





Magnetic Reed-Switch Position Indicators Option -02

MDC magnetic reed switches consist of four basic components: a glass capsule, a gas filler (the atmosphere inside the glass capsule), electrical contacts and two ferromagnetic reeds.

The reeds are hermetically sealed into the glass capsule in a cantilever fashion so that the ends align and overlap, while maintaining a small gap between them. The floating end of each reed will assume opposite magnetic polarity when brought into the proximity of a magnetic field. When the magnetic flux density is sufficient, the attraction force of the opposing magnetic poles will overcome the reed stiffness causing them to flex towards each other

and make electrical contact. Since these switches have no mechanical parts to wear out this operation can be repeated millions of times.

The characteristic life expectancy of these switches is rated at 100 million cycles, provided electrical ratings are not exceeded.

Contacts normally open, 110-120VAC, 0.5 amperes and 10 watts maximum. MDC reed switch position indicators will operate at temperatures ranging from (-) 40°C to (+) 125°C.



Air Control Solenoid Valve Option -03 and -09

Angle and inline valves fitted with standard electropneumatic actuators are equipped with Humphrey 310 or 410 series 120VAC 50/60Hz air control solenoid valves. Air-open / spring-close angle and inline valves use the 310 series solenoids, while the 410 series solenoid is used with the air-open / air-close angle and inline valves. AC/DC power consumption for this solenoid valve is 4.0 watts.

24VDC and 240VAC solenoid valves are optional and available by adding the option numbers to the end of the specific angle or inline valve part number. All solenoid valves are fitted with DIN type connectors that conform to international standards. DIN

connectors provide simplicity, convenience and fast, easy electrical installation. Solenoid valves come standard with push button / spring return manual override. The manual override is located at the top of the solenoid and identified by a prominent red push button.

Air control solenoid valves are designed for use with compressed air from 0 to 125psig. Media should be clean and uncontaminated. When in doubt, install a filter with a 40 micron filtering capacity. Periodically remove and clean or replace filter element.



High Temperature Poppet Seal Option -11

Angle and inline valves are supplied standard with FKM/FPM fluoroelastomer elastomer poppet seals. UHV series valves, which have metalsealed bonnet flanges, can be ordered with the high temperature Kalrez® compound 4079 poppet seal gasket option. Kalrez® compound 4079 elastomers are suitable for vacuum bakeout to 250°C (with poppet in an open position). Kalrez® compound 4079 offers excellent chemical resistance and good mechanical properties. When compared to FKM / FPM fluoroelastomer, Kalrez® has lower outgassing characteristics for any given temperature from ambient to 250°C.

As with standard poppet seals, Kalrez®

elastomer seals have a small amount of Krytox® LVP vacuum grease applied at the time of installation. Vacuum grease should be applied to elastomer gaskets in order to maximize its sealing properties and extend its cycle life.

Installation of a poppet seal is accomplished by pressing an O-ring into the poppet groove first at the 12 and 6 o'clock positions then at the 3 and 9 o'clock positions, etc. Pressing the O-ring into the groove in this manner avoids twisting the O-ring.

Note that Kalrez® has a much faster permeation rate for helium than does FKM / FPM fluoroelastomer.





General Guidelines

Installation and Orientation- Angle and inline valves can be installed using one of various port connections as summarized on page 199. Valves up to and including

4" ports can be installed in either a vertical or horizontal orientation. Valves with 6" and larger ports must be installed in a vertical orientation, as shown in the figure below. The bottom port is usually oriented towards the vacuum environment. Mounting in this fashion minimizes the in-vacuum volume and also aids poppet sealing when the side port is vented to air.

Sealing- Angle and inline valves can be sealed via manual or electropneumatic actuation. All valves up to 3" ports will seal against 15 psi differential atmospheric pressure in either a bottom or side port direction. Those with 4" and larger ports should be installed with vacuum at the valve seat port only, shown as bottom port.

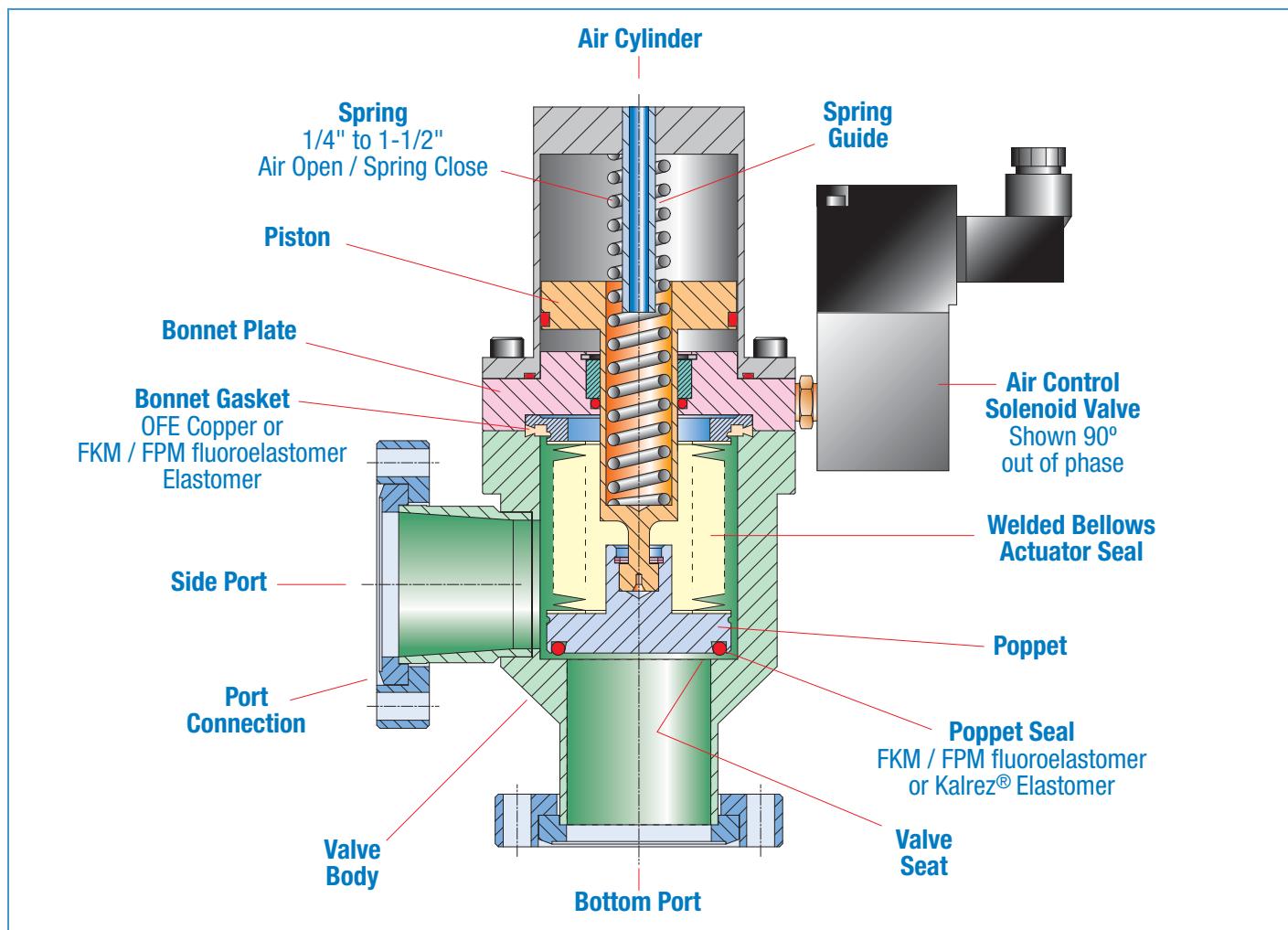
Electropneumatic angle and inline valves with 1/4" to 1-1/2" diameter ports are fitted with air-open / spring-close actuators. Valves with 2" or larger diameter ports employ air-open / air-close pneumatic

actuators. Custom actuator designs are available on request.

Bakeout- Air control solenoid valves must be removed or remotely mounted for valve maximum bakeout conditions. The solenoid valve temperature should not exceed 50°C. Pneumatically actuated air cylinder seals are FKM / FPM fluoroelastomer elastomer O-rings and therefore have a temperature limit of 150°C.

Maintenance- Actuator and poppet mechanism may be removed through the bonnet flange for seal replacement, cleaning or retrofitting without removing the valve body from the system. Refer to instruction manual for details.

Leak Testing- Each valve is tested using a helium mass spectrometer leak detector calibrated for a minimum sensitivity of 2×10^{-10} std. cc/sec of Helium. Internal welds are inspected for pits, cracks, and other irregularities which may cause virtual leaks.



Specifications

Material

Flanges	304ss
Valve Body	304ss
Air Cylinder	Teflon® coated Aluminum
Actuator Seal	AM-350 welded bellows
Gaskets, Bonnet	OFE Copper or FKM/FPM elastomer
Gaskets, Poppet	FKM/FPM or Kalrez® 4079 elastomer
Gaskets, pneumatic actuator	FKM/FPM fluoroelastomer elastomer
Bolts	300 Series stainless steel

Electropneumatic Actuator

Air Pressure	70 to 100 psig
Air Control Valve 1/4" to 1-1/2"	310 Series Humphrey solenoid valve
Air Control Valve 2" to 10"	410 Series Humphrey solenoid valve
Solenoid Power	120VAC 50/60Hz, 4Watts
Power Loss	Valve closes
Position Indicators, magnetic	0.5A, 120VAC, 10W maximum
Position Indicators, mechanical	5A, 120/240VAC micro switch

Port Fastening

Bolt Type	Silver plated 12-point and socket head bolts
Nut Type	Hexagonal nuts

Fastening Torque for Del-Seal™ CF Port Flanges

8-32 UNC	7 lb-ft
.250-28 UNF	12 lb-ft
.312-24 UNF	15 lb-ft
.375-24 UNF	26 lb-ft

Vacuum

Range	To 1x10 ⁻¹¹ Torr
Leak Test	2x10 ⁻¹⁰ cc/sec of He

Temperature Range... Bakeability, under vacuum in open / closed positions with the following bonnet / poppet seal combinations

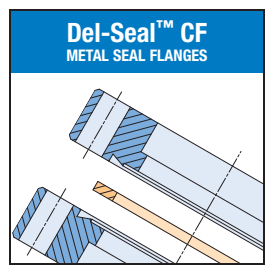
UHV Series with Copper / FKM/FPM	200°C open / 150°C closed
UHV Series with Copper / Kalrez®	250°C open / 200°C closed
HV Series with FKM/FPM / FKM/FPM	150°C open / 150°C closed

Weight and Dimensions See tables

Port Connection Guide

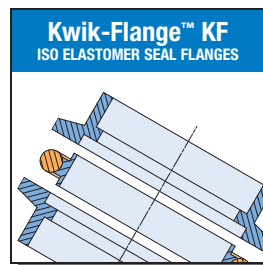
MDC offers five industry standard port connections. The port connections available for each valve size are depicted in the specific two page valve spread. Port connections not shown, are either not available for that specific valve size or only available on request.

The following port connection guide summarizes the five standard connection solutions available. For a detailed discussion of these connections reference Section 1.



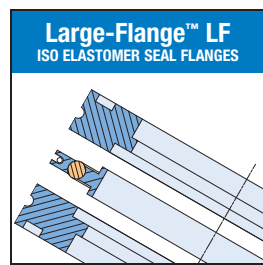
UHV Flange 1x10⁻¹³ Torr / 450°C

Del-Seal™ CF flanges employ a Conflat® compatible knife-edge sealing mechanism which produces a cold-flow deformation of a metal copper gasket. Flanges are available for tube sizes from .25" to 14" diameters. They are used in UHV environments where high temperature bakeouts are a must. Both port flanges are rotatable.



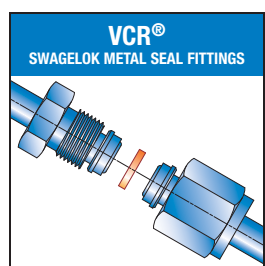
HV Flange 1x10⁻⁸ Torr / 150°C

Kwik-Flange™ ISO KF flanges are ideal for vacuum systems requiring frequent assembly and disassembly. Fastening and sealing is achieved by a hinged radial clamp, which provides compression of an elastomer gasket. KF flanges comply with all ISO specifications for vacuum hardware and are available for tube sizes up to 2" in diameter.



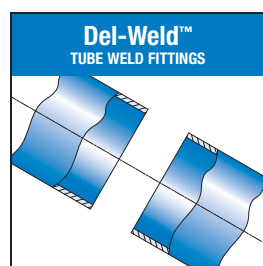
HV Flange 1x10⁻⁸ Torr / 150°C

Large-Flange™ LF flanges are a continuation of the Kwik-Flange™ family. They cover the range from 2.5" to 20" tube diameters. The main difference between LF and KF flanges is their method of fastening. LF flanges use multiple claw clamps versus a single hinged radial clamp in KF flanges. They also meet all ISO specifications for vacuum hardware.



UHV Tube Fitting 1x10⁻¹³ Torr / 450°C

Swagelok VCR® Tube fittings are designed for rapid make-up in tube, pipe and welded systems. They are zero clearance fittings, ideal for installation in limited space. Sealing is accomplished with the compression of a copper metal gasket. They are typically used for gas admission into UHV systems.



UHV Tube Weld 1x10⁻¹³ Torr / 450°C

Del-Weld™ Tube weld connections are intended for use in UHV or HV vacuum systems requiring a minimal amount of gasket joints thus reducing potential leak paths. Future use of a system must be considered when choosing this style of connection. Once welded, they become an integral and permanent part of the vacuum system.

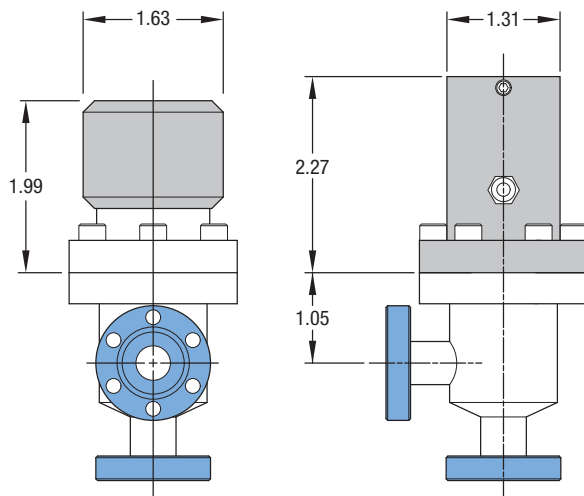


AV-050

VAV-025-P

See
Port Connections
for
flange details

Position Indicators
are not a standard option
for 1/4" and 1/2" valves.
Contact factory for
additional information.



* Solenoid valve is located remotely

ULTRAHIGH & HIGH VACUUM SERIES Metal & Elastomer Seal Bonnets

Features

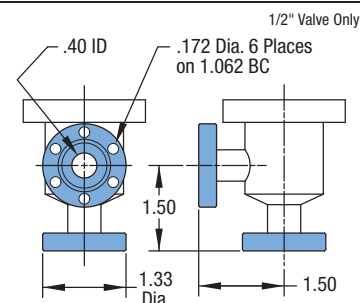
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / spring-close air cylinder

PORT CONNECTIONS

Del-Seal™ CF



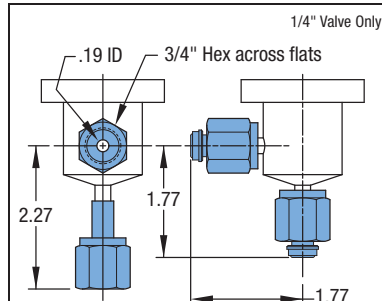
1-1/3"
Metal Seal Flange



Female VCR®



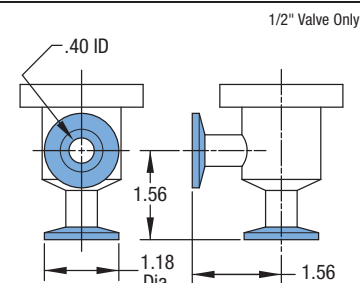
1/4"
Swagelok VCR® Fitting



Kwik-Flange™ KF



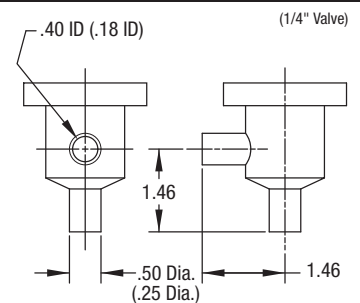
ISO NW16
Elastomer Seal Flange



Del-Weld™



1/4" & 1/2"
Tube Weld



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet **250°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1/4	MANUAL	FEMALE VCR	METAL	1	VAV-025M	312053
1/4	MANUAL	TUBE WELD	METAL	1	AV-023M	312054
1/4	PNEUMATIC	FEMALE VCR	METAL	1	VAV-025M-P	313070
1/4	PNEUMATIC	TUBE WELD	METAL	1	AV-023M-P	313071
1/2	MANUAL	DEL-SEAL	METAL	1	AV-050M	312055
1/2	MANUAL	TUBE WELD	METAL	1	AV-053M	312056
1/2	PNEUMATIC	DEL-SEAL	METAL	1	AV-050M-P	313072
1/2	PNEUMATIC	TUBE WELD	METAL	1	AV-053M-P	313073

HIGH VACUUM SERIES

Elastomer Seal Bonnet **150°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1/4	MANUAL	FEMALE VCR	FKM/FPM	1	VAV-025	310080
1/4	MANUAL	TUBE WELD	FKM/FPM	1	AV-023	310081
1/4	PNEUMATIC	FEMALE VCR	FKM/FPM	1	VAV-025-P	311087
1/4	PNEUMATIC	TUBE WELD	FKM/FPM	1	AV-023-P	311088
1/2	MANUAL	DEL-SEAL	FKM/FPM	1	AV-050	310082
1/2	MANUAL	ISO	FKM/FPM	1	KAV-050	310083
1/2	MANUAL	TUBE WELD	FKM/FPM	1	AV-053	310084
1/2	PNEUMATIC	DEL-SEAL	FKM/FPM	1	AV-050-P	311089
1/2	PNEUMATIC	ISO	FKM/FPM	1	KAV-050-P	311090
1/2	PNEUMATIC	TUBE WELD	FKM/FPM	1	AV-053-P	311091

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

OPTION -03 and -09 AIR CONTROL SOLENOID VALVES



OPTION -11 4079 KALREZ 250°C POPPET SEAL



DESCRIPTION	OPTION NUMBER
24 VDC SOLENOID VALVE	-03
240 VAC SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313072-09. Detailed descriptions of each option begin on page 196.

ACCESSORIES

HARDWARE & GASKETS



GASKET KIT	FOR USE ² WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-050M	351016
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-050	350013

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
SOCKET HEAD CLAMP	8-32 x 3/4"	DEL-SEAL	25	BA-075-SP	190037
CENTERING RING	-	ISO	1	K075-C	701000
	-	ISO	1	K075-CR	710000

² Each gasket kit contains one Bonnet and one Poppet seal, and is used for both the 1/4" and 1/2" angle valves



ULTRAHIGH VACUUM SERIES
250°C Metal Sealed Bonnet

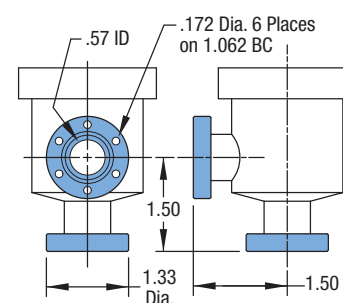
HIGH VACUUM SERIES
150°C Elastomer Sealed Bonnets

Features

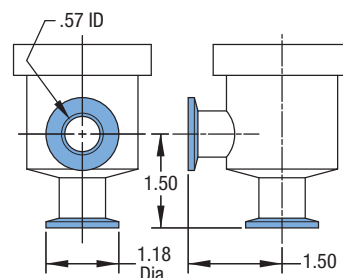
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / spring-close air cylinder

PORT CONNECTIONS

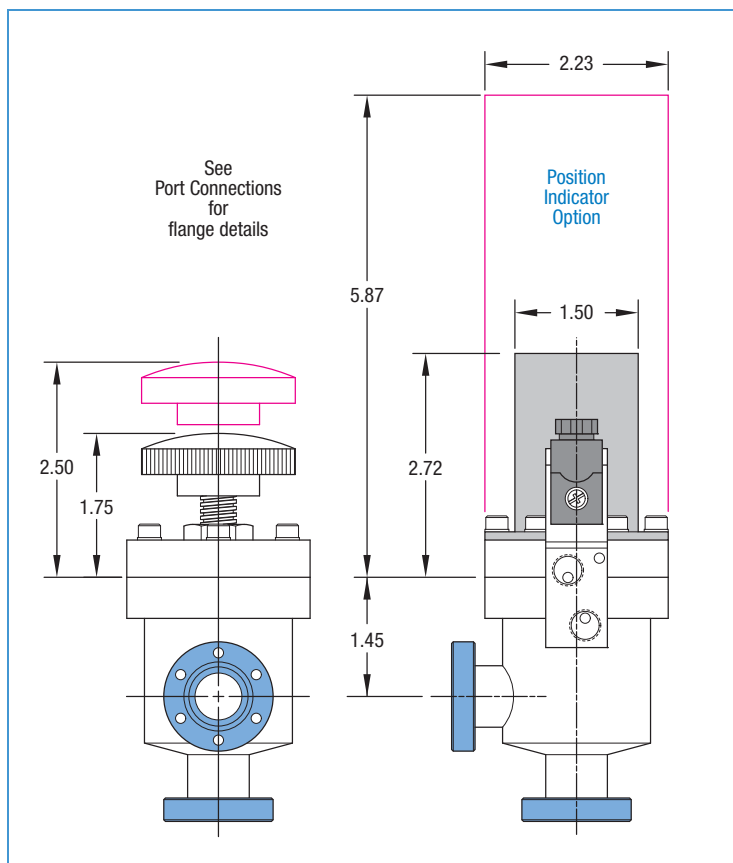
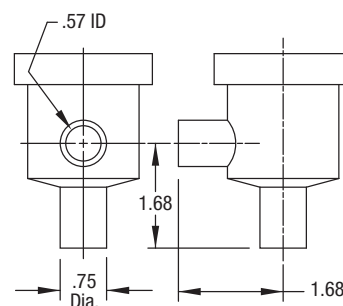
Del-Seal™ CF



Kwik-Flange™ KF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet **250°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
3/4	MANUAL	DEL-SEAL	METAL	1	AV-075M	312015
3/4	MANUAL	TUBE WELD	METAL	1	AV-073M	312021
3/4	PNEUMATIC	DEL-SEAL	METAL	2	AV-075M-P	313015
3/4	PNEUMATIC	TUBE WELD	METAL	1	AV-073M-P	313021

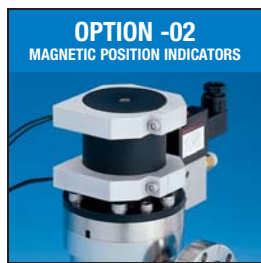
HIGH VACUUM SERIES

Elastomer Seal Bonnet **150°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
3/4	MANUAL	DEL-SEAL	FKM/FPM	1	AV-075	310015
3/4	MANUAL	ISO	FKM/FPM	1	KAV-075	310072
3/4	MANUAL	TUBE WELD	FKM/FPM	1	AV-073	310021
3/4	PNEUMATIC	DEL-SEAL	FKM/FPM	2	AV-075-P	311015
3/4	PNEUMATIC	ISO	FKM/FPM	1	KAV-075-P	311072
3/4	PNEUMATIC	TUBE WELD	FKM/FPM	1	AV-073-P	311021

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

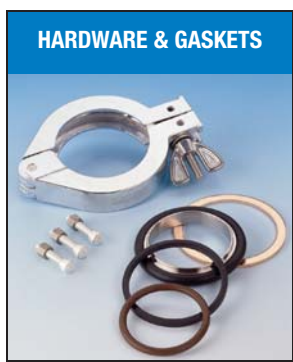


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313015-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-075M	351004
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-075	350004

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
SOCKET HEAD CLAMP	8-32 x 3/4"	DEL-SEAL	25	BA-075-SP	190037
CENTERING RING	-	ISO	1	K075-C	701000
	-	ISO	1 ³	K075-CR	710000

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnet

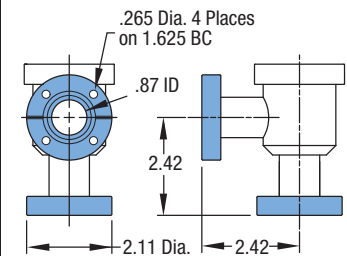
HIGH VACUUM SERIES 150°C Elastomer Sealed Bonnets

Features

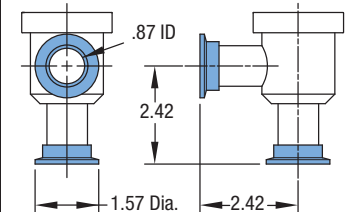
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / spring-close air cylinder

PORT CONNECTIONS

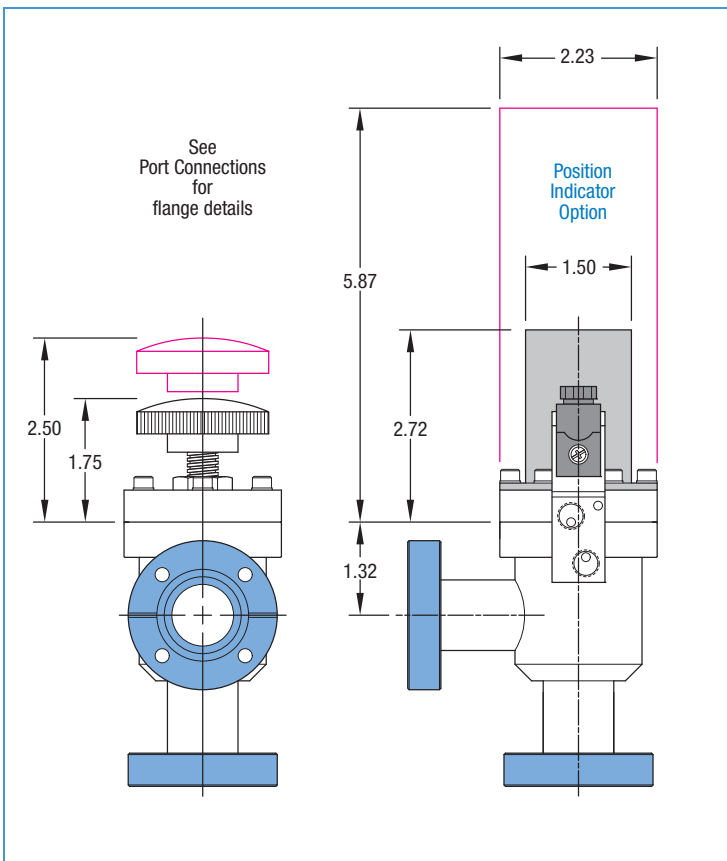
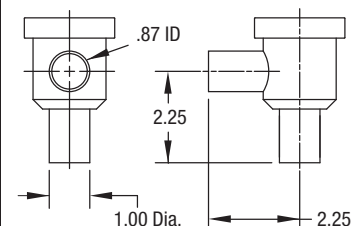
Del-Seal™ CF



Kwik-Flange™ KF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet 250°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1	MANUAL	DEL-SEAL	METAL	3	AV-100M	312022
1	MANUAL	TUBE WELD	METAL	2	AV-103M	312028
1	PNEUMATIC	DEL-SEAL	METAL	3	AV-100M-P	313022
1	PNEUMATIC	TUBE WELD	METAL	2	AV-103M-P	313028

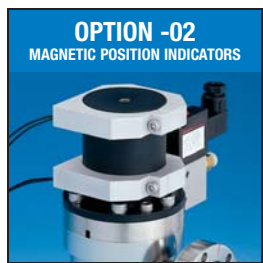
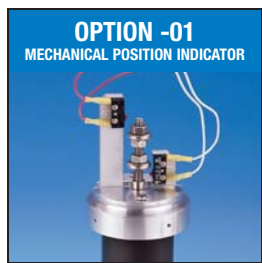
HIGH VACUUM SERIES

Elastomer Seal Bonnet 150°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1	MANUAL	DEL-SEAL	FKM/FPM	3	AV-100	310022
1	MANUAL	ISO	FKM/FPM	2	KAV-100	310073
1	MANUAL	TUBE WELD	FKM/FPM	2	AV-103	310028
1	PNEUMATIC	DEL-SEAL	FKM/FPM	3	AV-100-P	311022
1	PNEUMATIC	ISO	FKM/FPM	2	KAV-100-P	311073
1	PNEUMATIC	TUBE WELD	FKM/FPM	2	AV-103-P	311028

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

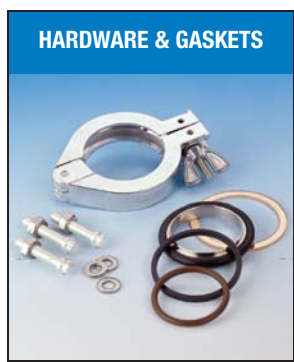


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313022-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-100M	351004
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-100	350004

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.250-28 x 1-1/4"	DEL-SEAL	25	BA-150-12-SP	190061
CLAMP	-	ISO	1	K100-C	701001
CENTERING RING	-	ISO	1 ³	K100-CR	710001

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnet

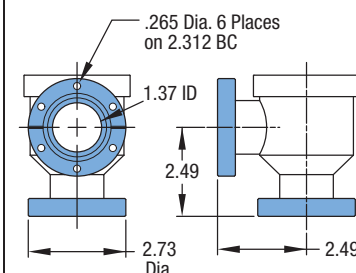
HIGH VACUUM SERIES 150°C Elastomer Sealed Bonnets

Features

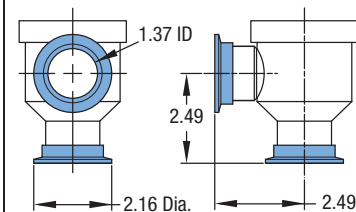
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / spring-close air cylinder

PORT CONNECTIONS

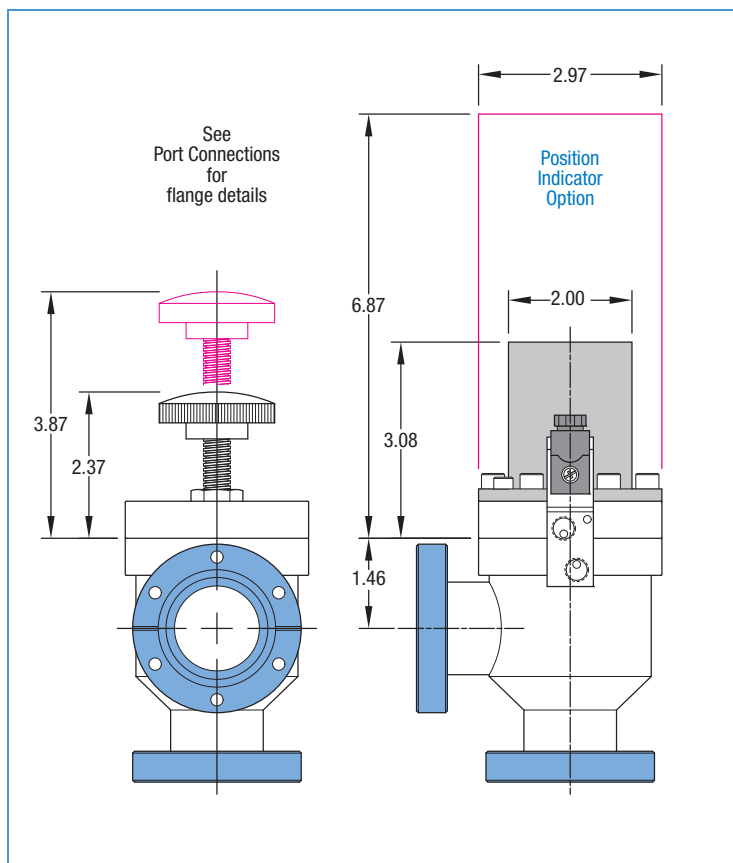
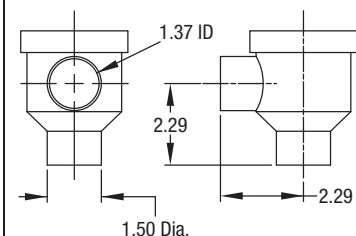
Del-Seal™ CF



Kwik-Flange™ KF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet 250°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1-1/2	MANUAL	DEL-SEAL	METAL	6	AV-150M	312029
1-1/2	MANUAL	TUBE WELD	METAL	5	AV-153M	312032
1-1/2	PNEUMATIC	DEL-SEAL	METAL	5	AV-150M-P	313029
1-1/2	PNEUMATIC	TUBE WELD	METAL	4	AV-153M-P	313032

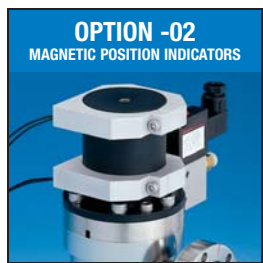
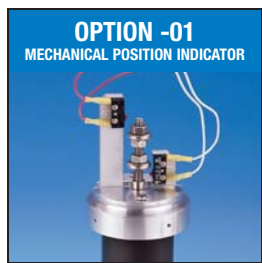
HIGH VACUUM SERIES

Elastomer Seal Bonnet 150°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1-1/2	MANUAL	DEL-SEAL	FKM/FPM	4	AV-150	310029
1-1/2	MANUAL	ISO	FKM/FPM	4	KAV-150	310074
1-1/2	MANUAL	TUBE WELD	FKM/FPM	3	AV-153	310032
1-1/2	PNEUMATIC	DEL-SEAL	FKM/FPM	6	AV-150-P	311029
1-1/2	PNEUMATIC	ISO	FKM/FPM	5	KAV-150-P	311074
1-1/2	PNEUMATIC	TUBE WELD	FKM/FPM	3	AV-153-P	311032

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

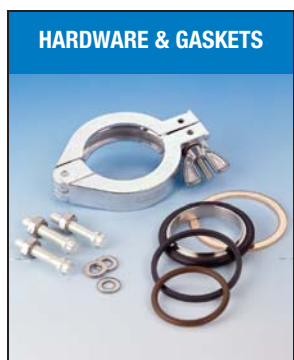


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313029-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-150M	351005
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-150	350005

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.250-28 x 1-1/4"	DEL-SEAL	25	BA-150-12-SP	190061
CLAMP	-	ISO	1	K150-C	701002
CENTERING RING	-	ISO	1 ³	K150-CR	710002

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



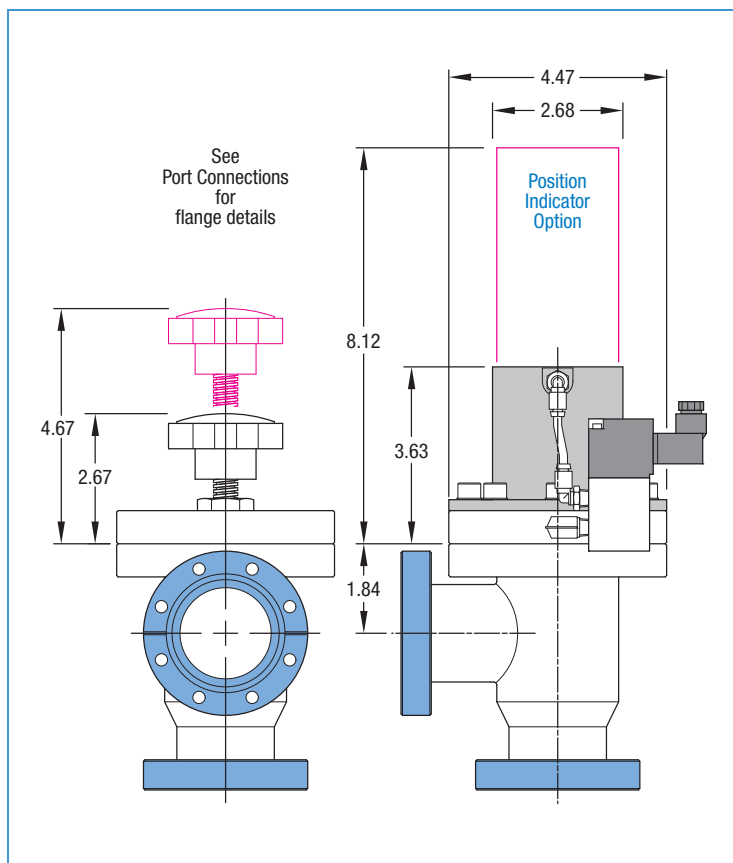
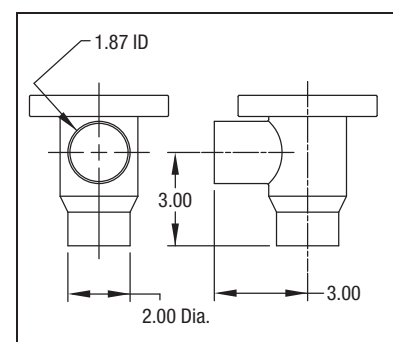
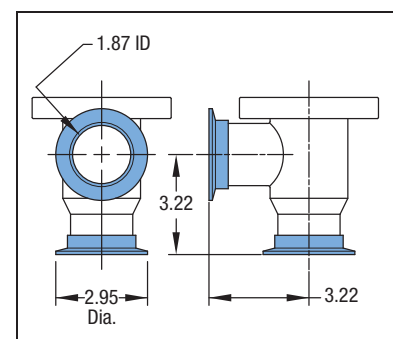
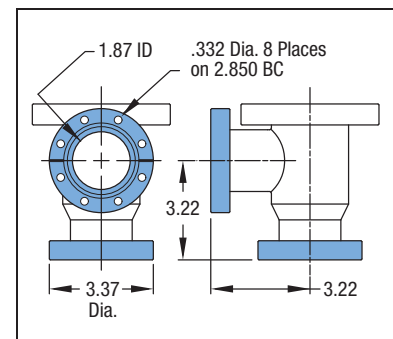
ULTRAHIGH VACUUM SERIES
250°C Metal Sealed Bonnet

HIGH VACUUM SERIES
150°C Elastomer Sealed Bonnets

Features

- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / air-close air cylinder

PORT CONNECTIONS



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet **250°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
2	MANUAL	DEL-SEAL	METAL	10	AV-200M	312033
2	MANUAL	TUBE WELD	METAL	9	AV-203M	312036
2	PNEUMATIC	DEL-SEAL	METAL	10	AV-200M-PAA	313033
2	PNEUMATIC	TUBE WELD	METAL	9	AV-203M-PAA	313036

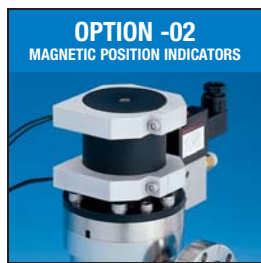
HIGH VACUUM SERIES

Elastomer Seal Bonnet **150°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
2	MANUAL	DEL-SEAL	FKM/FPM	10	AV-200	310033
2	MANUAL	ISO	FKM/FPM	10	KAV-200	310075
2	MANUAL	TUBE WELD	FKM/FPM	9	AV-203	310036
2	PNEUMATIC	DEL-SEAL	FKM/FPM	10	AV-200-PAA	311033
2	PNEUMATIC	ISO	FKM/FPM	10	KAV-200-PAA	311075
2	PNEUMATIC	TUBE WELD	FKM/FPM	9	AV-203-PAA	311036

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

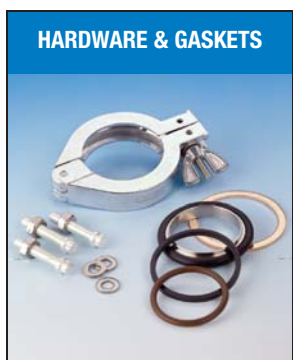


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313033-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-200M	351006
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-200	350006

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 1-3/4"	DEL-SEAL	25	BA-180-12-SP	190062
CLAMP	-	ISO	1	K200-C	701003
CENTERING RING	-	ISO	1 ³	K200-CR	710003

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnet

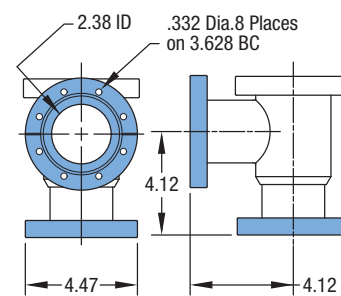
HIGH VACUUM SERIES 150°C Elastomer Sealed Bonnets

Features

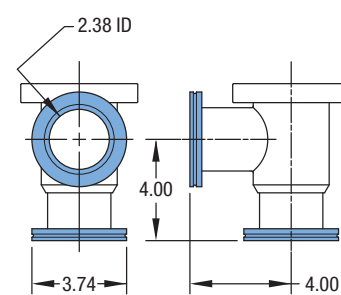
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / air-close air cylinder

PORT CONNECTIONS

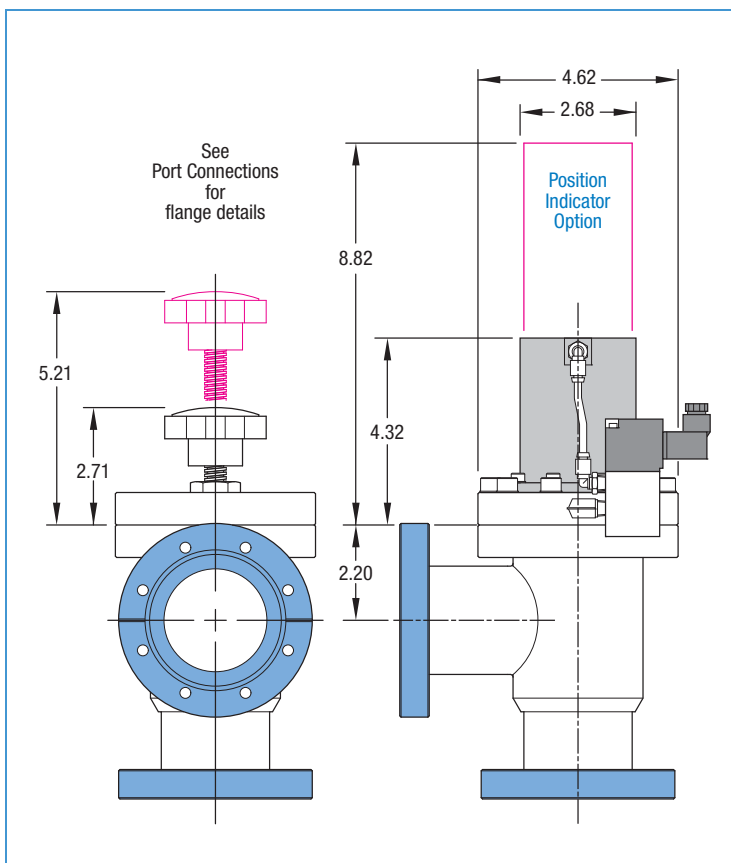
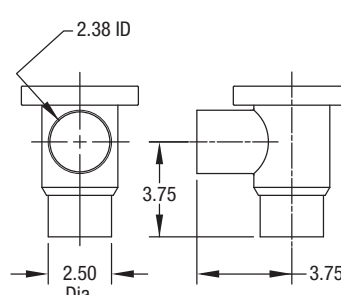
Del-Seal™ CF



Large-Flange™ LF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet 250°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
2-1/2	MANUAL	DEL-SEAL	METAL	12	AV-250M	312037
2-1/2	MANUAL	TUBE WELD	METAL	10	AV-253M	312040
2-1/2	PNEUMATIC	DEL-SEAL	METAL	12	AV-250M-PAA	313037
2-1/2	PNEUMATIC	TUBE WELD	METAL	10	AV-253M-PAA	313040

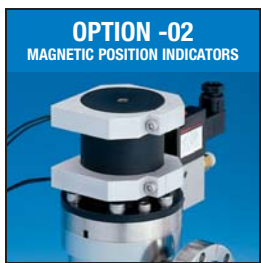
HIGH VACUUM SERIES

Elastomer Seal Bonnet 150°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
2-1/2	MANUAL	DEL-SEAL	FKM/FPM	12	AV-250	310037
2-1/2	MANUAL	ISO	FKM/FPM	12	LAV-250	310076
2-1/2	MANUAL	TUBE WELD	FKM/FPM	11	AV-253	310040
2-1/2	PNEUMATIC	DEL-SEAL	FKM/FPM	12	AV-250-PAA	311037
2-1/2	PNEUMATIC	ISO	FKM/FPM	12	LAV-250-PAA	311078
2-1/2	PNEUMATIC	TUBE WELD	FKM/FPM	11	AV-253-PAA	311040

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

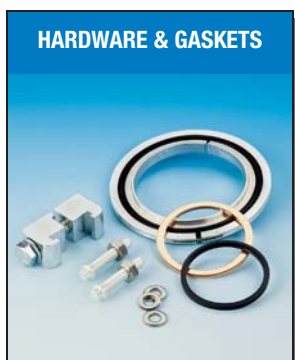


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313037-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-250M	351007
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-250	350007

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 2"	DEL-SEAL	25	BA-200-12-SP	190063
DOUBLE CLAW CLAMP	-	ISO	1	DC-8	802000
CENTERING RING	-	ISO	1 ³	L250-CR	810000

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



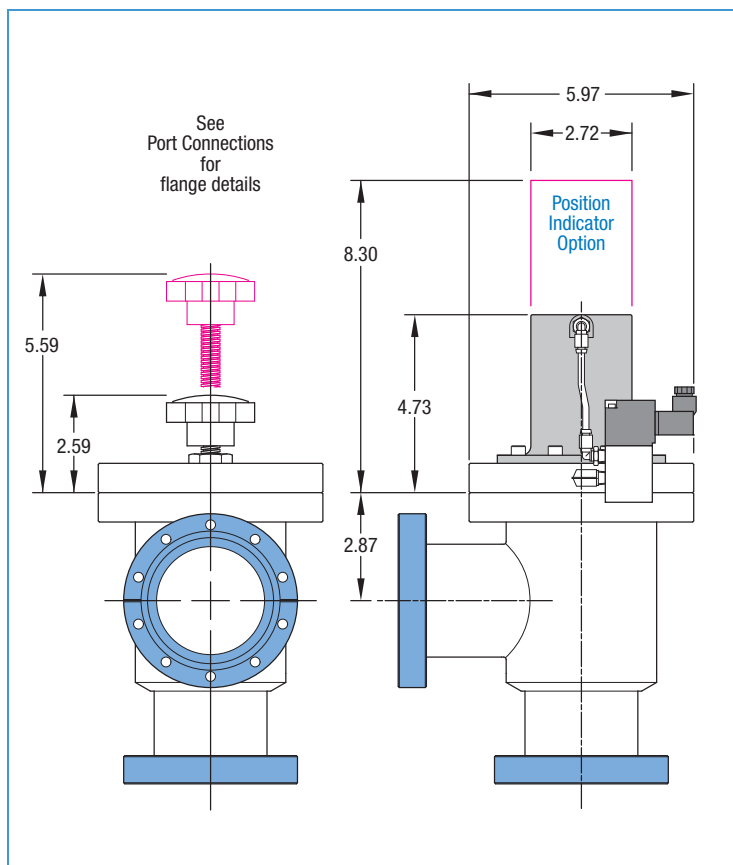
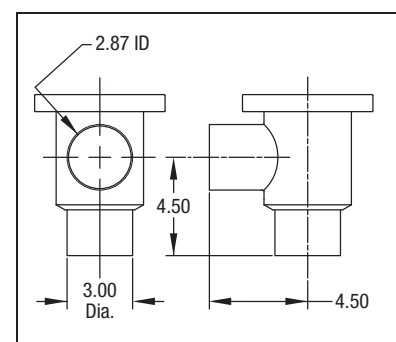
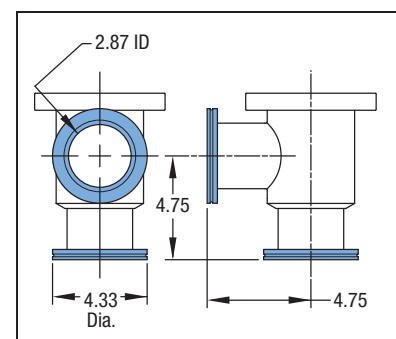
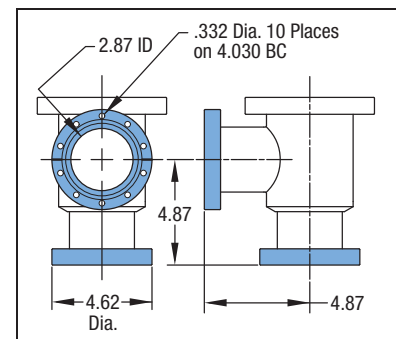
ULTRAHIGH VACUUM SERIES
250°C Metal Sealed Bonnet

HIGH VACUUM SERIES
150°C Elastomer Sealed Bonnets

Features

- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / air-close air cylinder

PORT CONNECTIONS



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet **250°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
3	MANUAL	DEL-SEAL	METAL	19	AV-300M	312041
3	MANUAL	TUBE WELD	METAL	18	AV-303M	312044
3	PNEUMATIC	DEL-SEAL	METAL	19	AV-300M-PAA	313041
3	PNEUMATIC	TUBE WELD	METAL	18	AV-303M-PAA	313044

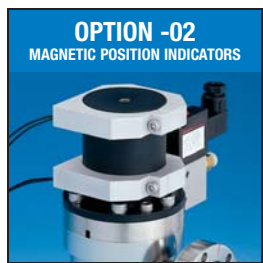
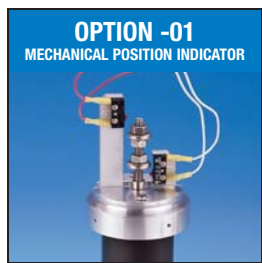
HIGH VACUUM SERIES

Elastomer Seal Bonnet **150°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
3	MANUAL	DEL-SEAL	FKM/FPM	19	AV-300	310041
3	MANUAL	ISO	FKM/FPM	19	LAV-300	310077
3	MANUAL	TUBE WELD	FKM/FPM	18	AV-303	310044
3	PNEUMATIC	DEL-SEAL	FKM/FPM	19	AV-300-PAA	311041
3	PNEUMATIC	ISO	FKM/FPM	19	LAV-300-PAA	311079
3	PNEUMATIC	TUBE WELD	FKM/FPM	18	AV-303-PAA	311044

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

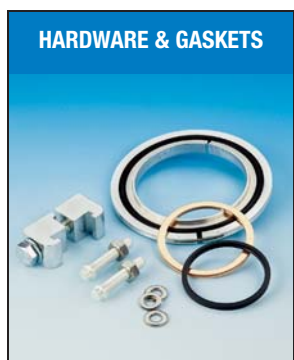


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313041-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-300M	351008
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-300	350008

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 2-1/4"	DEL-SEAL	25	BA-300-12-SP	190064
DOUBLE CLAW CLAMP	-	ISO	1	DC-8	802000
CENTERING RING	-	ISO	1 ³	L300-CR	810008

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES
250°C Metal Sealed Bonnet

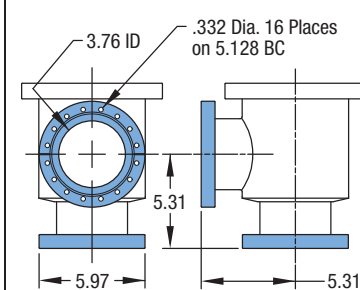
HIGH VACUUM SERIES
150°C Elastomer Sealed Bonnets

Features

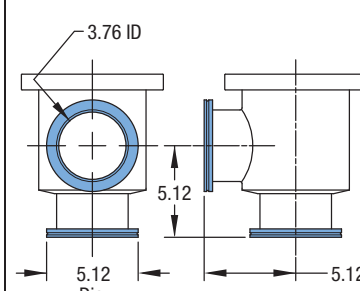
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / air-close air cylinder

PORT CONNECTIONS

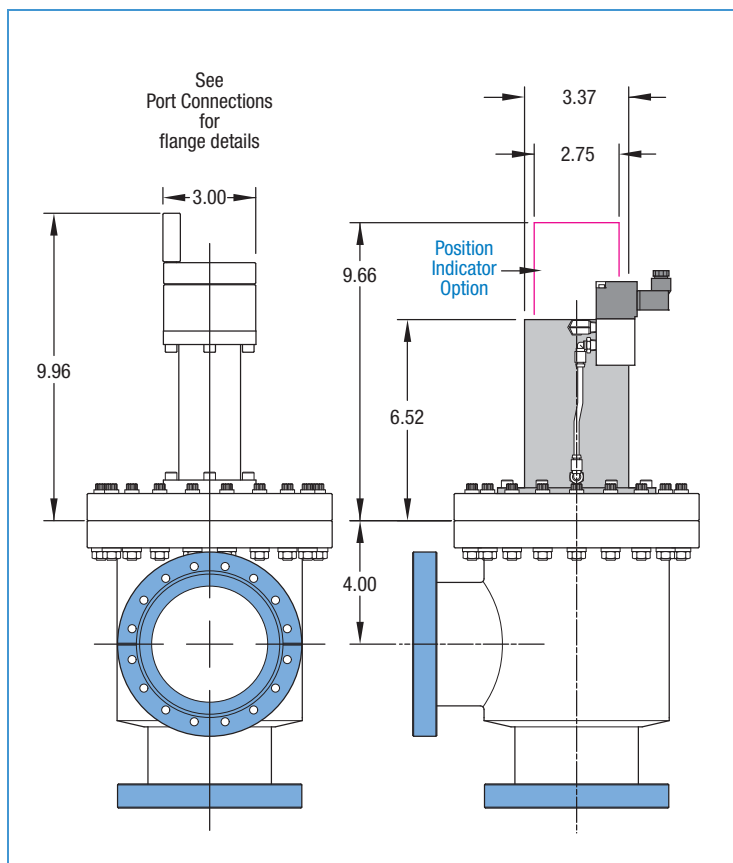
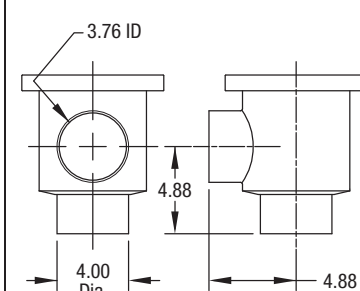
Del-Seal™ CF



Large-Flange™ LF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet 250°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
4	MANUAL	DEL-SEAL	METAL	37	AV-400M	312045
4	MANUAL	TUBE WELD	METAL	31	AV-403M	312048
4	PNEUMATIC	DEL-SEAL	METAL	37	AV-400M-PAA	313045
4	PNEUMATIC	TUBE WELD	METAL	35	AV-403M-PAA	313048

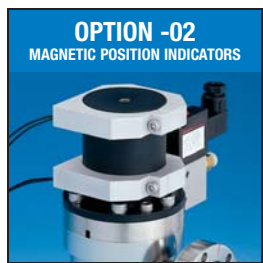
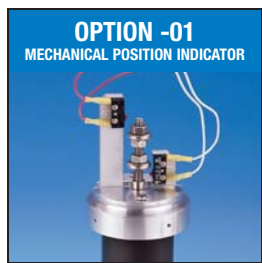
HIGH VACUUM SERIES

Elastomer Seal Bonnet 150°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
4	MANUAL	DEL-SEAL	FKM/FPM	37	AV-400	310045
4	MANUAL	ISO	FKM/FPM	37	LAV-400	310078
4	MANUAL	TUBE WELD	FKM/FPM	31	AV-403	310048
4	PNEUMATIC	DEL-SEAL	FKM/FPM	37	AV-400-PAA	311045
4	PNEUMATIC	ISO	FKM/FPM	37	LAV-400-PAA	311080
4	PNEUMATIC	TUBE WELD	FKM/FPM	31	AV-403-PAA	311048

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

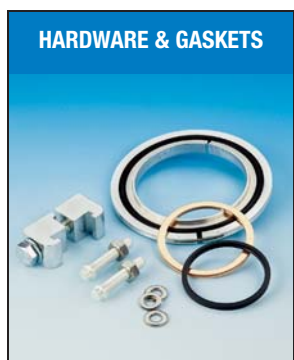


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313045-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-400M	351009
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-400	350009

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 2-1/4"	DEL-SEAL	25	BA-300-12-SP	190064
DOUBLE CLAW CLAMP	-	ISO	1	DC-8	802000
CENTERING RING	-	ISO	1 ³	L400-CR	810001

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnet

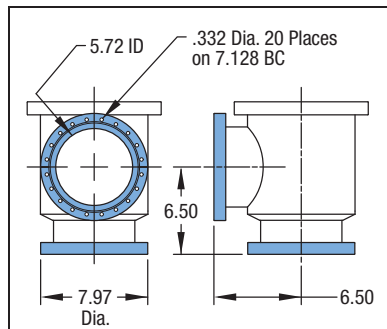
HIGH VACUUM SERIES 150°C Elastomer Sealed Bonnets

Features

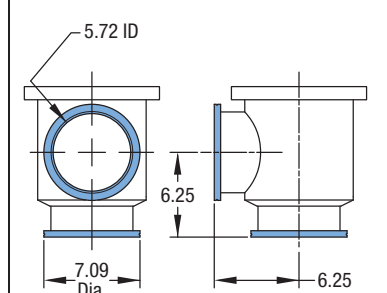
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / air-close air cylinder

PORT CONNECTIONS

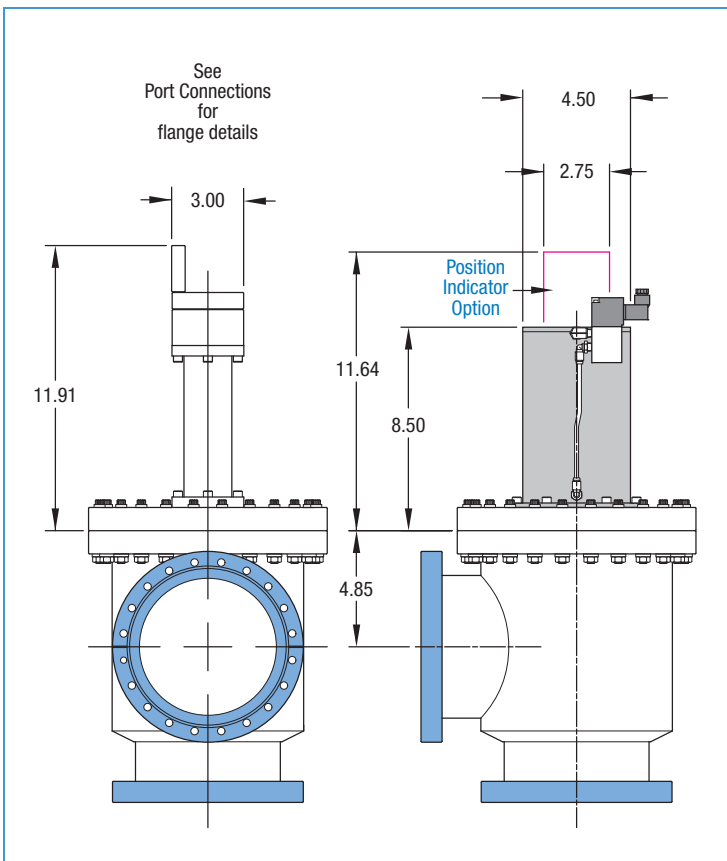
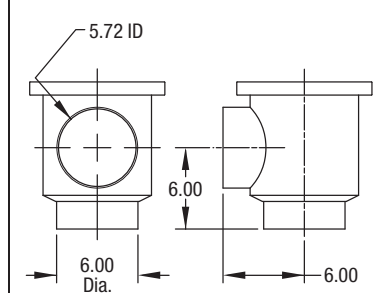
Del-Seal™ CF



Large-Flange™ LF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet 250°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
6	MANUAL	DEL-SEAL	METAL	63	AV-600M	312049
6	MANUAL	TUBE WELD	METAL	58	AV-603M	312052
6	PNEUMATIC	DEL-SEAL	METAL	63	AV-600M-PAA	313049
6	PNEUMATIC	TUBE WELD	METAL	58	AV-603M-PAA	313052

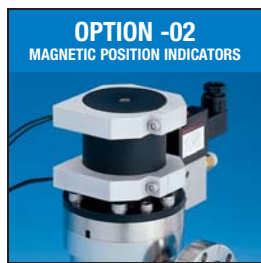
HIGH VACUUM SERIES

Elastomer Seal Bonnet 150°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
6	MANUAL	DEL-SEAL	FKM/FPM	63	AV-600	310049
6	MANUAL	ISO	FKM/FPM	63	LAV-600	310079
6	MANUAL	TUBE WELD	FKM/FPM	58	AV-603	310052
6	PNEUMATIC	DEL-SEAL	FKM/FPM	63	AV-600-PAA	311049
6	PNEUMATIC	ISO	FKM/FPM	63	LAV-600-PAA	311081
6	PNEUMATIC	TUBE WELD	FKM/FPM	59	AV-603-PAA	311052

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

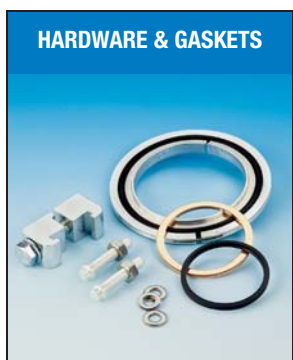


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313049-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-600M	351010
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-600	350010

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 2-1/4"	DEL-SEAL	25	BA-300-12-SP	190064
DOUBLE CLAW CLAMP	-	ISO	1	DC-10	802002
CENTERING RING	-	ISO	1 ³	L600-CR	810002

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnet

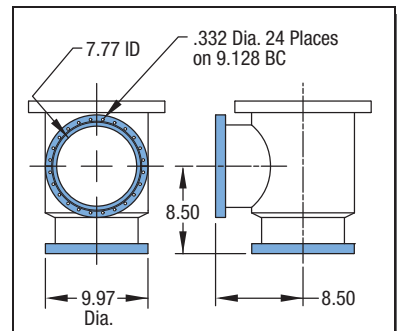
HIGH VACUUM SERIES 150°C Elastomer Sealed Bonnets

Features

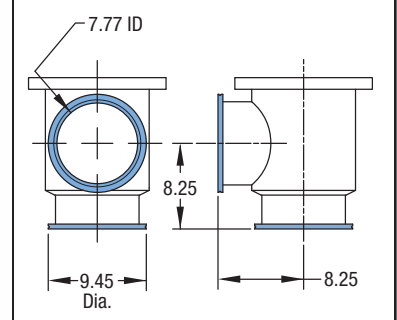
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / air-close air cylinder

PORT CONNECTIONS

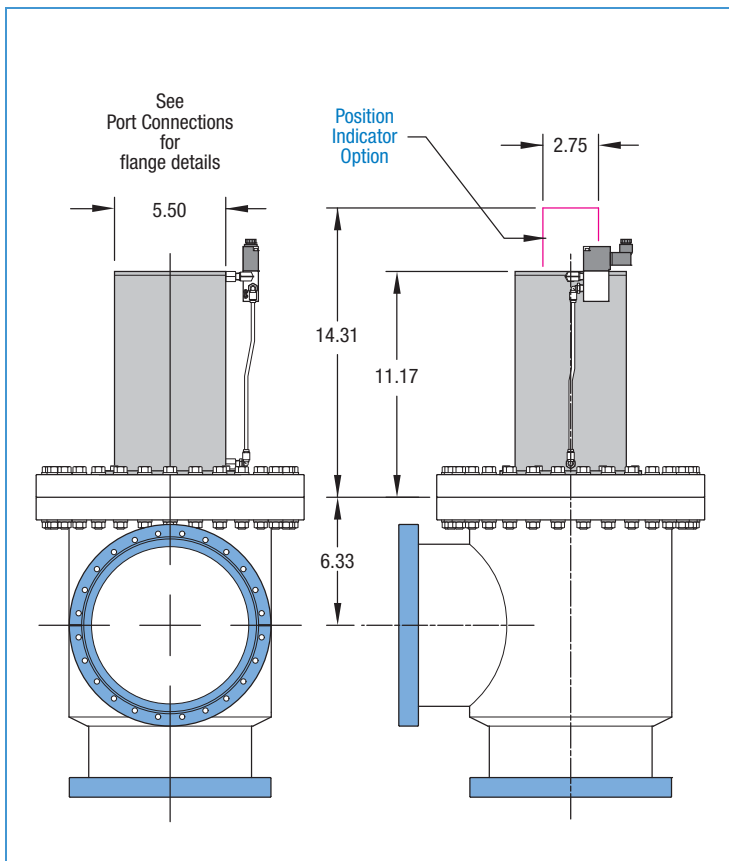
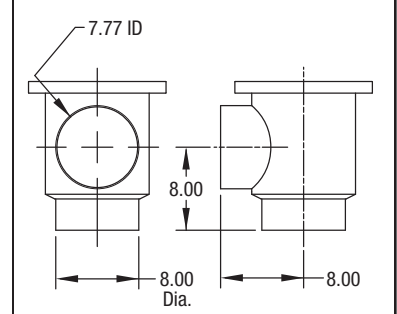
Del-Seal™ CF



Large-Flange™ LF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet **250°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
8	PNEUMATIC	DEL-SEAL	METAL	80	AV-800M-PAA	313053
8	PNEUMATIC	TUBE WELD	METAL	70	AV-803M-PAA	313056

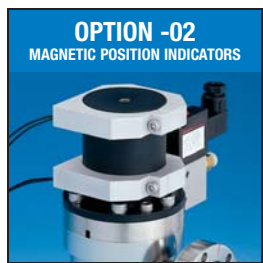
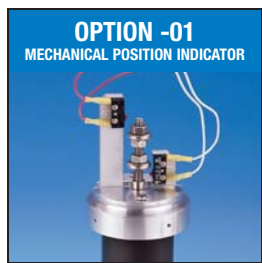
HIGH VACUUM SERIES

Elastomer Seal Bonnet **150°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
8	PNEUMATIC	DEL-SEAL	FKM/FPM	80	AV-800-PAA	311053
8	PNEUMATIC	ISO	FKM/FPM	80	LAV-800-PAA	311082
8	PNEUMATIC	TUBE WELD	FKM/FPM	60	AV-803-PAA	311056

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

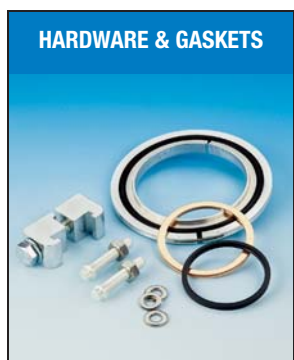


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313053-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-800M	351011
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-800	350011

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 2-1/2"	DEL-SEAL	25	BA-800-12-SP	190067
DOUBLE CLAW CLAMP	-	ISO	1	DC-10	802002
CENTERING RING	-	ISO	1 ³	L800-CR	810003

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES
250°C Metal Sealed Bonnet

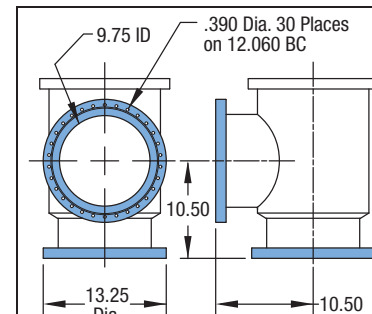
HIGH VACUUM SERIES
150°C Elastomer Sealed Bonnets

Features

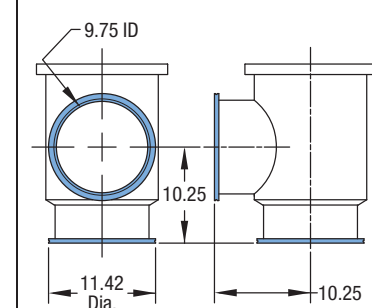
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Electropneumatic operation
- Air-open / air-close air cylinder

PORT CONNECTIONS

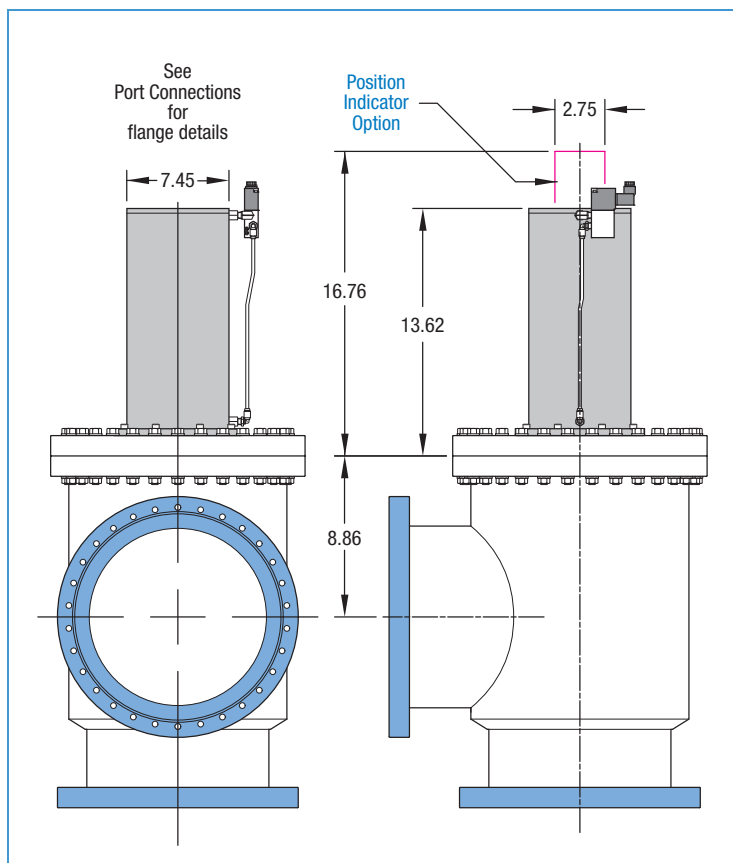
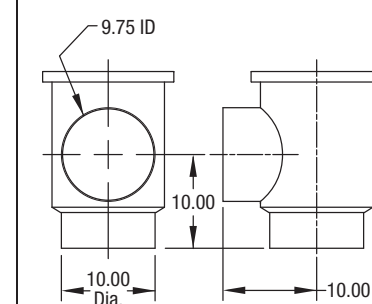
Del-Seal™ CF



Large-Flange™ LF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet **250°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
10	PNEUMATIC	DEL-SEAL	METAL	120	AV-1000M-PAA	313068
10	PNEUMATIC	TUBE WELD	METAL	120	AV-1003M-PAA	313069

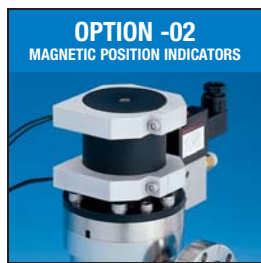
HIGH VACUUM SERIES

Elastomer Seal Bonnet **150°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
10	PNEUMATIC	DEL-SEAL	FKM/FPM	120	AV-1000-PAA	311083
10	PNEUMATIC	ISO	FKM/FPM	120	LAV-1000-PAA	311084
10	PNEUMATIC	TUBE WELD	FKM/FPM	120	AV-1003-PAA	311085

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

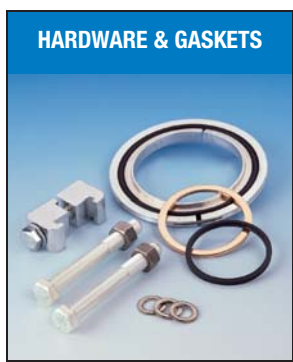


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Angle Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Angle Valve Part Number listed above. For example 313068-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	AVG-1000M	351012
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	AVG-1000	350012

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
HEX HEAD BOLT SET	.375-24 x 3"	DEL-SEAL	30	BA-1000-SP	190060
DOUBLE CLAW CLAMP	-	ISO	1	DC-10	802002
CENTERING RING	-	ISO	1 ³	L1000-CR	810004

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnet

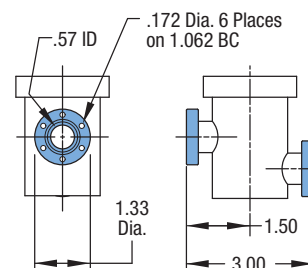
HIGH VACUUM SERIES 150°C Elastomer Sealed Bonnets

Features

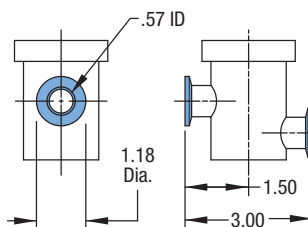
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / spring-close air cylinder

PORT CONNECTIONS

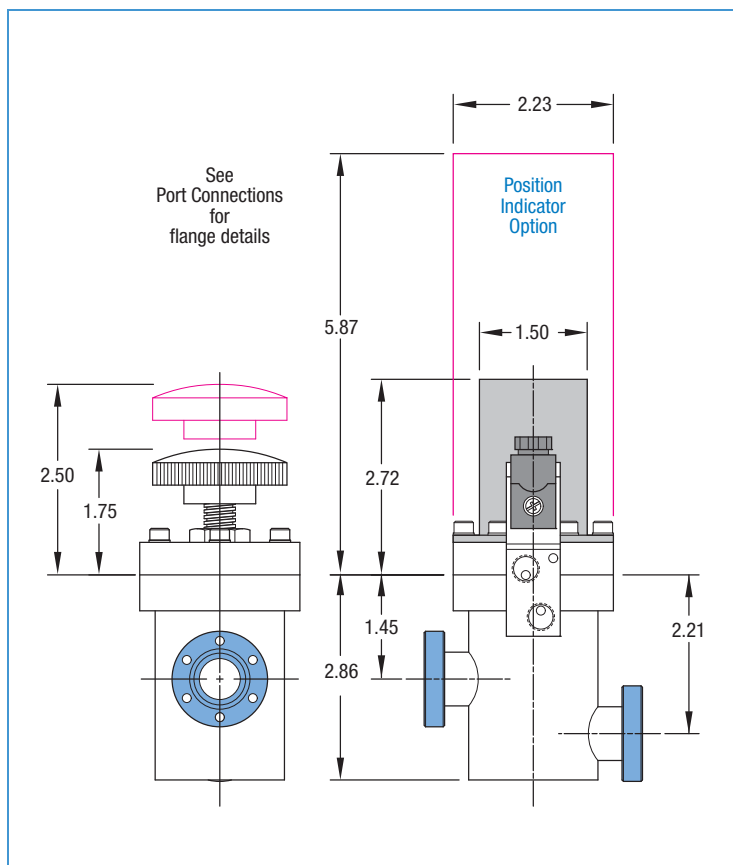
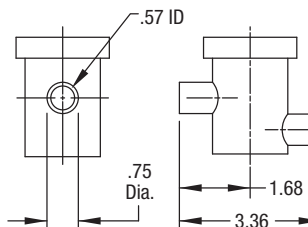
Del-Seal™ CF



Kwik-Flange™ KF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet 250°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
3/4	MANUAL	DEL-SEAL	METAL	2	IV-075M	322004
3/4	MANUAL	TUBE WELD	METAL	1	IV-073M	322010
3/4	PNEUMATIC	DEL-SEAL	METAL	2	IV-075M-P	323004
3/4	PNEUMATIC	TUBE WELD	METAL	1	IV-073M-P	323010

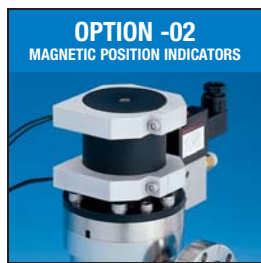
HIGH VACUUM SERIES

Elastomer Seal Bonnet 150°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
3/4	MANUAL	DEL-SEAL	FKM/FPM	2	IV-075	320004
3/4	MANUAL	ISO	FKM/FPM	1	KIV-075	320052
3/4	MANUAL	TUBE WELD	FKM/FPM	1	IV-073	320010
3/4	PNEUMATIC	DEL-SEAL	FKM/FPM	2	IV-075-P	321004
3/4	PNEUMATIC	ISO	FKM/FPM	1	KIV-075-P	321052
3/4	PNEUMATIC	TUBE WELD	FKM/FPM	1	IV-073-P	321010

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

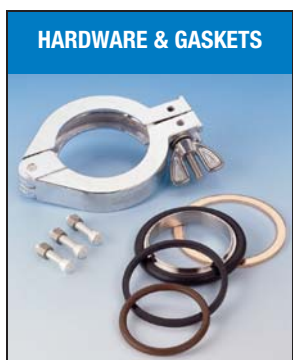


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Inline Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Inline Valve Part Number listed above. For example 323004-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	IVG-075M	351004
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	IVG-075	350004

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
SOCKET HEAD CLAMP	8-32 x 3/4"	DEL-SEAL	25	BA-075-SP	190037
CENTERING RING	-	ISO	1	K075-C	701000
	-	ISO	1 ³	K075-CR	710000

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnet

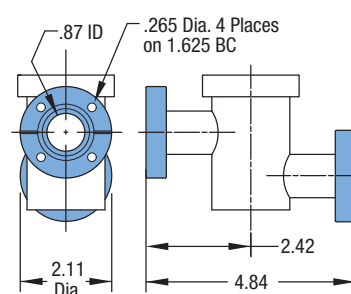
HIGH VACUUM SERIES 150°C Elastomer Sealed Bonnets

Features

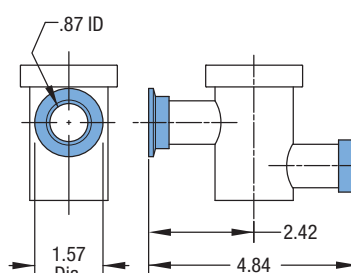
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / spring-close air cylinder

PORT CONNECTIONS

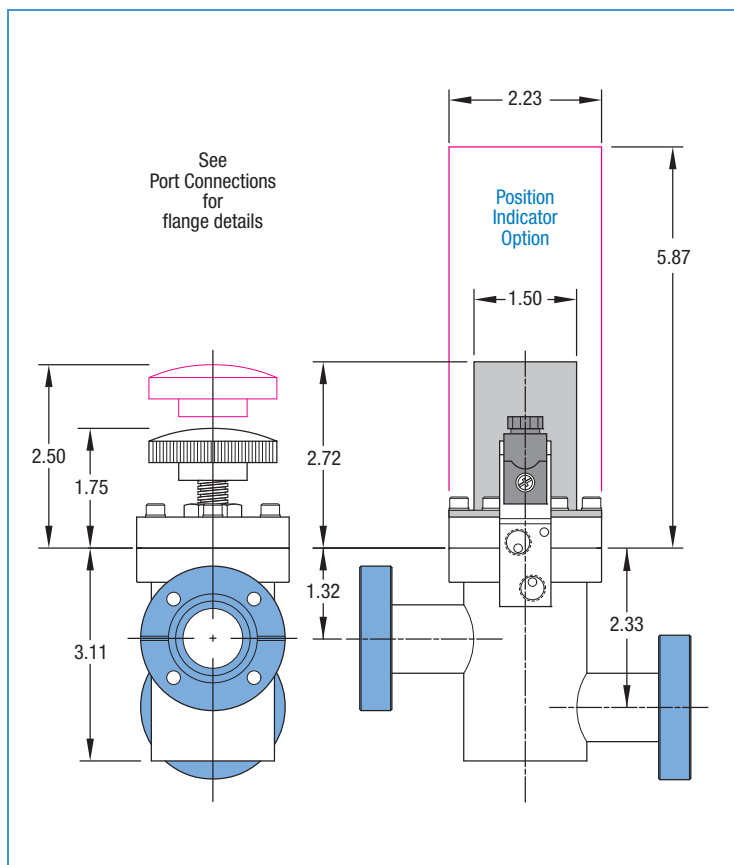
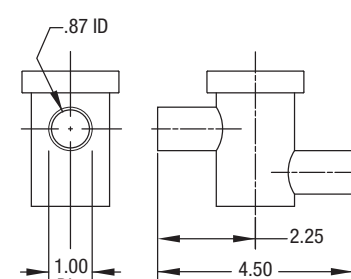
Del-Seal™ CF



Kwik-Flange™ KF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet 250°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1	MANUAL	DEL-SEAL	METAL	3	IV-100M	322011
1	MANUAL	TUBE WELD	METAL	2	IV-103M	322017
1	PNEUMATIC	DEL-SEAL	METAL	3	IV-100M-P	323011
1	PNEUMATIC	TUBE WELD	METAL	2	IV-103M-P	323017

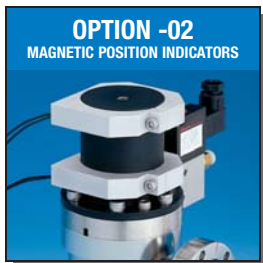
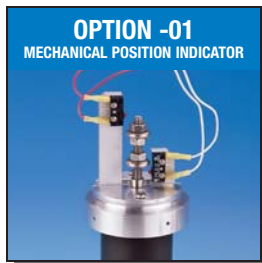
HIGH VACUUM SERIES

Elastomer Seal Bonnet 150°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1	MANUAL	DEL-SEAL	FKM/FPM	3	IV-100	320011
1	MANUAL	ISO	FKM/FPM	2	KIV-100	320053
1	MANUAL	TUBE WELD	FKM/FPM	2	IV-103	320017
1	PNEUMATIC	DEL-SEAL	FKM/FPM	3	IV-100-P	321011
1	PNEUMATIC	ISO	FKM/FPM	2	KIV-100-P	321053
1	PNEUMATIC	TUBE WELD	FKM/FPM	2	IV-103-P	321017

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

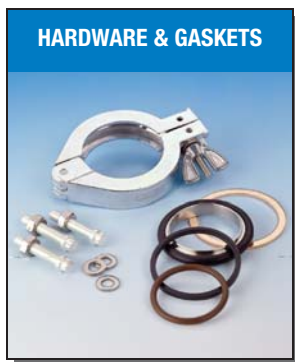


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Inline Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Inline Valve Part Number listed above. For example 323011-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	IVG-100M	351004
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	IVG-100	350004

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.250-28 x 1-1/4"	DEL-SEAL	25	BA-150-12-SP	190061
CLAMP	-	ISO	1	K100-C	701001
CENTERING RING	-	ISO	1 ³	K100-CR	710001

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



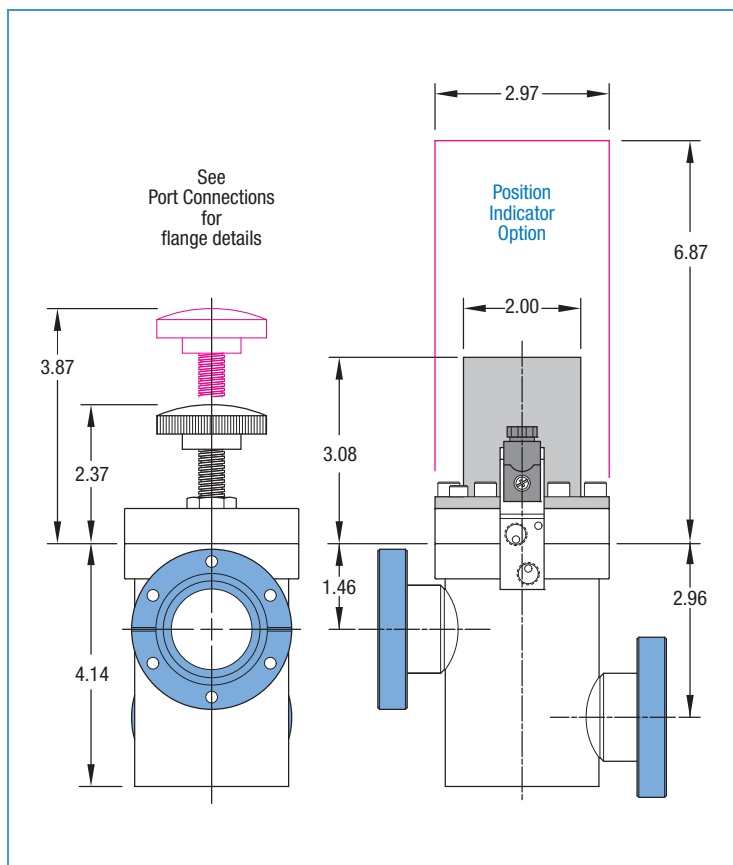
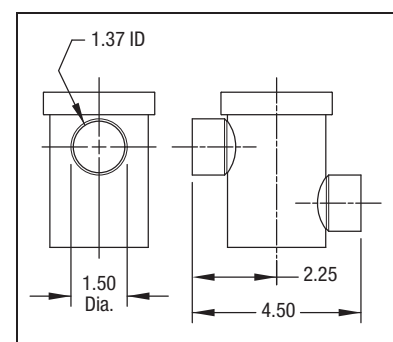
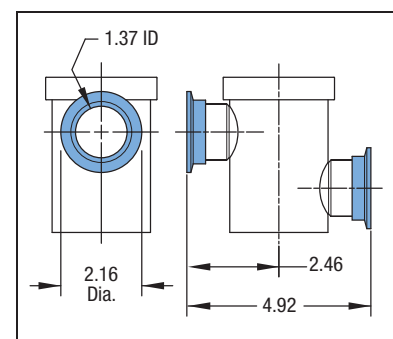
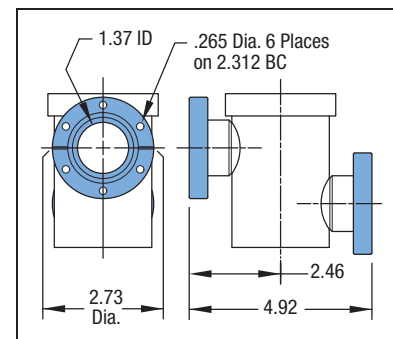
ULTRAHIGH VACUUM SERIES
250°C Metal Sealed Bonnet

HIGH VACUUM SERIES
150°C Elastomer Sealed Bonnets

Features

- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / spring-close air cylinder

PORT CONNECTIONS



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet 250°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1-1/2	MANUAL	DEL-SEAL	METAL	5	IV-150M	322018
1-1/2	MANUAL	TUBE WELD	METAL	4	IV-153M	322021
1-1/2	PNEUMATIC	DEL-SEAL	METAL	5	IV-150M-P	323018
1-1/2	PNEUMATIC	TUBE WELD	METAL	4	IV-153M-P	323021

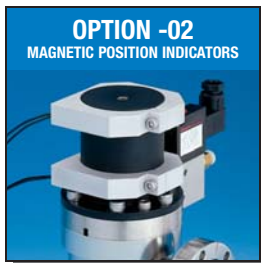
HIGH VACUUM SERIES

Elastomer Seal Bonnet 150°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1-1/2	MANUAL	DEL-SEAL	FKM/FPM	5	IV-150	320018
1-1/2	MANUAL	ISO	FKM/FPM	4	KIV-150	320054
1-1/2	MANUAL	TUBE WELD	FKM/FPM	3	IV-153	320021
1-1/2	PNEUMATIC	DEL-SEAL	FKM/FPM	5	IV-150-P	321018
1-1/2	PNEUMATIC	ISO	FKM/FPM	4	KIV-150-P	321054
1-1/2	PNEUMATIC	TUBE WELD	FKM/FPM	3	IV-153-P	321021

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

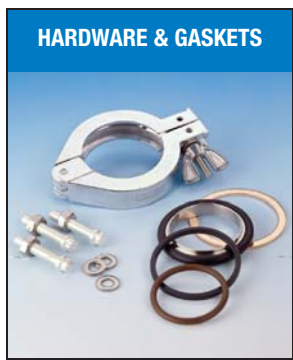


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Inline Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Inline Valve Part Number listed above. For example 323018-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	IVG-150M	351005
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	IVG-150	350005

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.250-28 x 1-1/4"	DEL-SEAL	25	BA-150-12-SP	190061
CLAMP	-	ISO	1	K150-C	701002
CENTERING RING	-	ISO	1 ³	K150-CR	710002

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnet

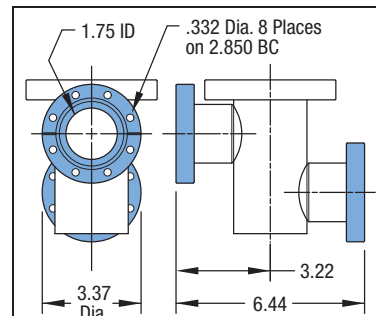
HIGH VACUUM SERIES 150°C Elastomer Sealed Bonnets

Features

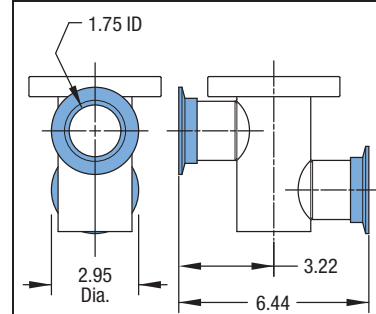
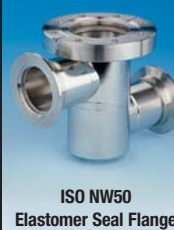
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / air-close air cylinder

PORT CONNECTIONS

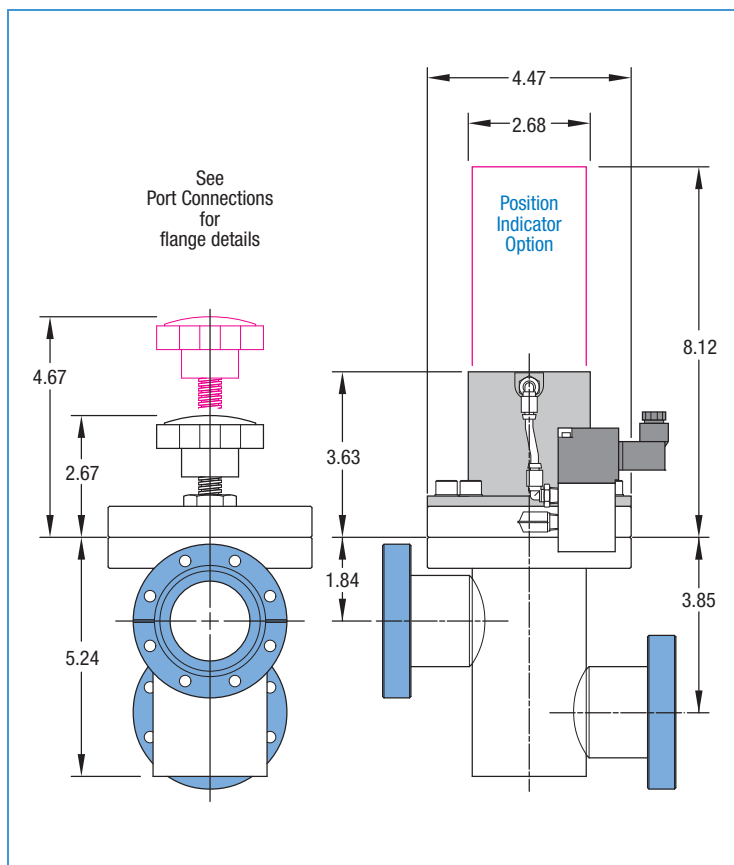
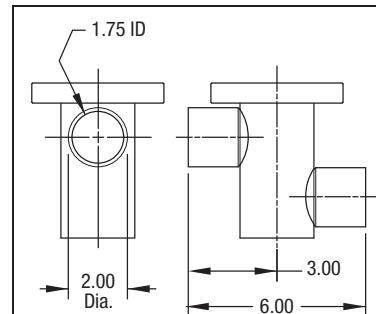
Del-Seal™ CF



Kwik-Flange™ KF



Del-Weld™



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet 250°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
2	MANUAL	DEL-SEAL	METAL	10	IV-200M	322022
2	MANUAL	TUBE WELD	METAL	9	IV-203M	322025
2	PNEUMATIC	DEL-SEAL	METAL	10	IV-200M-PAA	323022
2	PNEUMATIC	TUBE WELD	METAL	9	IV-203M-PAA	323025

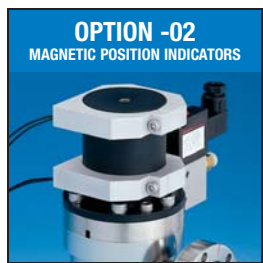
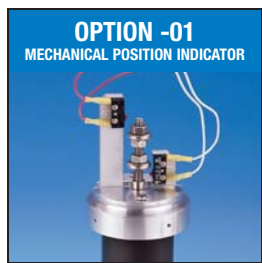
HIGH VACUUM SERIES

Elastomer Seal Bonnet 150°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
2	MANUAL	DEL-SEAL	FKM/FPM	10	IV-200	320022
2	MANUAL	ISO	FKM/FPM	10	KIV-200	320055
2	MANUAL	TUBE WELD	FKM/FPM	9	IV-203	320025
2	PNEUMATIC	DEL-SEAL	FKM/FPM	10	IV-200-PAA	321022
2	PNEUMATIC	ISO	FKM/FPM	10	KIV-200-PAA	321055
2	PNEUMATIC	TUBE WELD	FKM/FPM	9	IV-203-PAA	321025

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

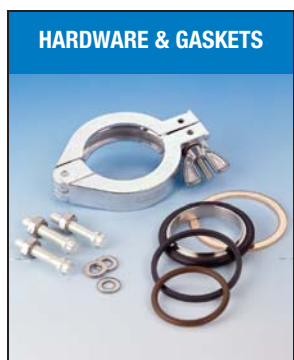


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Inline Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Inline Valve Part Number listed above. For example 323022-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES

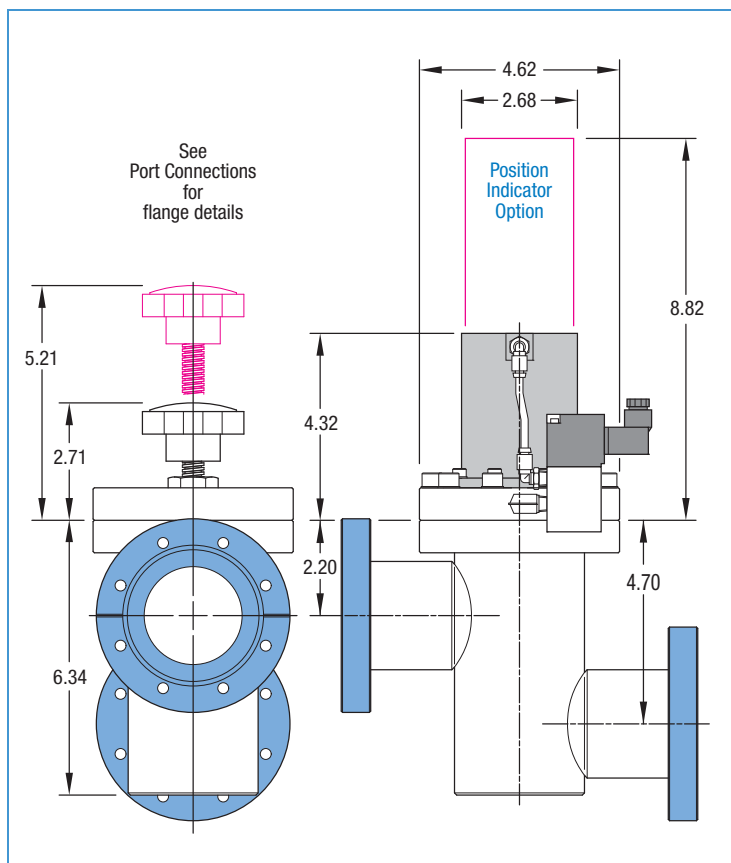


GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	IVG-200M	351006
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	IVG-200	350006

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 1-3/4"	DEL-SEAL	25	BA-180-12-SP	190062
CLAMP	-	ISO	1	K200-C	701003
CENTERING RING	-	ISO	1 ³	K200-CR	710003

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



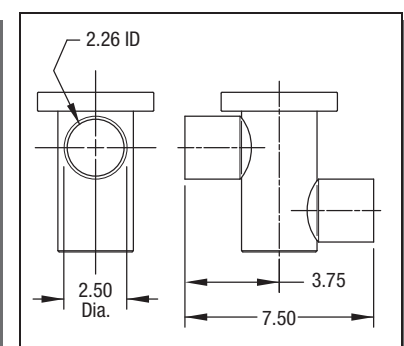
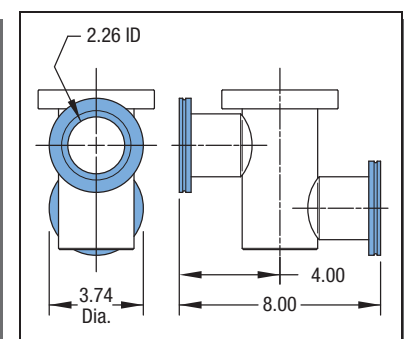
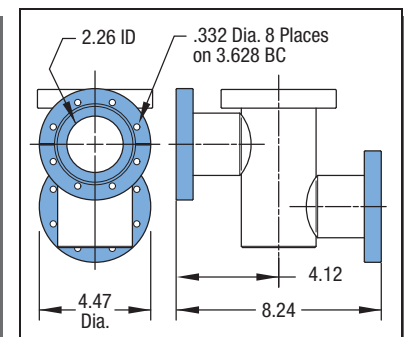
ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnet

HIGH VACUUM SERIES 150°C Elastomer Sealed Bonnets

Features

- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / air-close air cylinder

PORT CONNECTIONS



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet **250°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
2-1/2	MANUAL	DEL-SEAL	METAL	12	IV-250M	322026
2-1/2	MANUAL	TUBE WELD	METAL	10	IV-253M	322029
2-1/2	PNEUMATIC	DEL-SEAL	METAL	12	IV-250M-PAA	323026
2-1/2	PNEUMATIC	TUBE WELD	METAL	10	IV-253M-PAA	323029

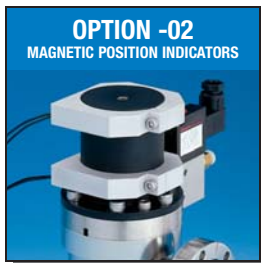
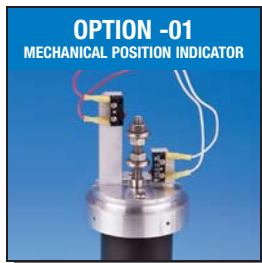
HIGH VACUUM SERIES

Elastomer Seal Bonnet **150°C¹**

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
2-1/2	MANUAL	DEL-SEAL	FKM/FPM	12	IV-250	320026
2-1/2	MANUAL	ISO	FKM/FPM	12	LIV-250	320056
2-1/2	MANUAL	TUBE WELD	FKM/FPM	11	IV-253	320029
2-1/2	PNEUMATIC	DEL-SEAL	FKM/FPM	12	IV-250-PAA	321026
2-1/2	PNEUMATIC	ISO	FKM/FPM	12	LIV-250-PAA	321056
2-1/2	PNEUMATIC	TUBE WELD	FKM/FPM	11	IV-253-PAA	321029

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

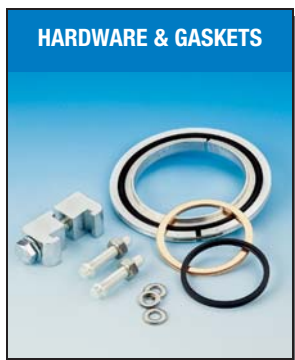


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Inline Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Inline Valve Part Number listed above. For example 323026-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	IVG-250M	351007
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	IVG-250	350007

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 2"	DEL-SEAL	25	BA-200-12-SP	190063
DOUBLE CLAW CLAMP	-	ISO	1	DC-8	802000
CENTERING RING	-	ISO	1 ³	L250-CR	810000

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



ULTRAHIGH VACUUM SERIES 250°C Metal Sealed Bonnet

HIGH VACUUM SERIES 150°C Elastomer Sealed Bonnets

Features

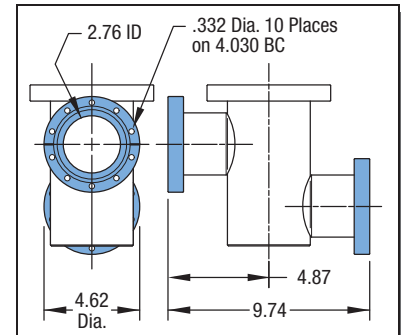
- Poppet elastomer seals made of FKM / FPM fluoroelastomer
- Stainless steel construction
- Manual or electropneumatic operation
- Air-open / air-close air cylinder

PORT CONNECTIONS

Del-Seal™ CF



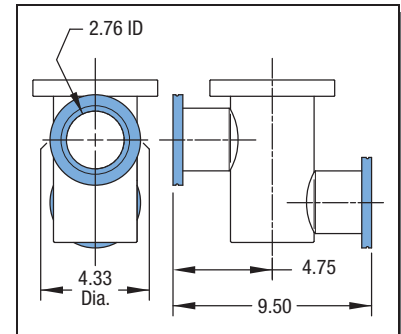
4-5/8"
Metal Seal Flange



Large-Flange™ LF



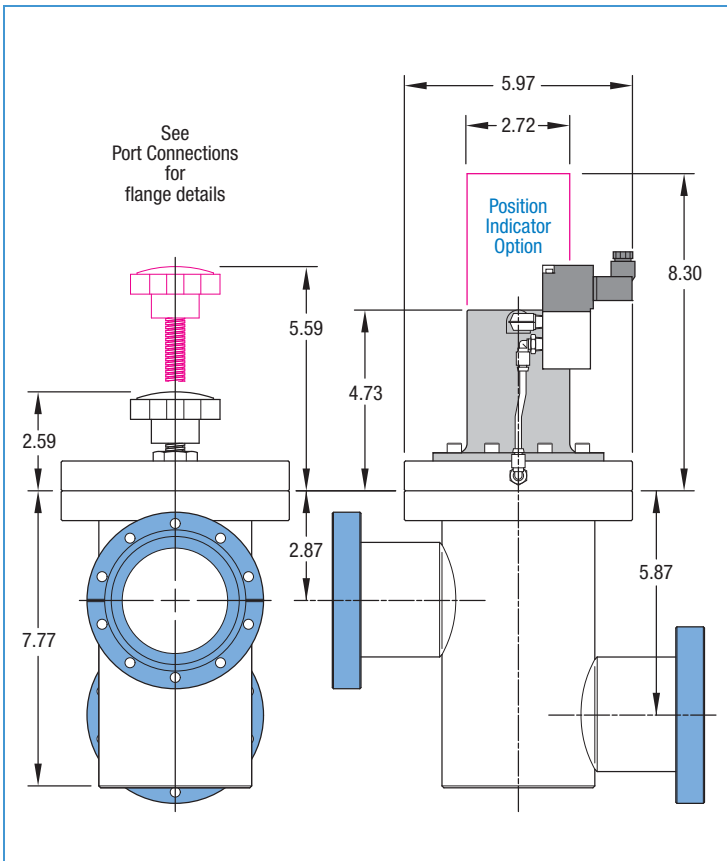
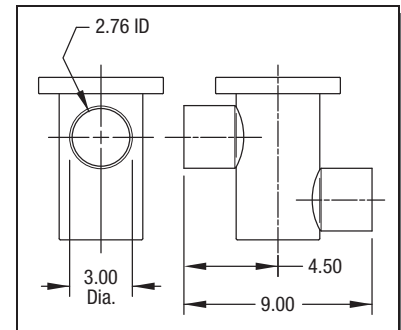
ISO NW80
Elastomer Seal Flange



Del-Weld™



3"
Tube Weld



ULTRAHIGH VACUUM SERIES

Metal Seal Bonnet 250°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
3	MANUAL	DEL-SEAL	METAL	19	IV-300M	322030
3	MANUAL	TUBE WELD	METAL	18	IV-303M	322033
3	PNEUMATIC	DEL-SEAL	METAL	19	IV-300M-PAA	323030
3	PNEUMATIC	TUBE WELD	METAL	18	IV-303M-PAA	323033

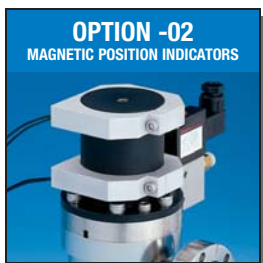
HIGH VACUUM SERIES

Elastomer Seal Bonnet 150°C¹

VALVE SIZE	ACTUATOR	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
3	MANUAL	DEL-SEAL	FKM/FPM	19	IV-300	320030
3	MANUAL	ISO	FKM/FPM	19	LIV-300	320057
3	MANUAL	TUBE WELD	FKM/FPM	18	IV-303	320033
3	PNEUMATIC	DEL-SEAL	FKM/FPM	19	IV-300-PAA	321030
3	PNEUMATIC	ISO	FKM/FPM	19	LIV-300-PAA	321057
3	PNEUMATIC	TUBE WELD	FKM/FPM	18	IV-303-PAA	321033

¹ See page 199 for detailed bakeout specifications

VALVE OPTIONS

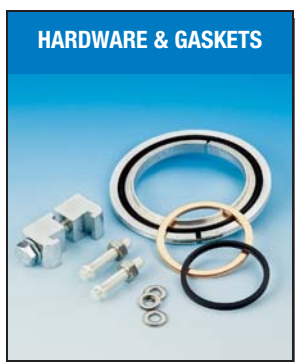


DESCRIPTION	OPTION NUMBER
MECHANICAL POSITION INDICATOR	-01
MAGNETIC POSITION INDICATORS	-02
24 VDC AIR CONTROL SOLENOID VALVE	-03
240 VAC AIR CONTROL SOLENOID VALVE	-09
HIGH TEMPERATURE POPPET SEAL	-11

When ordering Inline Valve Options, please add the option number(s) to the end of the desired UHV or HV Series Inline Valve Part Number listed above. For example 323030-02-09-11. Detailed descriptions of each option begin on page 196.



ACCESSORIES



GASKET KIT	FOR USE WITH	MATERIAL	QUANTITY PER PACK	REFERENCE	PART NUMBER
POPPET & BONNET SEAL	UHV	FKM/FPM & Copper	1 ²	IVG-300M	351008
POPPET & BONNET SEAL	HV	FKM/FPM	1 ²	IVG-300	350008

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
12PT HEAD BOLT SET	.312-24 x 2-1/4"	DEL-SEAL	25	BA-300-12-SP	190064
DOUBLE CLAW CLAMP	-	ISO	1	DC-8	802000
CENTERING RING	-	ISO	1 ³	L300-CR	810008

² Each gasket kit contains one Bonnet and one Poppet seal

³ Includes one elastomer gasket seal



Specifications

Material

Flanges	304ss
Valve Body	304ss
Bolts	300ss
Gaskets, Poppet and Bonnet	OFE Copper

Port Fastening

Bolt Type	Silver plated 12-point and socket head bolts
Nut Type	Hexagonal nuts

Vacuum

Range	1x10 ⁻¹¹ Torr
Leak Test	2x10 ⁻¹⁰ cc/sec of He

Poppet Sealing Torque

3/4" Valve, First / Subsequent Seals	7-10 / 6-7 lb-ft
1-1/2" Valve, First / Subsequent Seals	4-8 / 4-7 lb-ft
2-1/2" Valve, First / Subsequent Seals	7-10 / 6-7 lb-ft

Temperature Range

Closed / Open	300°C / 450°C
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Weight and Dimensions

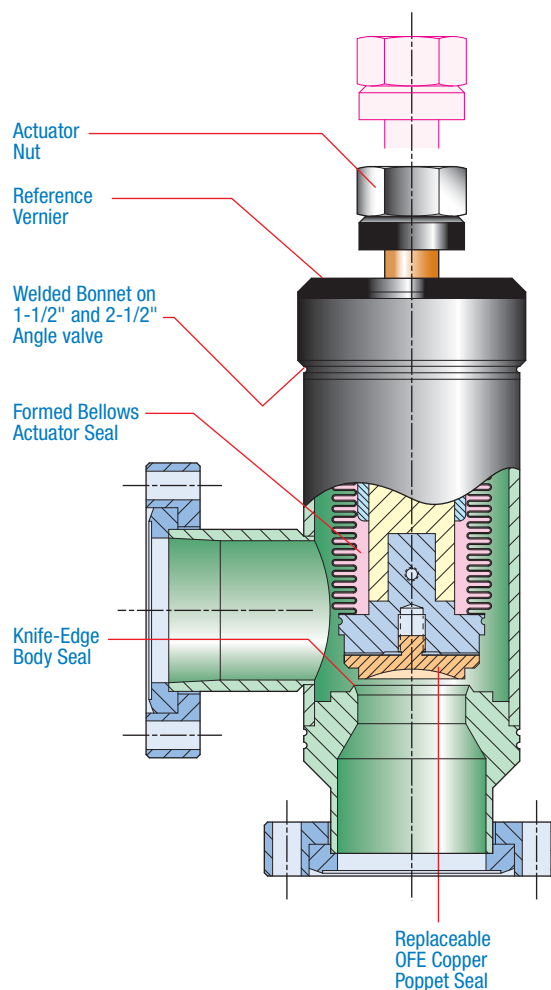
See tables

ULTRAHIGH VACUUM SERIES 450°C Metal Sealed Bonnet & Poppet

Features

- UHV compatible to 1x10⁻¹¹ Torr
- Manual actuation
- Hundreds of seal cycles per gasket
- Replaceable OFE copper poppet gasket
- High temperature service to 450°C
- 300 Series stainless steel construction
- Stainless steel bellows sealed actuator
- High conductance design

1-1/2" All-Metal Angle Valve Cross Section



MDC bakeable all-metal angle and inline valves are designed for use in ultrahigh vacuum environments where elevated temperatures preclude the use of elastomers and low temperature gasket metals. These valves provide reliable high temperature seals from atmospheric pressures to below 10^{-11} Torr.

Wherever possible, bonnet gasket seals have been eliminated in an effort to minimize the number of potential leak paths. Valves fitted with bonnet seals have been so designed to facilitate gasket replacement. The size and orientation of the valve body ports on bonnet fitted valves precludes gasket removal through its ports.

When operated at ambient temperatures, all-metal valves provide hundreds of leak free cycles between routine poppet gasket replacements. In high temperature applications, life cycles are inversely proportional to the bakeout temperatures. When operated at the maximum bakeout temperature of 450°C, the poppet seal gasket life is reduced to approximately 50 open/close cycles.

Seal Design

A vacuum seal is made by pressing the poppet OFE copper gasket onto a conical stainless steel knife edge seat as depicted in the diagram at top-right. The sealing pressure deforms the copper gasket, which conforms to the conical knife-edge seat. During thermal cycling the valve's loading mechanism counteracts component differential expansion to maintain a uniform pressure necessary for seal integrity.

Poppet Gasket Replacement

Poppet gasket replacement for the 1-1/2" and 2-1/2" all-metal angle valves must be done by removing the valve from the system, as these two valves have welded bonnets. Once detached from the system, gasket replacement is easily accomplished by inserting a standard blade screw driver into the bottom port and unscrewing the copper gasket, which is then extracted through the side port of the valve. The 3/4" angle valve and all inline valves are fitted with bonnet seals and do not require complete removal from the system for gasket replacement. Gasket removal and

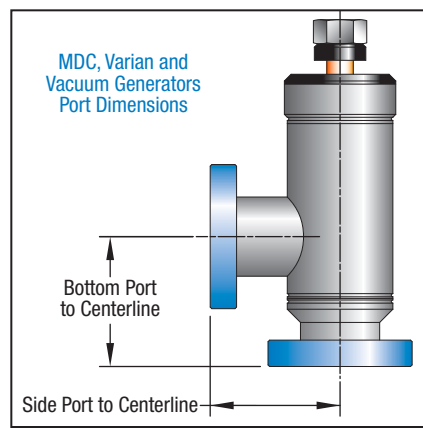
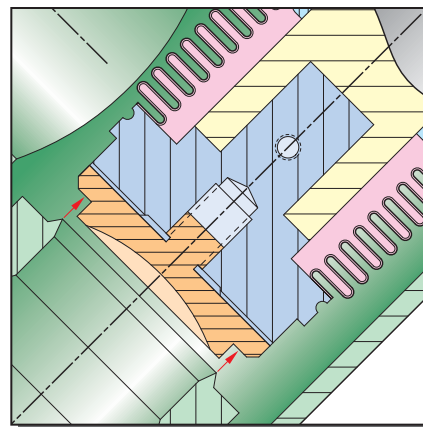
replacement is performed by detaching the bonnet flange from the valve body. Once the bonnet has been opened the gasket is easily detached by unscrewing with a standard blade screw driver.

Seal Torque

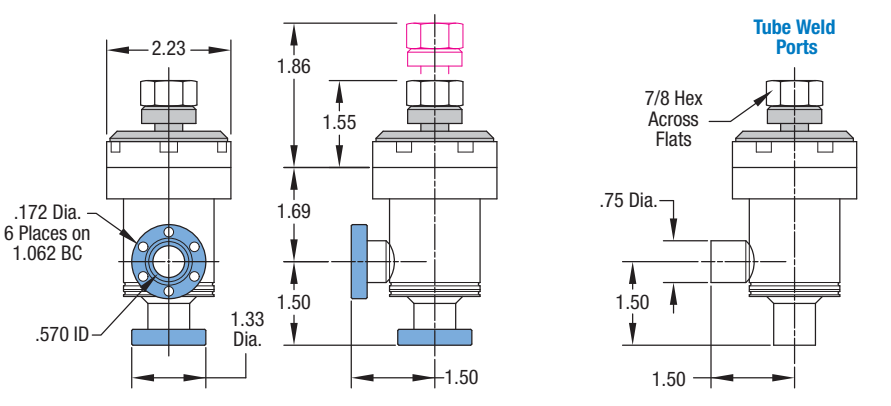
The first seal or closure in an all-metal valve causes plastic deformation of a virgin copper gasket leaving a permanent impression. This first closure is made at the factory and shipped to the customer in a ready to install sealed condition. Upon breaking this seal, resealing can be accomplished by torquing the valve according to the "Poppet Sealing Torque" data found in the specifications chart shown on page 234. To aid in the process of subsequent seal cycles the top of each valve body is fitted with a radially graduated vernier plate. The vernier plate provides a visual cue for previous and subsequent cycle or torque positions.

Valve Compatibility

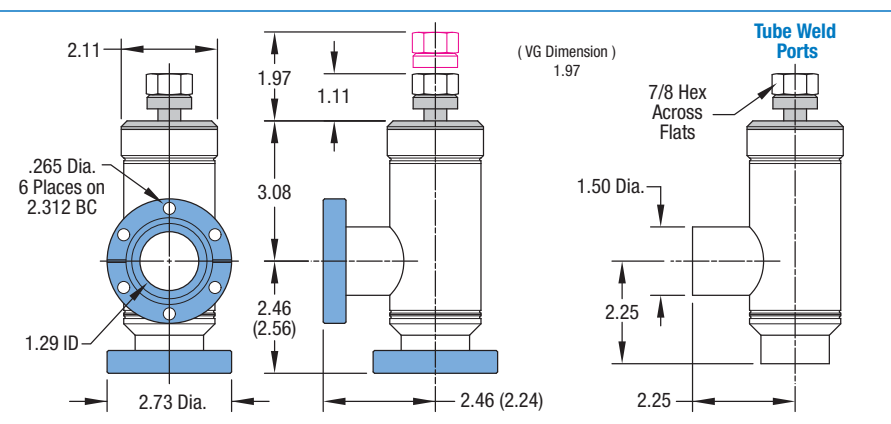
MDC offers Varian and Vacuum Generators (VG) compatible all-metal angle and inline valves. The Varian compatible valves have been labeled as "V" in the *valve type* column found in each product table. Vacuum Generators compatible valves are identified by a "VG" designation in the *valve type* column. Compatibility is defined herein as the ability to replace or interchange Varian and/or Vacuum Generators valves with MDC all-metal valves. Compatibility is limited to valves fitted with Del-Seal™ CF port flanges and exclusively to the port to port dimensional characteristics. In other words, the dimensions from any valves' flanged port centerline to the opposite ports' flange face are direct equivalents to Varian and VG valves. Other MDC all-metal valve dimensions may vary from those found on Varian and Vacuum Generators products. The "T" designation in the *valve type* column pertains to valves designed for either tube weld installation or custom flange attachment.



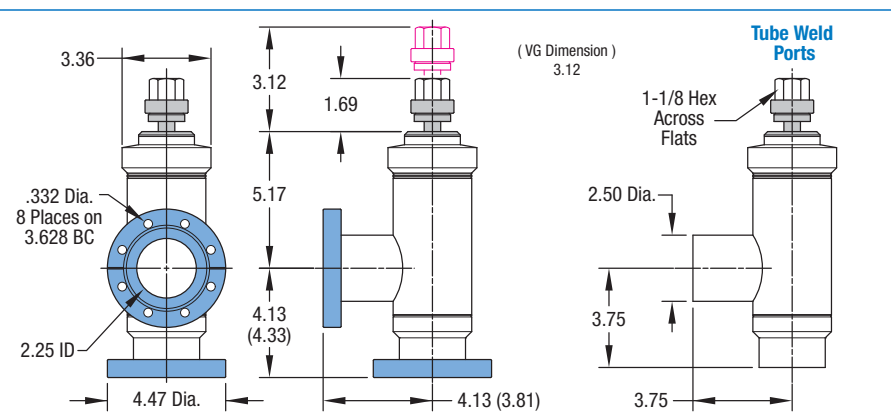
3/4" ANGLE VALVE



1-1/2" ANGLE VALVE



2-1/2" ANGLE VALVE



ANGLE VALVES

UHV All-Metal Series 450°C¹

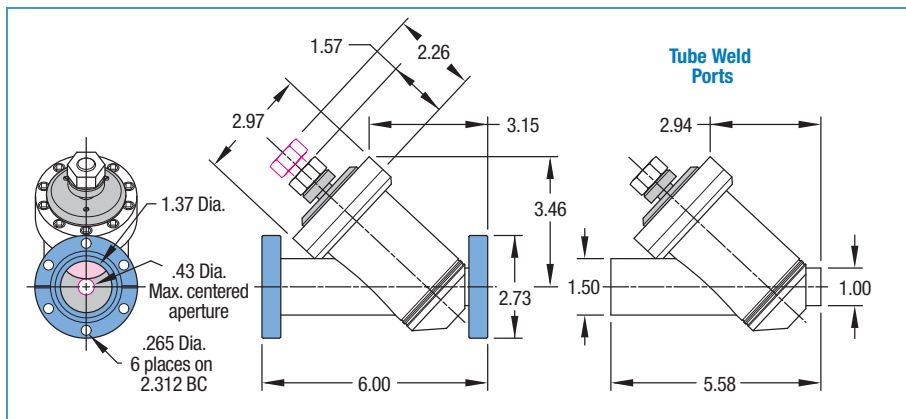
MDC all-metal angle valves designated as type "V" will interface in systems currently fitted with Varian all-metal angle valves. They have port to port dimensions which are compatible with Varian products. All-metal angle valves designated as type "VG" will interface in systems currently fitted with Vacuum Generators all-metal angle valves. They have port to port dimensions which are compatible with Vacuum Generators products.

VALVE SIZE	VALVE TYPE	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
3/4	T	TUBE WELD	METAL	1	MAV-075-T	314000
3/4	V	DEL-SEAL	METAL	2	MAV-075-V	314001
1-1/2	T	TUBE WELD	WELDED	3	MAV-150-T	314002
1-1/2	V	DEL-SEAL	WELDED	4	MAV-150-V	314003
1-1/2	VG	DEL-SEAL	WELDED	4	MAV-150-VG	314004
2-1/2	T	TUBE WELD	WELDED	15	MAV-250-T	314005
2-1/2	V	DEL-SEAL	WELDED	16	MAV-250-V	314006
2-1/2	VG	DEL-SEAL	WELDED	16	MAV-250-VG	314007

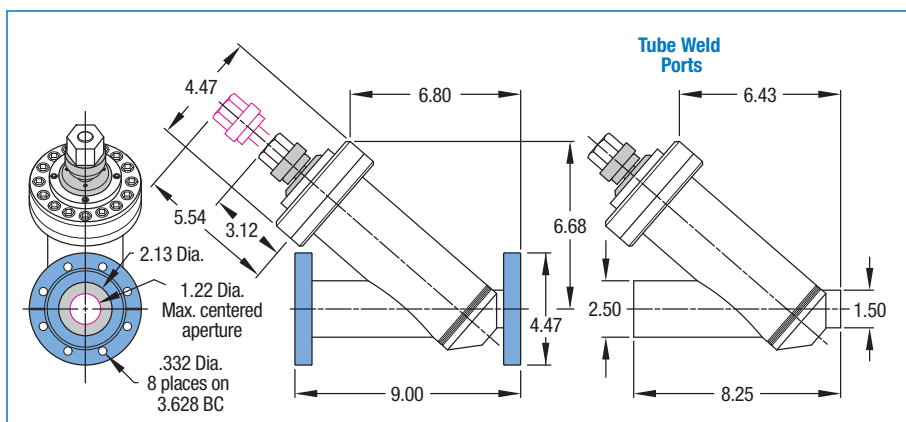
¹ See page 234 for detailed bakeout specifications

All-metal series angle & inline valve accessories are detailed at bottom of page 237

1-1/2" INLINE VALVE



2-1/2" INLINE VALVE



INLINE VALVES

UHV All-Metal Series 450°C¹

MDC all-metal inline valves designated as type "V" will interface in systems currently fitted with Varian all-metal inline valves. They have port to port dimensions which are compatible with Varian products.

VALVE SIZE	VALVE TYPE	PORT FLANGE	BONNET SEAL	WEIGHT POUNDS	REFERENCE	PART NUMBER
1-1/2	T	TUBE WELD	METAL	5	MIV-150-T	316000
1-1/2	V	DEL-SEAL	METAL	6	MIV-150-V	316001
2-1/2	T	TUBE WELD	METAL	17	MIV-250-T	316002
2-1/2	V	DEL-SEAL	METAL	18	MIV-250-V	316003

¹ See page 234 for detailed bakeout specifications

ACCESSORIES

HARDWARE & GASKETS



GASKET KIT USED WITH	GASKET TOTAL	Poppet	Bonnet	Port	MATERIAL	REFERENCE	PART NUMBER
3/4 ANGLE	2	1	1	-	OFE Copper	MAVG-075	351013
1-1/2 ANGLE	4	1	1 ²	2	OFE Copper	MAVG-150	351014
2-1/2 ANGLE	3	1	-	2	OFE Copper	MAVG-250	351015
1-1/2 INLINE	4	1	1	2	OFE Copper	MIVG-150	351014
2-1/2 INLINE	3	1	2	-	OFE Copper	MIVG-250	351015

HARDWARE	THREAD LENGTH	FOR USE WITH	QUANTITY PER PACK	REFERENCE	PART NUMBER
SOCKET HEAD SET	8-32 x 3/4"	1-1/3 CF	25	BA-075-SP	190037
12PT HEAD BOLT SET	.250-28 x 1-1/4"	2-3/4 CF	25	BA-150-12-SP	190061
12PT HEAD BOLT SET	.312-24 x 2"	4-1/2 CF	25	BA-200-12-SP	190063

² Used with Inline valve only



ULTRAHIGH VACUUM SERIES 450°C Metal Sealed Bonnet

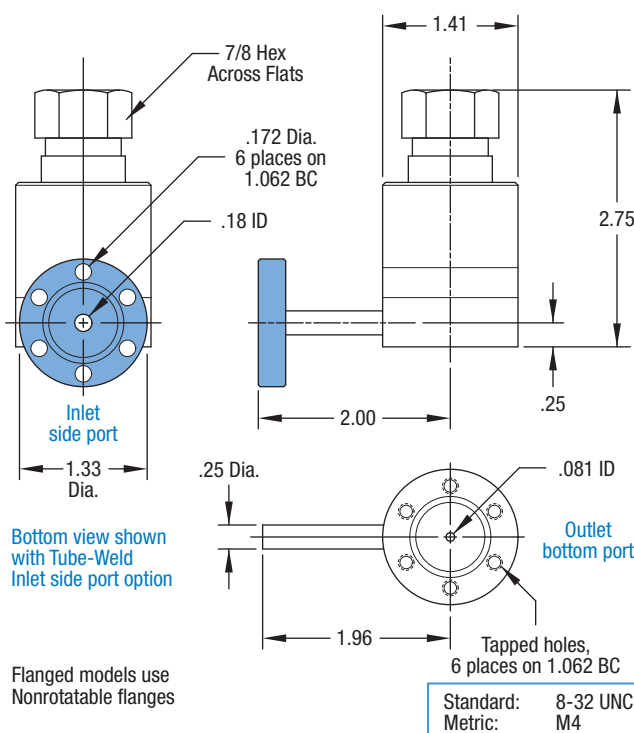
Features

- Adjustable leaks to 7.5×10^{-8} Torr l/sec
- High temperature service to 450°C
- Durable stellite superalloy seat
- Replaceable nickel diaphragm seal
- Manual actuator
- Stainless steel construction
- Dry film lubricated actuator
- Del-Seal™ CF ports

Specifications

Material	
Flanges	304ss
Valve Body / Seat	304ss / Stellite
Bolts	300ss
Gaskets, Poppet and Bonnet	Nickel
Port Fastening	
Bolt Type	Socket head and silver plated screws
Nut Type	Hexagonal nuts
Leak Rate	7.5×10^{-3} to 7.5×10^{-8} Torr l/sec
Inlet Pressure	≤ 750 Torr maximum
Temperature Rating	450°C
Weight	1Lb

All-metal MLV series leak valves are specifically designed to control gas admission into ultrahigh vacuum systems. They are manually actuated and ideally suited for handling hot or corrosive gases commonly used in demanding research environments. The valve body is constructed of type 304 stainless steel and fitted with a knife-edge seat made of a durable stellite superalloy. MDC ultrahigh vacuum leak valves are shipped in a leak-tight condition. Valve leak rates can be adjusted down to a minimum leak of 7.5×10^{-8} Torr l/sec. Leak rate is controlled by relieving the pressure applied to a replaceable nickel diaphragm. Although these valves can be fully closed and rendered leak tight, doing so repeatedly will reduce the life of the nickel diaphragm and require periodic replacement.



DESCRIPTION	WT LB	REFERENCE	PART NUMBER
VALVE, 1-1/3 CF	1	MLV-22	315002
VALVE, TUBE WELD	1	MLV-21	315003
VALVE, METRIC, 1-1/3 CF	1	E-MLV-22	315000
VALVE, METRIC, TUBE WELD	1	E-MLV-21	315001
NICKEL DIAPHRAGM	1	MLV-ND	931585



ULTRAHIGH VACUUM SERIES 450°C Welded Bonnet

Features

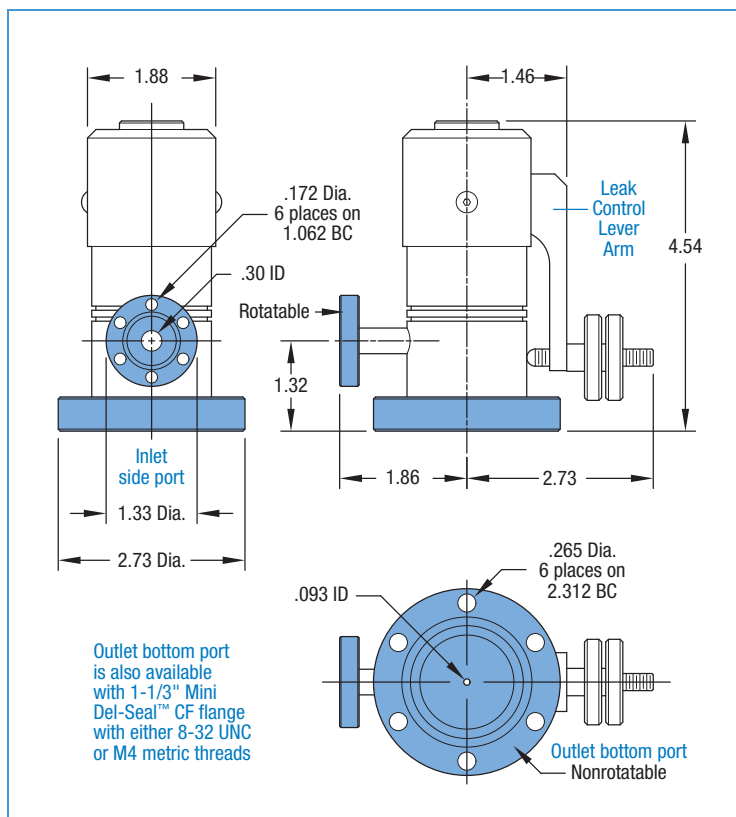
- Adjustable leaks to 1×10^{-10} Torr l/sec
- High temperature service to 450°C
- Replaceable sapphire poppet
- Replaceable OFE copper seat
- Manual cantilever actuator
- Stainless steel construction
- Dry film lubricated actuator
- Del-Seal™ CF ports

Specifications

Material	
Flanges	304ss
Valve Body / Seat	304ss / OFE Copper
Poppet	Sapphire
Bolts	300ss
Port Fastening	
Bolt Type	Silver plated 12-point and socket head bolts
Nut Type	Hexagonal nuts
Leak Rate	1×10^{-10} Torr l/sec
Inlet Pressure	≤ 750 Torr maximum
Temperature Rating	450°C
Weight	1Lb

All-metal ULV series precision ultrahigh vacuum leak valves are designed to control gas admission into high and ultra-high vacuum systems. They are manually actuated via a cantilever arm fitted with extra-fine pitch threads for precise adjustment. They are ideally suited for handling hot and corrosive gases commonly used in demanding research environments. The valve body is constructed of type 304 stainless steel and a replaceable OFE copper seat. The valve poppet is made of high purity sapphire and is also replaceable. ULV series precision leak valves are shipped in a leak-tight condition. Leak rates are controlled by relieving the pressure applied to the replaceable copper seat. Leak rates are adjustable down to a minimum of 1×10^{-10} Torr l/sec.

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
VALVE, 1-1/3 CF	3	ULV-075	315012
VALVE, METRIC, 1-1/3 CF	3	E-ULV-075	315013
VALVE, 2-3/4 CF	4	ULV-150	315010
SAPPHIRE SPARE KIT	1	ULV-SA	315011





Features

- Quick open / Quick close with positive locks
- Positive FKM / FPM fluoroelastomer O-ring vacuum seal
- Type 304 stainless steel valve body
- High conductance
- Choice of Del-Seal™ CF or Kwik-Flange™

Description

MDC Butterfly valves require only one-quarter turn rotation of the handle to go from fully open to the fully closed position. In the 1-1/3" Mini Del-Seal™ CF flange series, a spring loaded ball bearing becomes seated in an indent providing a positive mechanical stop. All other size valves employ a roll pin stop method.

These quick-acting Butterfly Valves feature an improved sealing action. The opening in the body of the valve has been machined at a slight angle to the plane of the flapper. The flapper is set to rotate slightly off-center. On closure, this causes the sealing pressure to be applied more uniformly all around the O-ring. A reliable, positive seal is made and the tendency of previous designs to roughen the surface of the O-ring and eject it from its groove is eliminated.

MDC Butterfly Valves are low outgassing. All internal surfaces are machined from solid stainless steel bar stock. The handle is made of aluminum. A small O-ring on the stem prevents shaft leakage. The valves are offered with a choice of Del-Seal™ CF ultrahigh vacuum metal-seal flanges or ISO Kwik-Flange™ O-ring seal flanges.

Specifications

Material

Flanges and body	304ss
Knob	Aluminum
O-rings	FKM / FPM fluoroelastomer elastomer

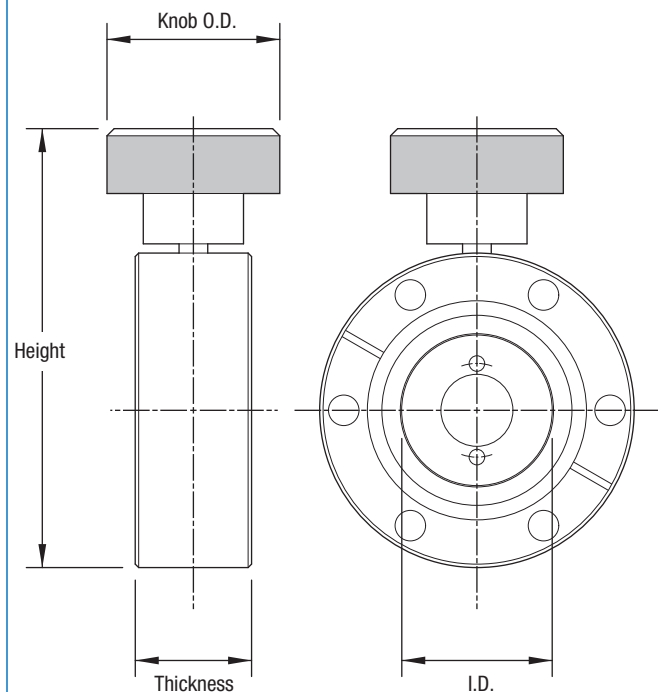
Vacuum Range 1x10⁻⁸ Torr

Temperature Rating 150°C open / 125°C closed

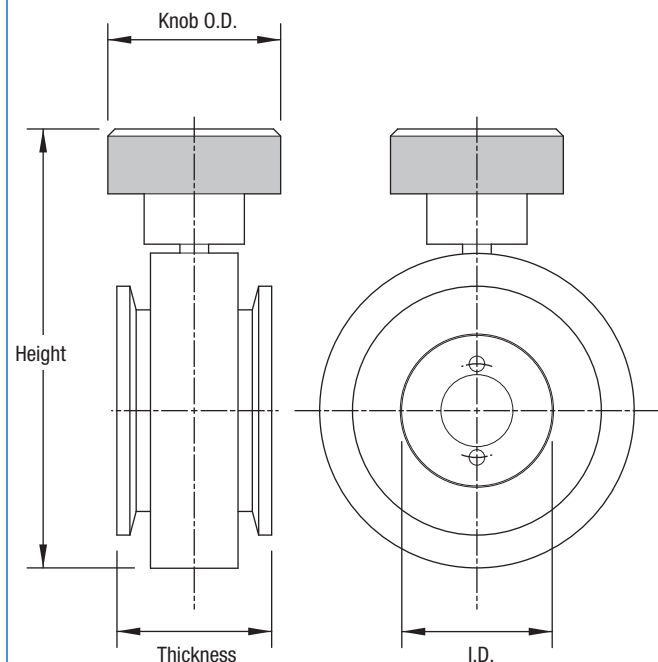
Weight and Dimensions See table

ULTRAHIGH & HIGH VACUUM SERIES

Del-Seal™ CF



Kwik-Flange™



All valves have identical flanges both sides

Del-Seal™ CF



NOM. SIZE	DEL-SEAL FLANGE	FLANGE O.D.	HEIGHT	THROUGH I.D.	THICKNESS	KNOB DIA.	WT LB	REFERENCE	PART NUMBER
3/4	1-1/3	1.33	1.96	.60	.75	.75	1	BFV-075	360000
1-1/2	2-3/4	2.73	3.81	1.33	1.00	1.50	1	BFV-150	360001
2	3-3/8	3.37	4.46	1.84	1.00	1.50	2-1/2	BFV-200	360002

Kwik-Flange™ KF



NOM. SIZE	ISO REF	FLANGE O.D.	HEIGHT	THROUGH I.D.	THICKNESS	KNOB DIA.	WT LB	REFERENCE	PART NUMBER
3/4	NW16	1.18	1.81	.60	1.25	.75	1	KBFV-075	360010
1	NW25	1.57	2.32	.87	1.25	.75	1	KBFV-100	360011
1-1/2	NW40	2.16	3.81	1.31	1.34	1.50	1	KBFV-150	360012
2	NW50	2.95	4.46	1.87	1.68	1.50	2-1/2	KBFV-200	360013

Accessories



DESCRIPTION ¹	NOMINAL SIZE	WT LB	REFERENCE	PART NUMBER
SEAL KIT	3/4	1/4	BFVG-075	360500
SEAL KIT	1	1/4	BFVG-100	360501
SEAL KIT	1-1/2	1/4	BFVG-150	360502
SEAL KIT	2	1/4	BFVG-200	360503

¹ Includes one stem seal and one flapper seal.

For port hardware, see Double Sided flanges for Del-Seal™ CF valves, and standard KF flanges for Kwik-Flange™ KF valves, Sections 1.1 and 1.2

3

Roughing Components



Foreline Traps

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Vacuum Pumps

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Accessories

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The MDC Precision family of roughing line traps

Features

- Molecular sieve trap
- Single piece coaxial trap
- Two piece coaxial trap
- Liquid nitrogen trap

Molecular Sieve Traps

Molecular sieve traps containing type 13X synthetic zeolite effectively prevent oil backstreaming and trap water vapors at room temperature. Type 13X zeolite will adsorb molecules with critical diameters up to 10 angstrom. The sieve charge can be reactivated by baking out in place when a base vacuum cannot be achieved. A valve should be used to isolate the evolved gas from the system during the bakeout cycle. During bakeout a mechanical pump removes the evolved gases from the sieve trapping material. To minimize down-time, bakeouts can be conducted, with the aid of a timer, during system off-hours. Oils trapped by the sieve material will not be evolved by baking. Periodic replacement of the sieve material is required whenever the sieve material exhibits evidence of hydrocarbon saturation as determined by empirical observation. The sieve trapping material is easily replaced through a port fitted to the top of the trap. Molecular sieve traps can be mounted in a vertical or horizontal position. A trap's built-in heater requires customer wiring to a 115VAC wall outlet. Once turned on, the heater reaches and maintains a self-regulated and constant 150°C temperature. Bakeout time depends on the amount of water vapor loading of the zeolite and can range from 4 to 12 hours.

Coaxial Traps

Coaxial foreline traps offer easy maintenance and room temperature operation, they require no bakeout or cooling and are virtually maintenance-free. They are ideally suited for trapping roughing pump hydrocarbons from backstreaming into a vacuum system. Single piece coaxial foreline traps contain absorbent filter cartridges with a bronze wool element. This filter element is permanently sealed inside the trap's body and can't be removed or replaced. These traps are serviced by replacing them with a

spare unit while cleaning the contaminated trap. Single piece traps are available in 4" and 6" body diameters.

In contrast to the single piece units, the two piece coaxial foreline traps offer a wider selection of filter element materials. Filter elements for a two piece trap are removable stainless steel screen cartridges filled with copper, stainless steel or bronze wools, activated alumina, activated carbon or dual element absorbent materials. During operation, pump oil coalesces on the element and returns to the pump. Activated alumina effectively adsorbs acids and water vapor while activated carbon adsorbs organics and water vapor. Filter cartridges are quickly and easily replaced by removing the banded clamp that fastens the two-piece body. MDC recommends keeping a spare element on-hand for a quick change to minimize down time. Reusable elements may be cleaned and ready for the next exchange. Note that filter elements are not included with trap assemblies and must be ordered separately. Two piece traps are offered with 2", 4", 6" and 8" body diameters. All coaxial trap bodies are made of type 304 stainless steel and are offered with a choice of hose or flange style connections. Del-Seal™ CF metal seal flange connections have one fixed and one rotatable flange for alignment purposes. Kwik-Flange™ ISO KF and Large-Flange™ ISO LF flanges are clamp-style. Hose connections may also be welded, but permanent installation must be carefully evaluated.

Contaminated traps may be cleaned with a solvent and allowed to dry before replacing into service. MDC recommends having a spare trap or filter element available for rapid replacement to minimize down time during the cleaning process.



Molecular sieve traps

All dimensions in this catalog are given in inches unless specified otherwise.

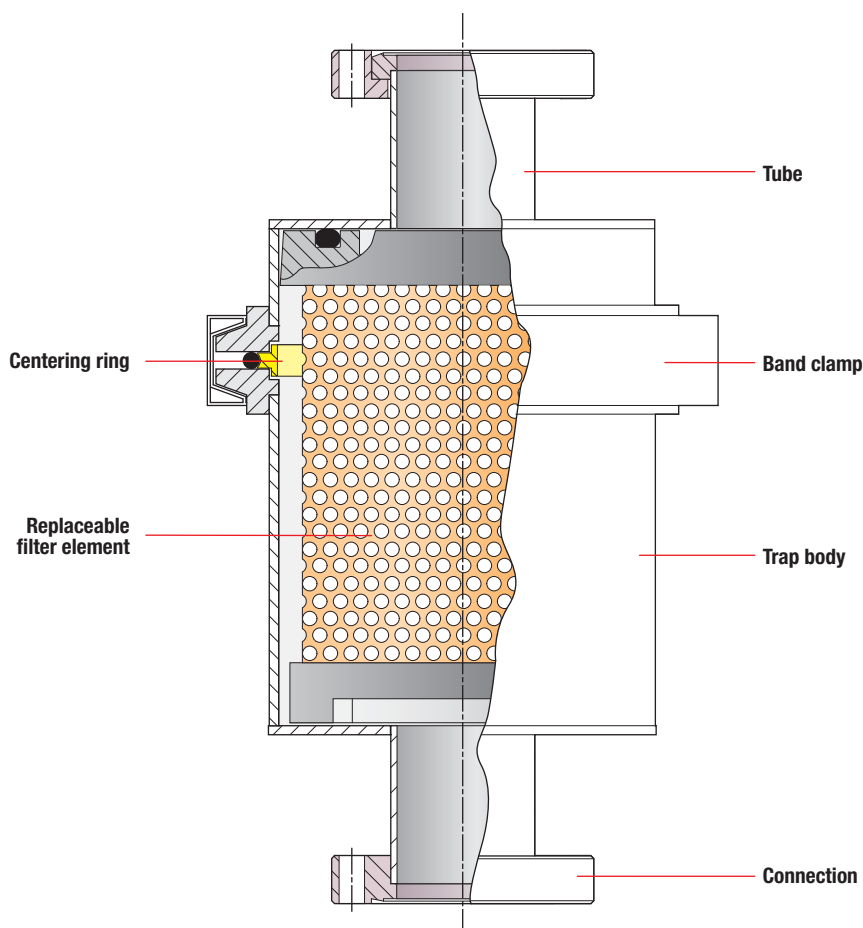
Liquid Nitrogen Traps

Liquid nitrogen traps remove condensables before they enter the pump or backstream from the pump to the vacuum system. Water trapping by the liquid nitrogen cooled surface is complete and permanent.

Liquid nitrogen traps can be fitted with a customer-supplied coolant level controller to automatically replenish consumed liquid nitrogen.

In general, trap performance will vary with the specific application, usage, number of process cycles and relative humidity in the region. One cycle per day in an R&D application could provide approximately six months of maintenance free service. Production type applications will require more stringent preventative maintenance programs tailored to a specific application.

Typical two-piece coaxial trap assembly
Shown with Dual-Element Cartridge



Coaxial, single piece traps

page 248



Coaxial, two piece traps

page 250



Liquid nitrogen traps

page 254



Features

- Effectively blocks backstreaming by absorbing hydrocarbons
- Traps water vapor
- Regeneration using built-in heater
- Type 304 stainless steel trap body
- Available in five connection sizes

Description

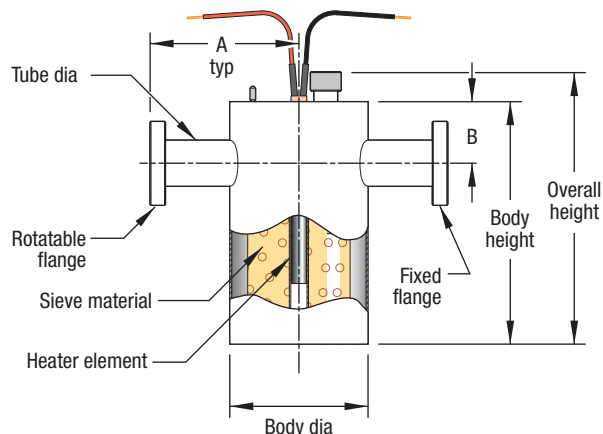
Molecular Sieve Traps containing Type 13X synthetic zeolite effectively prevent oil backstreaming at room temperature. They also trap water vapor in the sieve charge. The sieve charge can be reactivated by baking out in place when the base vacuum cannot be achieved. A valve should be used to isolate evolved gas from the system during bakeout cycle. During the bakeout the mechanical pump removes the evolved gas from the sieve trapping material. Normal bakeout can be accomplished by use of a timer during system off-hours.

Any oils trapped by the sieve material cannot be removed by baking. Periodic replacement is required whenever the sieve material exhibits evidence of hydrocarbon loading as determined by empirical observation. Sieve trapping material can be replaced through port on top of trap. Traps can be mounted in the standard vertical or horizontal position.

The built-in heater requires wiring to a 115 VAC wall outlet. Once turned on, the heater reaches and maintains a self-regulated constant 150°C temperature. Bakeout time depends on the amount of water vapor loading of the zeolite, within the range of 4 to 12 hours.

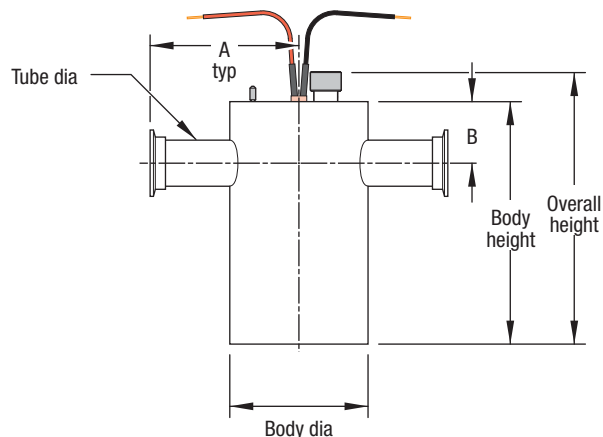
ULTRAHIGH & HIGH VACUUM SERIES

Del-Seal™ CF ports

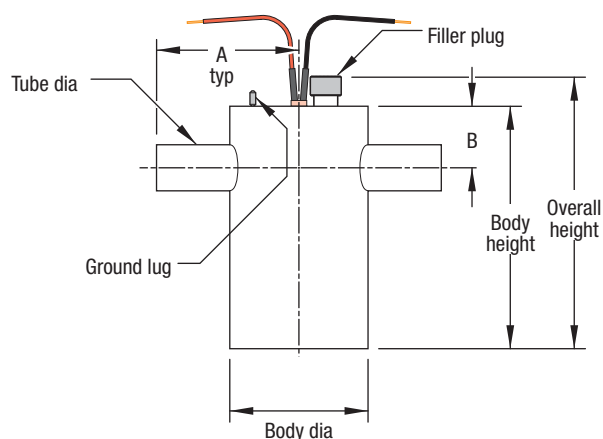


ISO KF and LF ports

3/4" to 2" Tube dia: Kwik-Flange™
3" Tube dia: Large-Flange™



Hose connection





Del-Seal™ CF



TRAP SIZE	DEL-SEAL FLANGE	TUBE DIA.	BODY DIA.	BODY HEIGHT	OVERALL HEIGHT	A	B	WT LB	REFERENCE	PART NUMBER
4	1-1/3	.75	4.50	5.25	6.38	5.00	1.69	4	MST-075-2	431016
4	2-1/8	1.00	4.50	5.25	6.38	4.67	1.69	5	MST-100-2	431003
4	2-3/4	1.50	4.50	7.88	9.00	4.70	2.00	5-1/2	MST-150-2	431006
4	3-3/8	2.00	4.50	7.88	9.00	4.72	2.00	6	MST-200-2	431009
6	4-5/8	3.00	6.00	10.00	11.13	5.87	3.00	7-1/2	MST-300-2	431012

ISO KF and ISO LF



TRAP SIZE	ISO REF.	TUBE DIA.	BODY DIA.	BODY HEIGHT	OVERALL HEIGHT	A	B	WT LB	REFERENCE	PART NUMBER
4	NW16	.75	4.50	5.25	6.38	5.00	1.69	4	KMST-075-2	431029
4	NW25	1.00	4.50	5.25	6.38	4.67	1.69	5	KMST-100-2	431030
4	NW40	1.50	4.50	7.88	9.00	4.71	2.00	5-1/2	KMST-150-2	431031
4	NW50	2.00	4.50	7.88	9.00	4.73	2.00	6	KMST-200-2	431032
6	NW80	3.00	6.00	10.00	11.13	5.75	3.00	7-1/2	LMST-300-2	431033

Hose Connection



TRAP SIZE	TUBE DIA.	TUBE WALL	BODY DIA.	BODY HEIGHT	OVERALL HEIGHT	A	B	WT LB	REFERENCE	PART NUMBER
4	.75	.035	4.50	5.25	6.38	4.50	1.69	4	MST-075	431000
4	1.00	.065	4.50	5.25	6.38	4.50	1.69	5	MST-100	431001
4	1.50	.065	4.50	7.88	9.00	4.50	2.00	5-1/2	MST-150	431004
4	2.00	.065	4.50	7.88	9.00	4.50	2.00	6	MST-200	431007
6	3.00	.065	6.00	10.00	11.13	5.50	3.00	7-1/2	MST-300	431010

Accessories



DESCRIPTION	WT LB	REFERENCE	PART NUMBER
MOLECULAR SIEVE REPLACEMENT CHARGE, TYPE 13X, 1-1/2 LB ¹	1-1/2	MST-C	431013
REPLACEMENT HEATER ASSEMBLY, 115 V, 75 W	1/4	MST-H	431014

Mechanical Pump Size	Recommended Trap Size	Gas Handling Load (50% Rel Humidity)	Capacity lbs	Trap Ref. No.	¹ Number Charges Required
Up to 8 cfm	3/4 & 1	60 cu. ft.	1.1	MST-075 & -100	1
8 to 17 cfm	1-1/2	125 cu. ft.	1.6	MST-150	2
17 to 30 cfm	2	125 cu. ft.	1.6	MST-200	2
Over 30 cfm	3	150 cu. ft.	4.0	MST-300	3



Features

- Significantly reduces oil backstreaming
- Low cost one-piece body design
- Bronze wool element
- Type 304 stainless steel trap body
- Four-inch and six-inch body diameters

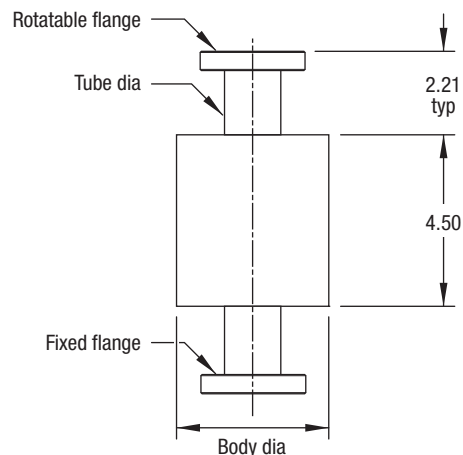
Description

Coaxial foreline traps offer easy maintenance and room temperature operation, they require no bakeout or cooling and are virtually maintenance-free. They are ideally suited for trapping roughing pump hydrocarbons and preventing them from backstreaming into a vacuum system. Single piece coaxial foreline traps contain absorbent filter cartridges filled with a bronze wool element. This filter element is permanently sealed inside the trap's body and can't be removed or replaced. These traps are serviced by replacing them with a spare unit while cleaning the contaminated trap. Single piece traps are available in 4" and 6" body diameters.

Trap bodies are manufactured from type 304 stainless steel. Traps are offered with a choice of hose or flange connections in seven sizes. Del-Seal™ CF metal seal flange connections have one fixed and one rotatable flange for alignment purposes. Kwik-Flange™ and Large-Flange™ ISO flanges are clamp-style. Hose connections may also be welded, but permanent installation is not recommended. Used traps may be cleaned with a solvent and allowed to dry before replacing into service. MDC recommends having a spare trap available for rapid replacement to minimize down time. The used unit may be cleaned and stored for re-use as convenient.

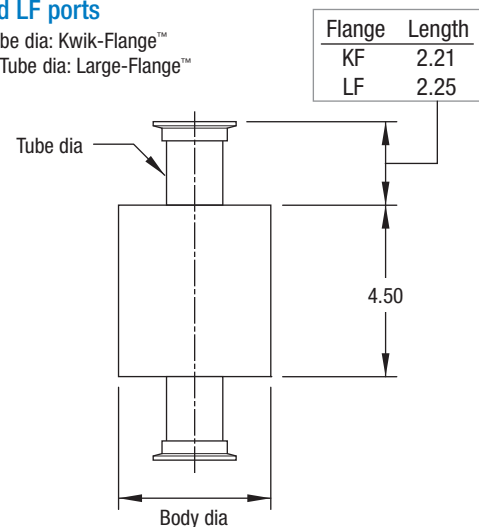
ULTRAHIGH & HIGH VACUUM SERIES

Del-Seal™ CF ports

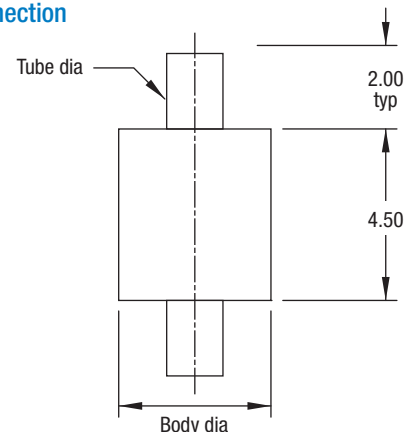


ISO KF and LF ports

3/4" to 2" Tube dia: Kwik-Flange™
2-1/2" to 4" Tube dia: Large-Flange™



Hose connection





Del-Seal™ CF



TRAP SIZE	DEL-SEAL FLANGE	TUBE DIA.	BODY DIA.	WT LB	REFERENCE	PART NUMBER
4	1-1/3	.75	4.00	2-1/2	TX-075-2	430000
4	2-1/8	1.00	4.00	3	TX-100-2	430003
4	2-3/4	1.50	4.00	4-1/2	TX-150-2	430006
4	3-3/8	2.00	4.00	5	TX-200-2	430009
4	4-1/2	2.50	4.00	5	TX-250-2	430012
4	4-5/8	3.00	4.00	5-1/2	TX-300-2	430015
6	6	4.00	6.00	6-1/2	TX-400-2	430018

ISO KF and ISO LF



TRAP SIZE	ISO REF	TUBE DIA.	BODY DIA.	WT LB	REFERENCE	PART NUMBER
4	NW16	.75	4.00	2-1/2	KTX-075-2	430050
4	NW25	1.00	4.00	3	KTX-100-2	430051
4	NW40	1.50	4.00	4-1/2	KTX-150-2	430052
4	NW50	2.00	4.00	5	KTX-200-2	430053
4	NW63	2.50	4.00	5	LTX-250-2	430054
4	NW80	3.00	4.00	5-1/2	LTX-300-2	430062
6	NW100	4.00	6.00	6-1/2	LTX-400-2	430055

Hose Connection



TRAP SIZE	TUBE DIA.	BODY DIA.	WT LB	REFERENCE	PART NUMBER
4	.75	4.00	2-1/2	TX-075	430002
4	1.00	4.00	3	TX-100	430005
4	1.50	4.00	4-1/2	TX-150	430008
4	2.00	4.00	5	TX-200	430011
4	2.50	4.00	5	TX-250	430014
4	3.00	4.00	5-1/2	TX-300	430017
6	4.00	6.00	6-1/2	TX-400	430020



Features

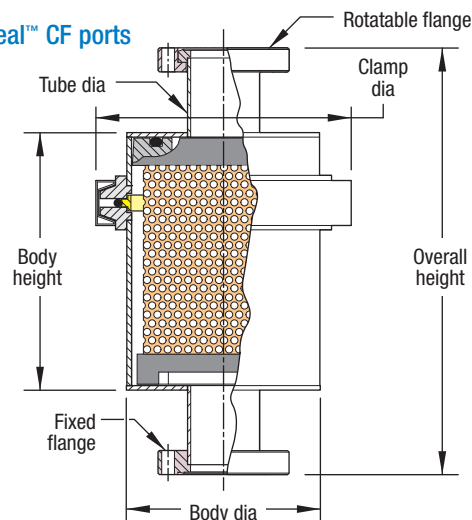
- Significantly reduces oil backstreaming
- Two-piece clamped body design for easy element replacement
- Choice of copper, stainless steel, bronze, activated alumina and activated carbon filter elements
- Two-inch through eight-inch body diameters
- Type 304 stainless steel trap body
- FKM / FPM fluoroelastomer O-ring body seal

Description

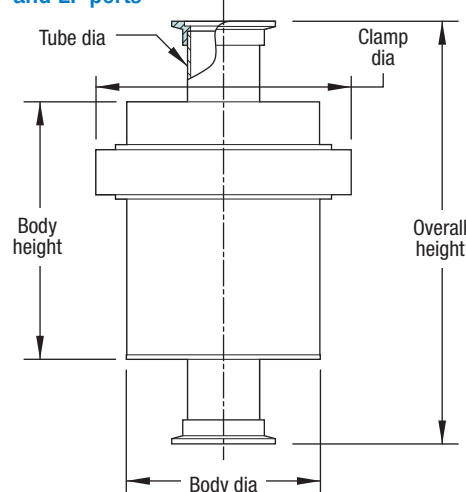
In contrast to the single piece units on the previous two pages, the two-piece coaxial foreline traps offer a wider selection of filter element materials. Filter elements for a two-piece trap are removable stainless steel screen cartridges filled with copper, stainless steel or bronze wools, activated alumina, activated carbon or dual element absorbent material. During operation, pump oil coalesces on the element and returns to the pump. Activated alumina effectively adsorbs acids and water vapor, while activated carbon adsorbs organics and water vapor. Filter cartridges are quickly and easily replaced by removing the banded clamp that fastens the two-piece body. MDC recommends keeping a spare element on-hand for a quick change to minimize down time. Reusable elements may be cleaned and ready for the next exchange. Note that filter elements are not included with trap assemblies and must be ordered separately. Two-piece traps are offered with 2", 4", 6" and 8" body diameters. All coaxial trap bodies are made of type 304 stainless steel and are offered with a choice of hose or flange style connections. Del-Seal™ CF metal seal flange connections have one fixed and one rotatable flange for alignment purposes. Kwik-Flange™ ISO KF and Large-Flange™ ISO LF flanges are clamp-style. Hose connections may also be welded, but permanent installation must be carefully evaluated. Contaminated traps may be cleaned with a solvent and allowed to dry before replacing into service. MDC recommends having a spare trap or filter element available for rapid replacement to minimize down time during the cleaning process. Filter elements are not included with trap assemblies; they must be ordered separately from the tables on page 253.

ULTRAHIGH & HIGH VACUUM SERIES

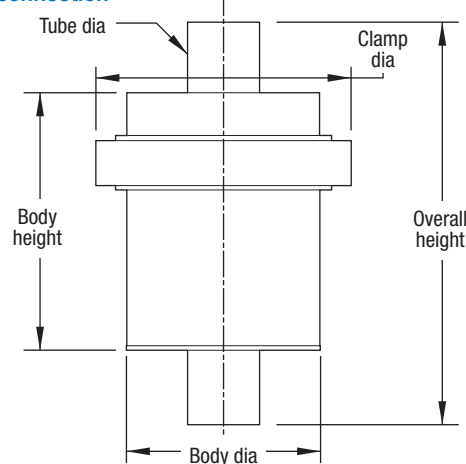
Del-Seal™ CF ports



ISO KF and LF ports



Hose connection



Foreline Traps

Coaxial with Replaceable Filter



Section 3.1

Del-Seal™ CF



TRAP SIZE	DEL-SEAL FLANGE	TUBE DIA.	BODY DIA.	BODY HEIGHT	OVERALL HEIGHT	CLAMP O.D.	WT LB	REFERENCE	PART NUMBER
2	1-1/3	.75	2.00	5.32	9.32	4.54	2	DFT-2075-2	433002
2	2-1/8	1.00	2.00	5.32	8.66	4.54	2	DFT-2100-2	433005
4	1-1/3	.75	4.00	5.31	9.31	5.38	5	DFT-4075-2	433008
4	2-1/8	1.00	4.00	5.31	8.65	5.38	5	DFT-4100-2	433011
4	2-3/4	1.50	4.00	5.31	8.73	5.38	5	DFT-4150-2	433014
4	3-3/8	2.00	4.00	5.31	8.76	5.38	5	DFT-4200-2	433017
6	2-3/4	1.50	6.00	7.07	10.49	7.25	15	DFT-6150-2	433020
6	3-3/8	2.00	6.00	7.07	10.52	7.25	15	DFT-6200-2	433023
6	4-1/2	2.50	6.00	7.07	10.82	7.25	15	DFT-6250-2	433026
6	4-5/8	3.00	6.00	7.07	10.82	7.25	15	DFT-6300-2	433029
8	4-1/2	2.50	8.00	10.07	13.82	9.56	25	DFT-8250-2	433032
8	4-5/8	3.00	8.00	10.07	13.82	9.56	25	DFT-8300-2	433035
8	6	4.00	8.00	10.07	13.94	9.56	25	DFT-8400-2	433038
8	8	6.00	8.00	10.07	14.07	9.56	25	DFT-8600-2	433041

ISO KF and ISO LF



TRAP SIZE	ISO REF.	TUBE DIA.	BODY DIA.	BODY HEIGHT	OVERALL HEIGHT	CLAMP O.D.	WT LB	REFERENCE	PART NUMBER
2	NW16	.75	2.00	5.32	9.32	4.54	2	KDFT-2075-2	433003
2	NW25	1.00	2.00	5.32	8.66	4.54	2	KDFT-2100-2	433006
4	NW16	.75	4.00	5.31	9.31	5.38	5	KDFT-4075-2	433009
4	NW25	1.00	4.00	5.31	8.65	5.38	5	KDFT-4100-2	433012
4	NW40	1.50	4.00	5.31	8.73	5.38	5	KDFT-4150-2	433015
4	NW50	2.00	4.00	5.31	8.76	5.38	5	KDFT-4200-2	433018
6	NW40	1.50	6.00	7.07	10.49	7.25	15	KDFT-6150-2	433021
6	NW50	2.00	6.00	7.07	10.52	7.25	15	KDFT-6200-2	433024
6	NW63	2.50	6.00	7.07	10.57	7.25	15	LDFT-6250-2	433027
6	NW80	3.00	6.00	7.07	10.57	7.25	15	LDFT-6300-2	433030
8	NW63	2.50	8.00	10.07	13.57	9.56	25	LDFT-8250-2	433033
8	NW80	3.00	8.00	10.07	13.57	9.56	25	LDFT-8300-2	433036
8	NW100	4.00	8.00	10.07	13.57	9.56	25	LDFT-8400-2	433039
8	NW160	6.00	8.00	10.07	13.57	9.56	25	LDFT-8600-2	433042

Hose Connection



TRAP SIZE	TUBE DIA.	BODY DIA.	BODY HEIGHT	OVERALL HEIGHT	CLAMP O.D.	WT LB	REFERENCE	PART NUMBER
2	.50	2.00	5.32	8.32	4.54	2	DFT-2050	433000
2	.75	2.00	5.32	8.32	4.54	2	DFT-2075	433001
2	1.00	2.00	5.32	8.32	4.54	2	DFT-2100	433004
4	.75	4.00	5.31	8.31	5.38	5	DFT-4075	433007
4	1.00	4.00	5.31	8.31	5.38	5	DFT-4100	433010
4	1.50	4.00	5.31	8.31	5.38	5	DFT-4150	433013
4	2.00	4.00	5.31	8.31	5.38	5	DFT-4200	433016
6	1.50	6.00	7.07	10.07	7.25	15	DFT-6150	433019
6	2.00	6.00	7.07	10.07	7.25	15	DFT-6200	433022
6	2.50	6.00	7.07	10.07	7.25	15	DFT-6250	433025
6	3.00	6.00	7.07	10.07	7.25	15	DFT-6300	433028
8	2.50	8.00	10.07	13.07	9.56	25	DFT-8250	433031
8	3.00	8.00	10.07	13.07	9.56	25	DFT-8300	433034
8	4.00	8.00	10.07	13.07	9.56	25	DFT-8400	433037
8	6.00	8.00	10.07	13.07	9.56	25	DFT-8600	433040

Replaceable Filter Elements,
page 252



Filters for two-piece coaxial traps

Features

- Easy exchange of cartridges
- Metal sieve units are reusable
- Use with two-piece coaxial trap bodies detailed on page 251

Description

Two-piece coaxial foreline traps offer a wide selection of replaceable filter element materials. Filter elements for a two-piece trap are removable stainless steel screen cartridges filled with copper, stainless steel or bronze wools, activated alumina, activated carbon or dual element absorbent material.

Metal wool filter elements are used primarily for the trapping of pump oil backstreaming through a vacuum system. During pump operation, oil coalesces on the metal wool element and drains back to the vacuum pump. Activated alumina effectively adsorbs both acids and water vapor while activated carbon adsorbs organics and water vapor. The selection chart at the bottom of the facing page will help in choosing a filter element for your specific application.

Filter cartridges are quickly and easily replaced by removing the banded clamp that fastens a two-piece coaxial trap body. To minimize down time, MDC recommends keeping spare filter elements on-hand for quick replacement. Reusable elements may be cleaned and stored for the next exchange. With the exception of the activated carbon and dual element filters, all others are reusable. Filter elements are not included with trap assemblies and must be ordered separately using the part numbers detailed on the next page. Filters for 2", 4", 6" and 8" body diameters are included. Contaminated elements may be cleaned with a solvent and allowed to dry before reusing.

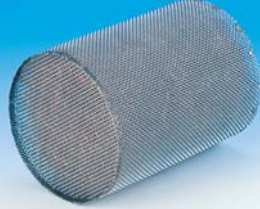




Copper



Stainless Steel



Bronze



Activated Alumina



Activated Carbon



Dual Element



DESCRIPTION

REFERENCE

**PART
NUMBER**

USE WITH 2" BODY TRAPS

COPPER SIEVE ELEMENT	DFT-2F-CU	433050
STAINLESS STEEL SIEVE ELEMENT	DFT-2F-SS	433051
BRONZE SIEVE ELEMENT	DFT-2F-BR	433052
ACTIVATED ALUMINA CARTRIDGE ²	DFT-2F-AA	433053
ACTIVATED CARBON CARTRIDGE ²	DFT-2F-AC	433054

USE WITH 4" BODY TRAPS

COPPER SIEVE ELEMENT	DFT-4F-CU	433055
STAINLESS STEEL SIEVE ELEMENT	DFT-4F-SS	433056
BRONZE SIEVE ELEMENT	DFT-4F-BR	433057
ACTIVATED ALUMINA CARTRIDGE ²	DFT-4F-AA	433058
ACTIVATED CARBON CARTRIDGE ²	DFT-4F-AC	433059
DUAL ELEMENT AC / FG ^{1,2}	DFT-4F-DE	433060

USE WITH 6" BODY TRAPS

COPPER SIEVE ELEMENT	DFT-6F-CU	433061
STAINLESS STEEL SIEVE ELEMENT	DFT-6F-SS	433062
BRONZE SIEVE ELEMENT	DFT-6F-BR	433063
ACTIVATED ALUMINA CARTRIDGE ²	DFT-6F-AA	433064
ACTIVATED CARBON CARTRIDGE ²	DFT-6F-AC	433065
DUAL ELEMENT AC / FG ^{1,2}	DFT-6F-DE	433066

USE WITH 8" BODY TRAPS

COPPER SIEVE ELEMENT	DFT-8F-CU	433067
STAINLESS STEEL SIEVE ELEMENT	DFT-8F-SS	433068
BRONZE SIEVE ELEMENT	DFT-8F-BR	433069
ACTIVATED ALUMINA CARTRIDGE ²	DFT-8F-AA	433070
ACTIVATED CARBON CARTRIDGE ²	DFT-8F-AC	433071

¹ Activated Carbon and Fiberglass

² Requires initial pump-down

Filter Element Selection Table

	Stainless Steel	Copper	Bronze	Activated Alumina	Activated Carbon	Dual Element	
Prevent Oil Back-Streaming - - - - -	XXX	XXX	XXX	X	X	XXX	Effectiveness Rating: xxx Very Good xx Good x Fair
Trap Water Vapor - - - - -				XX	XX		
Trap Organics - - - - -					XXX	XXX	
Trap Acid Vapors - - - - -				XXX			

This table is offered as a general guideline for filter selection. Please contact factory for additional information.



Features

- Traps all types of condensable vapors
- Two-piece clamped body for easy maintenance
- Type 304 stainless steel trap body
- Aluminum centering ring with FKM / FPM fluoroelastomer O-ring
- Low LN₂ consumption

Description

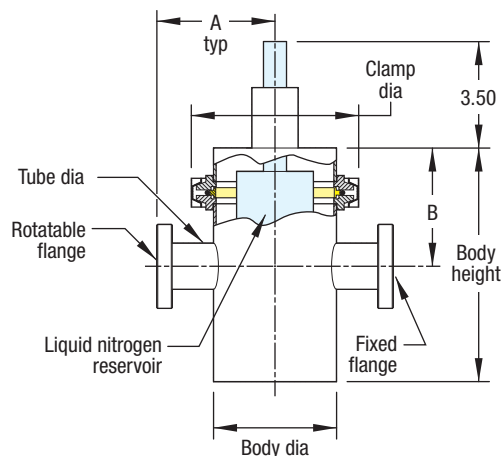
Liquid nitrogen traps remove condensables before they enter the pump or backstream from the pump to the vacuum system. Water trapping by the liquid nitrogen cooled stainless steel surface is complete and permanent.

Liquid nitrogen is added to the reservoir through a fill and vent tube at the top of the trap. A liquid level sensor from a customer-supplied controller can also be inserted through the tube. Reservoir capacities, given in liters, are listed in the product tables.

Liquid nitrogen consumption is largely dependent on the level of vacuum maintained in the roughing line. Other factors such as frequency of vacuum cycling, ambient relative humidity and gas bleed also affect consumption. Regeneration is achieved by isolating the trap from the vacuum system and removing the band clamp to separate the upper and lower body sections.

ULTRAHIGH & HIGH VACUUM SERIES

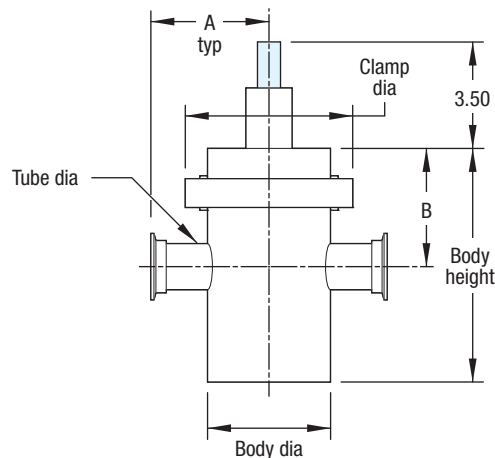
Del-Seal™ CF ports



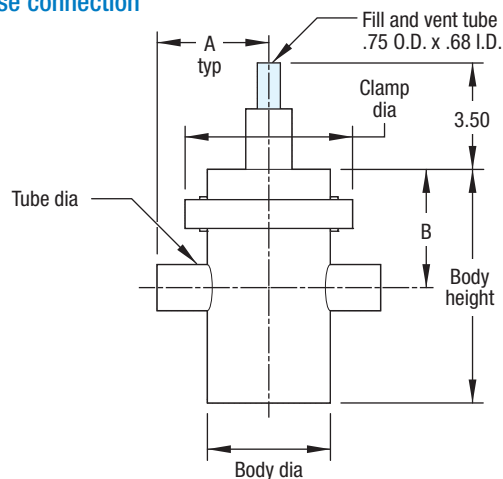
ISO KF and LF ports

3/4" to 2" Tube dia: Kwik-Flange™

2-1/2" to 4" Tube dia: Large-Flange™



Hose connection



Foreline Traps

Liquid Nitrogen



Section 3.1

Del-Seal™ CF



TRAP SIZE	NOM. CAP. ¹	DEL-SEAL FLANGE	TUBE DIA.	BODY DIA.	BODY HEIGHT	A	B	CLAMP O.D.	WT LB	REFERENCE	PART NUMBER
4	.45	1-1/3	.75	4.00	7.57	4.00	3.84	5.50	6	DFT-4075-2LN	434001
4	.45	2-1/8	1.00	4.00	7.57	3.67	3.84	5.50	6	DFT-4100-2LN	434004
4	.45	2-3/4	1.50	4.00	7.57	3.70	3.84	5.50	6	DFT-4150-2LN	434007
6	1.59	2-3/4	1.50	6.00	10.26	4.70	5.73	7.50	13	DFT-6150-2LN	434010
6	1.59	3-3/8	2.00	6.00	10.26	4.72	5.73	7.50	13	DFT-6200-2LN	434013
6	1.59	4-1/2	2.50	6.00	10.26	4.87	5.73	7.50	13	DFT-6250-2LN	434016
8	4.13	4-1/2	2.50	8.00	11.26	5.87	6.26	9.62	25	DFT-8250-2LN	434019
8	4.13	4-5/8	3.00	8.00	11.26	5.87	6.26	9.62	25	DFT-8300-2LN	434022
8	4.13	6	4.00	8.00	11.26	5.93	6.26	9.62	25	DFT-8400-2LN	434025

ISO KF and ISO LF



TRAP SIZE	NOM. CAP. ¹	ISO REF.	TUBE DIA.	BODY DIA.	BODY HEIGHT	A	B	CLAMP O.D.	WT LB	REFERENCE	PART NUMBER
4	.45	NW16	.75	4.00	7.57	4.00	3.84	5.50	6	KDFT-4075-2LN	434002
4	.45	NW25	1.00	4.00	7.57	3.67	3.84	5.50	6	KDFT-4100-2LN	434005
4	.45	NW40	1.50	4.00	7.57	3.71	3.84	5.50	6	KDFT-4150-2LN	434008
6	1.59	NW40	1.50	6.00	10.26	4.71	5.73	7.50	13	KDFT-6150-2LN	434011
6	1.59	NW50	2.00	6.00	10.26	4.73	5.73	7.50	13	KDFT-6200-2LN	434014
6	1.59	NW63	2.50	6.00	10.26	4.75	5.73	7.50	13	LDFT-6250-2LN	434017
8	4.13	NW63	2.50	8.00	11.26	5.75	6.26	9.62	25	LDFT-8250-2LN	434020
8	4.13	NW80	3.00	8.00	11.26	5.75	6.26	9.62	25	LDFT-8300-2LN	434023
8	4.13	NW100	4.00	8.00	11.26	5.75	6.26	9.62	25	LDFT-8400-2LN	434026

Hose Connection



TRAP SIZE	NOM. CAP. ¹	TUBE DIA.	TUBE WALL	BODY DIA.	BODY HEIGHT	A	B	CLAMP O.D.	WT LB	REFERENCE	PART NUMBER
4	.45	.75	.035	4.00	7.57	3.50	3.84	5.50	6	DFT-4075-LN	434000
4	.45	1.00	.065	4.00	7.57	3.50	3.84	5.50	6	DFT-4100-LN	434003
4	.45	1.50	.065	4.00	7.57	3.50	3.84	5.50	6	DFT-4150-LN	434006
6	1.59	1.50	.065	6.00	10.26	4.50	5.73	7.50	13	DFT-6150-LN	434009
6	1.59	2.00	.065	6.00	10.26	4.50	5.73	7.50	13	DFT-6200-LN	434012
6	1.59	2.50	.065	6.00	10.26	4.50	5.73	7.50	13	DFT-6250-LN	434015
8	4.13	2.50	.065	8.00	11.26	5.50	6.26	9.62	25	DFT-8250-LN	434018
8	4.13	3.00	.065	8.00	11.26	5.50	6.26	9.62	25	DFT-8300-LN	434021
8	4.13	4.00	.083	8.00	11.26	5.50	6.26	9.62	25	DFT-8400-LN	434024

¹ Nominal capacity in liters



Dual sorption pump assembly

page 258

Features

- 1×10^{-3} Torr vacuum level
- Economical roughing source
- No moving parts
- Vibration free operation
- Heat regeneration
- Positive pressure safety vent
- Multiple pump capability
- Clean and noncontaminating operation

Sorption roughing pumps or sorption pumps are used for pumping systems from atmospheric pressure to a pressure of approximately 10^{-2} Torr. They rely on the dispersion forces existing between a gas and a surface to bind gas molecules on chilled surfaces inside the pump. In other words, they pump by cryosorption.

Sorption pumps typically consist of a cylindrical canister or body that is filled with an adsorbent material. The adsorbent is usually a molecular sieve material, or zeolite, which consists of pellets made of a calcium or a sodium aluminosilicate crystalline matrix. The canister is placed in a dewar cooled by liquid nitrogen. Zeolite is a poor heat conductor, so an array of aluminum fins inside the pump is used to improve thermal contact with the sieve material. The pump body and internal cooling fins are specially designed for maximum heat transfer. The pump neck and flange are made of stainless steel. The pumps are mounted and supported by the flanges and since stainless steel is a poor thermal conductor frosting of adjacent components is minimized. Sorption pumps need liquid nitrogen to operate and, as with any capture pump, they have to be periodically regenerated. Sorption pumps are very clean noncontaminating roughing pumps and are ideal for low throughput applications. They are used in conjunction with getter pumps, ion pumps, or mechanical cryopumps.

In a sorption pump, molecules are held on the zeolite surface by physical adsorption. The number of molecules that can be held on an adsorbent is dependent on the temperature of both gas and surface, the chemical nature of gas and surface, the microscopic roughness of the surface, and the incident flux of molecules. The key is to have equilibrium conditions such that

practical amounts of gas can be captured at the desired pressures. It follows that a large surface area at low temperatures will have the capability of adsorbing large volumes of gas. By providing large surface areas, practical amounts of nitrogen can be pumped. The key elements of a sorption pump include an aluminum body, an array of fins that remove heat from the zeolite, and a pressure relief mechanism. All MDC sorption pumps are fitted with an elastomer stopper that automatically releases positive pressure. When a sorption pump is saturated with air and allowed to warm up to room temperature, very high pressures can be generated. The elastomer stopper is a key safety element of MDC sorption pumps and operation of this stopper should never be obstructed or disabled.

The adsorbent used is a Type 5A synthetic zeolite molecular sieve material. Zeolite is a highly porous material with a surface to volume ratio of about 800 square meters per cubic centimeter. It is supplied in pellets of about 1.58mm in diameter with molecular sized cavities that are linked by 5 Angstrom size pores. These pores are large enough to trap nitrogen, oxygen, and argon molecules, the main constituents of air. Zeolite also has a very high affinity for water vapor. Water vapor accumulated through repeated pump cycles of a chamber filled with ambient air will eventually saturate the sieve material, reducing and eventually eliminating its capacity for adsorbing nitrogen and oxygen. To remove the accumulated water and regenerate the adsorbent material, the pump must then be baked to 250°C or higher. Under normal operating conditions, the sieve material can be recycled indefinitely.

Sorption pumps do not include the optional bakeout heater. Heaters must be purchased separately. During pump operation, do not

All dimensions in this catalog are given in inches unless specified otherwise.



Dual sorption pump manifold with TC gauge



Optional heater assembly

run the heater while it's immersed in liquid nitrogen.

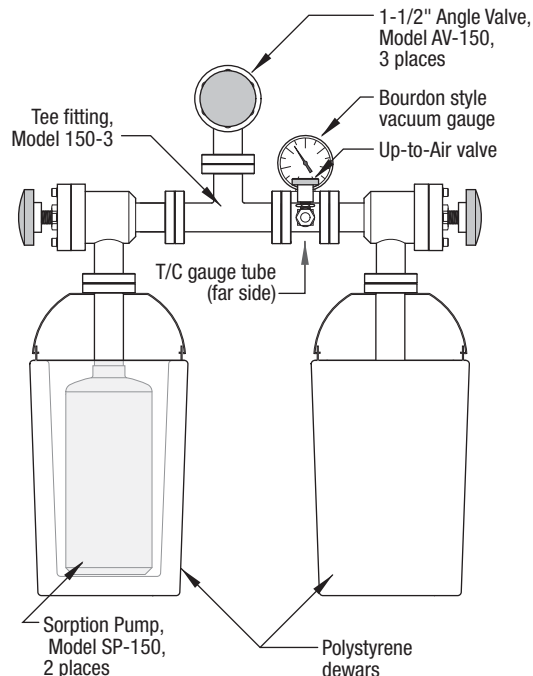
Noble gases such as neon and helium are pumped poorly by sorption pumps. If, for instance, neon is pumped together with air, its capacity will be less because the neon will be replaced by the active air gases, starting at pressures below 7.5 Torr. For this reason, sorption pumps are quite often staged. When two pumps are staged, one pump is used to achieve a pressure of 7.5 Torr and is then valved off. The second pump is then opened and the pressure is further reduced. By this method, 99% of the air is removed with the first pump, and noble gases are also swept into this pump and cannot backstream into the system when pressure is further reduced. Staged or multiple pump assemblies are fitted with both Bourdon and Thermocouple vacuum gauge tubes for monitoring vacuum levels. These manifolds are supplied with three manual UHV angle valves which allow the isolation of each pump and the manifold from the main vacuum system.

Pump operation is simple and fast. To begin pumping, add liquid nitrogen to the dewars. No electrical power is required and there are no moving parts and no vibration. A single sorption pump can evacuate a 100 liter chamber from atmosphere to 10^{-2} Torr in approximately 10 minutes. Each sorption pump has a capacity of 60,000 Torr-liters. Multiple pump systems are commonly used as they are faster and more efficient. Double and triple pump systems are mounted or connected to the chamber via a vacuum manifold. Single pumps, on the other hand, mount directly to a chamber. Pumpdown begins as soon as the adsorbent material in the pump is chilled with liquid nitrogen.



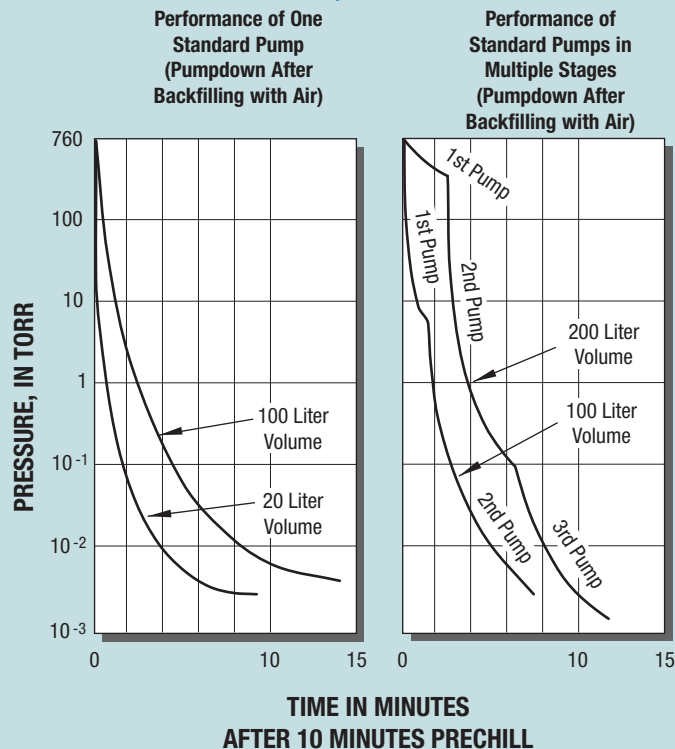
Type 5A Zeolite adsorbent material

Double Sorption Pump System Model SPS-2-150



- 2-3/4" Del-Seal™ CF flanges are joined using copper gaskets
- Liquid nitrogen supplied by user

Pumpdown Curves





Double Sorption Pump System

Features

- Contamination-free roughing
- Requires only LN₂ for operation
- Fail-safe pressure relief valve
- Aluminum construction for high rate of heat transfer
- No moving parts - no vibration

Specifications

Material

Pump, wall and internal fins	Aluminum
Flanges	304ss
Dewar	High density rigid polystyrene

Fastening

Bolts, .250-28 UNF	12 lb-ft
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Vacuum Range	5x10 ⁻³ Torr
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Temperature Range	Pump: -210°C to 450°C
	Dewar: -210°C to ambient

Weight, without LN₂

Single pump with dewar added	7 lb
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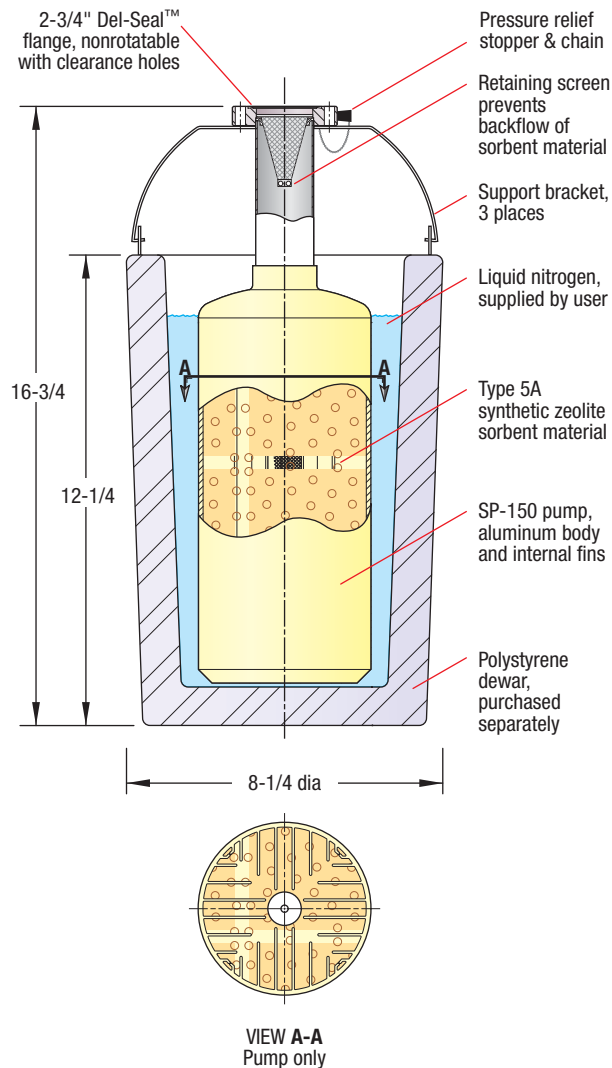
Double pump system	28 lb
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Dimensions	See drawings
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LOW VACUUM

Sorption Pump Model SP-150

Shown installed in polystyrene dewar

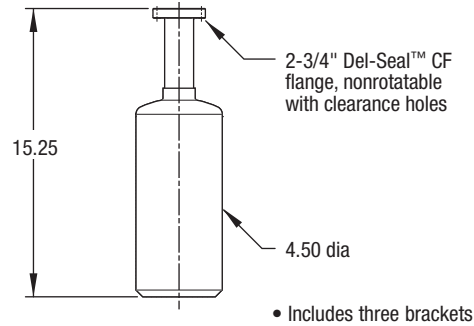


ACCESSORIES

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
DEWAR	1	SPD-150	500001
BAKEOUT HEATER	4	SPH-150	500002
SORBENT MATERIAL	3	SPMS-150	500003
STOPPER	1/8	VSCA-18	950011



Single Pump

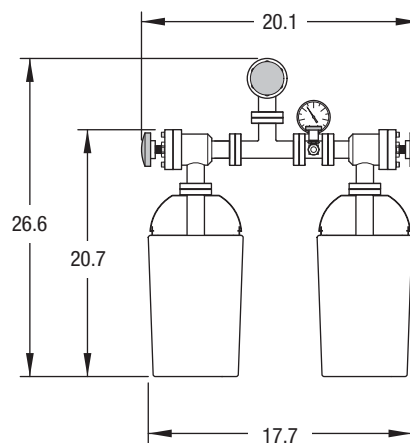


Individual pump includes...

- Aluminum body with stainless steel neck
- 2-3/4" Del-Seal™ CF flange
- Includes initial sorbent material charge, copper gasket and hardware
- 7 pound shipping weight

REFERENCE	PART NUMBER
SP-150	500000

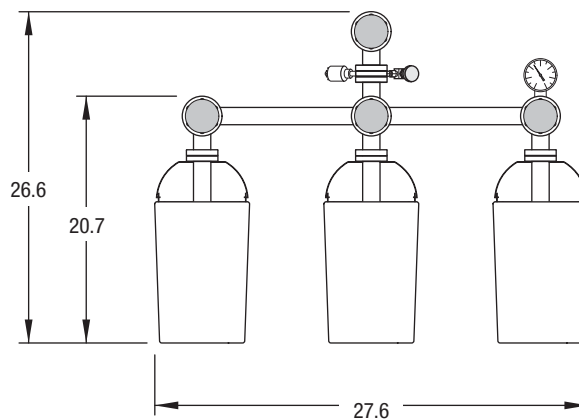
Multiple Pump



Dual system includes...

- 2 each SP-150 pumps with sorbent material
- 2 each SPD-150 dewars
- 3 each AV-150 manual Right-Angle valves
- 1 each 150-3 Tee fitting
- 1 each Gauge nipple Assembly, including thermocouple gauge tube, Up-to-Air valve and Bourdon vacuum gauge
- 28 pound shipping weight

REFERENCE	PART NUMBER
SPS-2-150	500004



Triple system includes...

- 3 each SP-150 pumps with sorbent material
- 3 each SPD-150 dewars
- 4 each AV-150 manual Right-Angle valves
- 1 each 150-3 Tee fitting
- 1 each Gauge nipple Assembly, including thermocouple gauge tube, Up-to-Air valve and Bourdon vacuum gauge
- 33 pound shipping weight

REFERENCE	PART NUMBER
SPS-3-150	500005

Accessories shown at right are ordered from the table on the facing page



PART NUMBER 500001



PART NUMBER 500002



PART NUMBER 500003



PART NUMBER 950011



Braided and unbraided flexible stainless steel hose, starting on page 263

Features

- Wire reinforced PVC hose
- Stainless steel flexible hose
- Stainless steel braided hose
- PVC tubes and fittings
- Double-sided access flanges
- Up-to-Air valves
- Pressure surge discs
- Leak detector, port reducer kits
- Vacuum greases and lubricants

All dimensions in this catalog are given in inches unless specified otherwise.

Wire Reinforced PVC Hose

MDC wire reinforced PVC hose is a flexible and economical solution for mechanical pump roughing lines. They are suitable for basic vacuum service to levels of 1×10^{-3} Torr. The wire reinforced wall prevents tube collapse while under vacuum loads, yet provides adequate flexibility for convoluted line paths. A 20 inch minimum static radius is typical for all hose sizes. Flexible PVC wire reinforced hose is available in sizes from 3/4 to 2 inch diameters, with or without end terminations. In an nonterminated form, hose is sold by the foot to 100 feet maximum lengths. In a terminated form they are available with stainless steel Kwik-Flange™ ISO KF flanges in sizes including NW16, NW25, NW40, and NW50. The PVC hose is secured to the Kwik-Flange™ terminations via stainless steel hose clamps.

Flexible Stainless Steel Hose

MDC flexible stainless steel hose is the perfect solution for applications where standard straight-line vacuum plumbing is not practical or where vibration isolation is required. This type of hose consists of a relatively thin wall formed stainless steel bellows which is available with an optional stainless steel braided sheath. The flexible stainless steel braiding protects the formed bellows from abrasion or impact produced by component movement or vacuum cycling and also protects the hose from excessive bending. Both braided and unbraided configurations are offered with a choice of three end terminations including Del-Seal™ CF metal seal flanges, Kwik-Flange™ ISO KF and Large-Flange™ ISO LF flanges as well as tube end terminations. Limited only by the choice of mount, all stainless steel hoses can be baked to 450°C. Custom sizes, lengths and terminations other than those listed are available on request. Hoses with

Del-Seal™ CF metal seal flanges provide a complete metal air-to-vacuum seal required for UHV applications. Note that the large and convoluted internal surface area will require lengthy pumping to achieve UHV pressures. Stainless steel roughing lines are available in a very flexible thin wall configuration and a less flexible medium wall configuration. Care must be taken when installing thin wall hose so as to not exceed the specified bend. MDC recommends that all thin wall hose be used primarily for vibration isolation purposes and installed with minimal bend. Flexible hoses tend to contract when subjected to internal vacuum loads. Components connected to either end of a hose must be securely anchored to prevent movement or possible damage. The total load exerted by atmospheric pressure is substantial and can move roughing pumps and other light, non-secured components. The static bend radius specification for a formed bellows is the minimum radius the bellows can be curved without permanent deformation. The spring rates for stainless steel flexible hose are given for reference only and are typically used as a means to quantify hose flexibility or rigidity. Spring rates are based on the amount of force required to compress one linear inch of a hose that is supported over its entire length. Since unguided hose squirms or deflects laterally, the stated spring rates are of no value unless a hose is supported over its entire length.

Small Diameter Process Lines

MDC Del-Flex™ is the perfect solution for applications where process lines are not straight-line or where vibration isolation is required. The new process lines consist of a relatively thin wall formed 321 stainless steel bellows with 316L tube ends. Our process lines are fully vacuum annealed to enhance cleanliness. Annealing also



Del-Flex process lines

page 271



PVC tubing and components

page 278



Manually actuated up-to-air valves

page 283



allows the line to be formed with a preset static bend for ease of installation. These convoluted lines are capable of manual compression and extension in length to a maximum of 20% of the nominal convoluted free length. This allows customization at installation without degrading performance integrity. The most severe static bend can be accomplished by bending the line until the convolutions touch at the minimum bend area and then allowing slight spring back to naturally occur, leaving the assembly in the "at rest" condition. Braided lines are available for applications where movement dynamics necessitates part contact. The braided sheath, however, does limit line flexibility.

All welds are accomplished utilizing a state of the art programmable orbital TIG welding process. During welding, argon gas is used as a purge to eliminate oxidation and ensure complete and uniform penetration.

PVC Fittings and Components

Polyvinyl chloride, PVC components offer an economical solution for long vacuum pump exhaust lines and rough vacuum lines. PVC's light weight and flexibility make it simple to assemble in custom configurations right on site. PVC has excellent corrosion resistance and is ideally suited for harsh chemical environments. Kwik-Flange™ ISO KF PVC components can be used in some corrosive environment applications where exposed metal surfaces are subject to chemical attack. Note that many mechanical vacuum pumps are typically supplied with ISO KF inlet and outlet ports. Kwik-Flange™ ISO KF PVC flanges are easily connected to these ports with standard centering rings and hinged clamps. PVC tubing and fittings are assembled, sealed and permanently bonded by using a PVC primer and cement.

Access Flanges

MDC Double-sided access flanges are constructed around the standard double-sided 2-3/4 inch Del-Seal™ CF metal seal flange and provide a convenient method of adding roughing accessories to a vacuum system. These flanges are offered with one or two 1/8"-27 NPT female pipe threads which accept MDC thermocouple gauge tubes and up-to-air valves or other NPT fitted components required by a specific application. These flanges can be installed in an existing vacuum system without the need for additional ports. Simply insert a double-sided flange assembly between two 2-3/4 inch Del-Seal™ CF vacuum flanges and refasten using longer bolts. Bolt kits for fastening double-sided flanges can be found in the flanges and fittings section of this catalog. Double-sided flanges are also offered with no accessory holes. Other configurations are available on request. Note that vacuum and temperature ratings for a finished assembly will be limited by the lowest rated component and by the method used to seal the pipe threads.

Up-to-Air Valves

MDC up-to-air valves are used primarily for the venting or back filling of vacuum vessels. They are vacuum rated to 1×10^{-8} Torr. When fitted with Del-Seal™ CF metal seal flanges they can be baked to 300°C. These are manually actuated 1/4 inch diameter valves fitted with a bellows actuator seal.

Pressure Burst Discs

Most vacuum vessels are designed and constructed with internal vacuum joints and welds that are rated for an external load of one atmosphere. They are not pressure vessels and as such should never be subjected to positive pressure loads in excess of one atmosphere. For this purpose

fail-safe burst discs have been developed to prevent the accidental pressurizing of a vacuum vessel. MDC burst discs are offered with 1/8 inch male NPT fittings or Del-Seal™ CF metal seal flanges. They can be fitted to most any vacuum system where over pressurization is a possibility. The burst disc is constructed with a thin metal membrane which is capable of sustaining a vacuum load. As pressure begins to build inside a vacuum vessel, the thin metal diaphragm is deformed outwardly until it comes in contact with the sharp edges of the burst disk housing and finally ruptures, relieving the pressure in the system. Once ruptured, the unit is not reusable and must be replaced to make the vessel operational. The disc is designed to burst at a positive pressure anywhere in the range from atmosphere to 25 psig, with rupture certain to occur before 25 psig.

Leak Detector, Port Reducer Kits

MDC Test Port Reducer Kits offer a set of ten different size aluminum reducing adapters for either 1-1/8 or 2 inch leak detector inlet or test ports. They can be used with leak detectors and other devices using an internal elastomer seal. The kits provide a quick, simple, and inexpensive method for reducing standard inlets to 1, 7/8, 3/4, 5/8, 1/2, 3/8, 5/16, 1/4, 3/16 and 1/8 inch tube diameters. In the 2 inch kit, the small test ports fit inside the large adapter. Note that the 1-1/8 inch kit does not include the 2 inch adapter. Each set is supplied in a durable carrying and storage case.

Vacuum Greases and Lubricants

MDC offers a wide selection of vacuum compatible greases and lubricants ideally suited for lubricating static and dynamic elastomer seals or mechanisms in most high vacuum environments.



Leak detector port reducer kits

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Pressure burst discs

page 284



Vacuum lubricants, greases and sealer

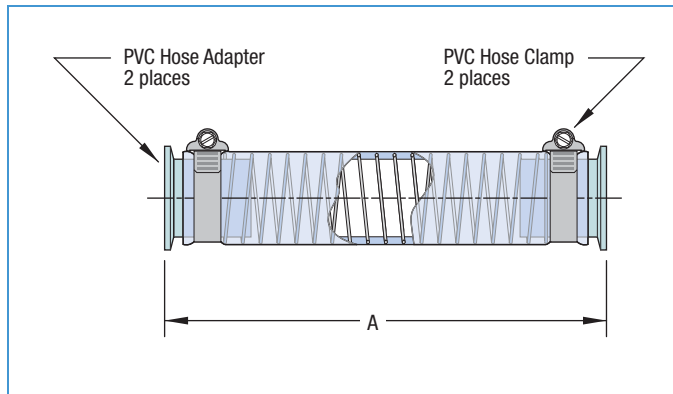
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Kwik-Flange™



- Complete assembly includes one Kwik-Flange™ PVC Hose Adapter and Hose Clamp on each end
- Additional hardware available below



- Mates with standard ISO Kwik-Flange™ fittings
- Roughing applications to 10^{-3} Torr
- 35°C (95°F) maximum temperature
- 2-foot or 6-foot lengths
- Non-standard lengths available to 100-ft max
- Does not require cementing

HOSE SIZE	FLANGE SIZE	FLANGE O.D.	ISO REF	STATIC BEND RADIUS	A INCH	WT LB	REFERENCE	PART NUMBER
3/4	K-075	1.18	NW16	19.69	24	1	K075-PVC-24	728000
3/4	K-075	1.18	NW16	19.69	72	2	K075-PVC-72	728047
1	K-100	1.57	NW25	19.69	24	1	K100-PVC-24	728001
1	K-100	1.57	NW25	19.69	72	6	K100-PVC-72	728048
1-1/2	K-150	2.16	NW40	19.69	24	1-1/2	K150-PVC-24	728002
1-1/2	K-150	2.16	NW40	19.69	72	6-1/2	K150-PVC-72	728049
2	K-200	2.95	NW50	19.69	24	1-1/2	K200-PVC-24	728003
2	K-200	2.95	NW50	19.69	72	7-1/2	K200-PVC-72	728050

Coiled Hose



- Bulk hose available to 100-foot maximum length

HOSE SIZE	HOSE I.D.	HOSE WALL	HOSE O.D.	STATIC BEND RADIUS	WT / FOOT LB	REFERENCE	PART NUMBER
1/2	.50	.124	.748	19.69	1/4	PVC-050	728034
3/4	.75	.137	1.024	19.69	1/4	PVC-075	728035
1	1.00	.160	1.319	19.69	1-1/4	PVC-100	728036
1-1/2	1.50	.205	1.909	19.69	1-1/4	PVC-150	728037
2	2.00	.191	2.382	19.69	1-1/2	PVC-200	728038

Hardware



- Hose adapters are stainless steel construction

HOSE SIZE	FLANGE SIZE	ISO REF	QTY	HOSE CLAMP SIZE	WT LB	REFERENCE	PART NUMBER
PVC HOSE ADAPTER							
1/2	K-050	NW16	1	-	1/4	K050-HPV	736000
3/4	K-075	NW16	1	-	1/4	K075-HPV	736001
1	K-100	NW25	1	-	1/4	K100-HPV	736002
1-1/2	K-150	NW40	1	-	1/4	K150-HPV	736003
2	K-200	NW50	1	-	1/4	K200-HPV	736004
PVC HOSE CLAMP							
1/2 AND 3/4	-	-	1	1/2 to 1-1/8	1/8	-	072810
1	-	-	1	3/4 to 1-1/2	1/8	-	072811
1-1/2	-	-	1	1-1/8 to 2	1/8	-	072812
2	-	-	1	1-3/4 to 2-5/8	1/8	-	072813



ULTRAHIGH & HIGH VACUUM SERIES

Features

- Type 304 stainless steel
- Unbraided or braided configurations
- Medium wall or thin wall configurations
- Highly flexible
- Allows misalignment of pump and chamber
- Provides vibration isolation from mechanical pumps
- All-metal flange hose bakeable to 450°C

Description

MDC flexible stainless steel hose is useful in situations where standard straight-line plumbing is impractical or where vibration isolation is necessary. The hose consists of stainless steel formed bellows covered with an optional tough metal braid of the same material. The flexible braid protects the bellows from abrasion or impact and provides external support to a component that tends to move under vacuum. Both unbraided and braided configurations are offered with a choice of flanges and connectors. The hose provides great flexibility, strength and durability, and is bakeable. The sizes and lengths shown are standard items. Other lengths and connector combinations are available on request.

Hoses with Del-Seal™ CF flanges provide a complete metal air-to-vacuum seal required for UHV applications. Note that the large internal surface area requires lengthy pumping to achieve UHV pressures.

Stainless steel hoses are available in a highly flexible thin wall configuration and a more rigid medium wall configuration. Care must be taken when installing the thin wall versions to not exceed the specified bend radius. MDC recommends that thin wall hoses be used for vibration isolation purposes and installed with minimal curvature.

Because all flex hoses compress when subjected to internal vacuum pressures, equipment connected to either end of a flex hose must be securely anchored. Atmospheric pressure exerts a substantial force and can move roughing pumps or other light, non-secured components.

The static bend radius of a flex hose is the minimum radius a hose can be curved without encountering permanent deformation. The spring rate of a flex hose is the amount of force required to compress a hose one linear inch, with the hose guided over its entire length. Unguided hose will squirm or deflect sideways and stated spring rates no longer apply. Nominal values given in the tables are for reference only.



Specifications

Material

Hose	304ss
Flanges	304ss
Gaskets	OFE copper or FKM / FPM fluoroelastomer elastomer
O-rings	FKM / FPM fluoroelastomer, Buna-N® or Silicone elastomer
Clamps, hinged & bulkhead	Aluminum

Fastening

Bolt, Clamp, Bulkhead	Refer to individual flange
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Vacuum Range

Del-Seal™ CF and Weldable Nipple	1x10 ⁻¹⁰ Torr
Kwik-Flange™ and Large-Flange™	1x10 ⁻⁸ Torr

Temperature Range	Minimum	Intermittent	Sustained
Copper gasket	-200°C	450°C	400°C
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C
Silicone	-20°C	200°C	150°C

Bellows Thickness	Medium Wall	Thin Wall
3/4" O.D. nominal	.008	.005
1" O.D. nominal	.009	.005
1-1/2" O.D. nominal	.011	.006
2" O.D. nominal	.012	.006
2-1/2" O.D. nominal	.012	-
3" O.D. nominal	.014	-
4" O.D. nominal	.014	-

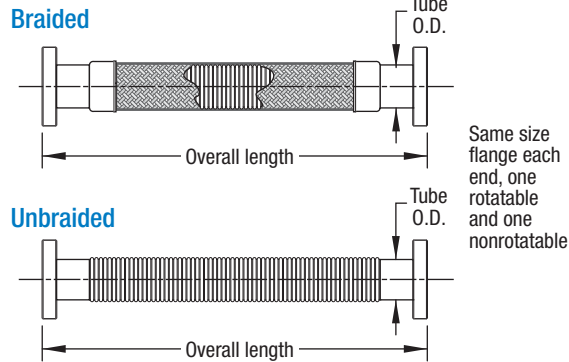
Static Bend Radius	See hose size, given in inches
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Spring Rate	See table, given in pounds per inch
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Weight & Additional Dimensions	See table
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Medium Wall



- Del-Seal™ CF flanges
- Medium wall braided and unbraided
- Thin wall unbraided
- Other flanges, connectors and custom lengths available upon request

NOMINAL TUBE O.D.	FLANGE NOM.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	SPRING RATE	WT LB	REFERENCE	PART NUMBER
BRAIDED								
3/4	1-1/3	18	.008	3	25	3	FRL-075-18F2	440002
3/4	1-1/3	24	.008	3	19	3	FRL-075-24F2	440006
3/4	1-1/3	36	.008	3	13	4	FRL-075-36F2	440010
3/4	1-1/3	48	.008	3	11.5	5	FRL-075-48F2	440014
1	2-1/8	18	.009	4.25	38	4	FRL-100-18F2	440070
1	2-1/8	24	.009	4.25	28	4	FRL-100-24F2	440076
1	2-1/8	36	.009	4.25	18	5	FRL-100-36F2	440082
1	2-1/8	48	.009	4.25	16.5	6	FRL-100-48F2	440088
1-1/2	2-3/4	18	.011	6.5	56	6	FRL-150-18F2	440018
1-1/2	2-3/4	24	.011	6.5	40	7	FRL-150-24F2	440024
1-1/2	2-3/4	36	.011	6.5	27	9	FRL-150-36F2	440030
1-1/2	2-3/4	48	.011	6.5	25	10	FRL-150-48F2	440036
2	3-3/8	18	.012	9	85	8	FRL-200-18F2	440042
2	3-3/8	24	.012	9	63	11	FRL-200-24F2	440046
2	3-3/8	36	.012	9	40	15	FRL-200-36F2	440050
2	3-3/8	48	.012	9	34	17	FRL-200-48F2	440054
2-1/2	4-1/2	18	.012	10	120	10	FRL-250-18F2	440152
2-1/2	4-1/2	24	.012	10	82	13	FRL-250-24F2	440153
2-1/2	4-1/2	36	.012	10	67	18	FRL-250-36F2	440154
2-1/2	4-1/2	48	.012	10	58	22	FRL-250-48F2	440155
3	4-5/8	18	.014	11	196	15	FRL-300-18F2	440058
3	4-5/8	24	.014	11	150	19	FRL-300-24F2	440061
3	4-5/8	36	.014	11	108	23	FRL-300-36F2	440064
3	4-5/8	48	.014	11	88	27	FRL-300-48F2	440067
4	6	18	.014	13	142	21	FRL-400-18F2	440093
4	6	24	.014	13	108	25	FRL-400-24F2	440095
4	6	36	.014	13	73	27	FRL-400-36F2	440097
4	6	48	.014	13	80	31	FRL-400-48F2	440099

Spring rates are in pounds per inch, axial

Vacuum Roughing Hose

Del-Seal™ CF



Section 3.3

Medium Wall



NOMINAL TUBE O.D.	FLANGE NOM.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	SPRING RATE	WT LB	REFERENCE	PART NUMBER
UNBRAIDED								
3/4	1-1/3	18	.008	2	23	3	UB-FRL-075-18F2	441002
3/4	1-1/3	24	.008	2	17	3	UB-FRL-075-24F2	441006
3/4	1-1/3	36	.008	2	11	4	UB-FRL-075-36F2	441010
3/4	1-1/3	48	.008	2	10	5	UB-FRL-075-48F2	441014
1	2-1/8	18	.009	4	34	4	UB-FRL-100-18F2	441070
1	2-1/8	24	.009	4	25	4	UB-FRL-100-24F2	441076
1	2-1/8	36	.009	4	16	5	UB-FRL-100-36F2	441082
1	2-1/8	48	.009	4	15	6	UB-FRL-100-48F2	441088
1-1/2	2-3/4	18	.011	5	51	6	UB-FRL-150-18F2	441018
1-1/2	2-3/4	24	.011	5	37	7	UB-FRL-150-24F2	441024
1-1/2	2-3/4	36	.011	5	24	8	UB-FRL-150-36F2	441030
1-1/2	2-3/4	48	.011	5	22	10	UB-FRL-150-48F2	441036
2	3-3/8	18	.012	7.75	78	6	UB-FRL-200-18F2	441042
2	3-3/8	24	.012	7.75	57	7	UB-FRL-200-24F2	441046
2	3-3/8	36	.012	7.75	37	9	UB-FRL-200-36F2	441050
2	3-3/8	48	.012	7.75	33	11	UB-FRL-200-48F2	441054
2-1/2	4-1/2	18	.012	8.25	109	7	UB-FRL-250-18F2	441152
2-1/2	4-1/2	24	.012	8.25	75	8	UB-FRL-250-24F2	441153
2-1/2	4-1/2	36	.012	8.25	61	12	UB-FRL-250-36F2	441154
2-1/2	4-1/2	48	.012	8.25	53	14	UB-FRL-250-48F2	441155
3	4-5/8	18	.014	9	186	9	UB-FRL-300-18F2	441058
3	4-5/8	24	.014	9	112	10	UB-FRL-300-24F2	441061
3	4-5/8	36	.014	9	93	13	UB-FRL-300-36F2	441064
3	4-5/8	48	.014	9	80	15	UB-FRL-300-48F2	441067
4	6	18	.014	11	131	13	UB-FRL-400-18F2	441093
4	6	24	.014	11	97	15	UB-FRL-400-24F2	441095
4	6	36	.014	11	65	19	UB-FRL-400-36F2	441097
4	6	48	.014	11	71	23	UB-FRL-400-48F2	441099

Spring rates are in pounds per inch, axial

Thin Wall



NOMINAL TUBE O.D.	FLANGE NOM.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	SPRING RATE	WT LB	REFERENCE	PART NUMBER
UNBRAIDED								
3/4	1-1/3	18	.005	1	7	3	UB-FRLT-075-18F2	441500
3/4	1-1/3	24	.005	1	5	3	UB-FRLT-075-24F2	441501
3/4	1-1/3	36	.005	1	3	4	UB-FRLT-075-36F2	441502
1	2-1/8	18	.005	1.4	5	4	UB-FRLT-100-18F2	441504
1	2-1/8	24	.005	1.4	3	4	UB-FRLT-100-24F2	441505
1	2-1/8	36	.005	1.4	2	5	UB-FRLT-100-36F2	441506
1	2-1/8	48	.005	1.4	2	6	UB-FRLT-100-48F2	441507
1-1/2	2-3/4	18	.006	2.36	8	6	UB-FRLT-150-18F2	441508
1-1/2	2-3/4	24	.006	2.36	6	7	UB-FRLT-150-24F2	441509
1-1/2	2-3/4	36	.006	2.36	4	8	UB-FRLT-150-36F2	441510
1-1/2	2-3/4	48	.006	2.36	4	10	UB-FRLT-150-48F2	441511
2	3-3/8	18	.006	2.5	9	6	UB-FRLT-200-18F2	441512
2	3-3/8	24	.006	2.5	6	9	UB-FRLT-200-24F2	441513
2	3-3/8	36	.006	2.5	4	13	UB-FRLT-200-36F2	441514
2	3-3/8	48	.006	2.5	4	15	UB-FRLT-200-48F2	441515

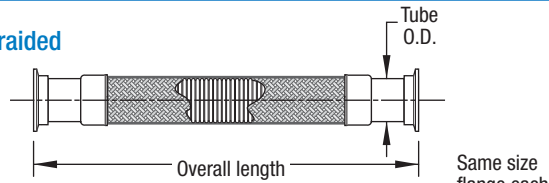
Spring rates are in pounds per inch, axial



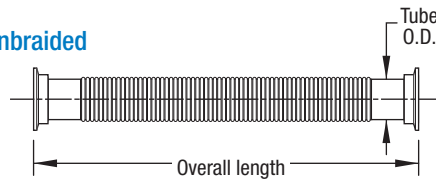
Medium Wall



Braided



Unbraided



- Kwik-Flange™ and Large-Flange™
- Medium wall braided and unbraided
- Thin wall unbraided
- Other flanges, connectors and custom lengths available upon request

NOMINAL TUBE O.D.	ISO REF.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	SPRING RATE	WT LB	REFERENCE	PART NUMBER
BRAIDED								
3/4	NW16	18	.008	3	25	3	KFRL-075-18F2	440101
3/4	NW16	24	.008	3	19	3	KFRL-075-24F2	440103
3/4	NW16	36	.008	3	13	4	KFRL-075-36F2	440105
3/4	NW16	48	.008	3	11.5	5	KFRL-075-48F2	440107
1	NW25	18	.009	4.25	38	4	KFRL-100-18F2	440109
1	NW25	24	.009	4.25	28	4	KFRL-100-24F2	440111
1	NW25	36	.009	4.25	18	5	KFRL-100-36F2	440113
1	NW25	48	.009	4.25	16.5	6	KFRL-100-48F2	440115
1-1/2	NW40	18	.011	6.5	56	5	KFRL-150-18F2	440117
1-1/2	NW40	24	.011	6.5	40	6	KFRL-150-24F2	440121
1-1/2	NW40	36	.011	6.5	27	8	KFRL-150-36F2	440125
1-1/2	NW40	48	.011	6.5	25	9	KFRL-150-48F2	440129
2	NW50	18	.012	9	85	6	KFRL-200-18F2	440133
2	NW50	24	.012	9	63	9	KFRL-200-24F2	440135
2	NW50	36	.012	9	40	13	KFRL-200-36F2	440137
2	NW50	48	.012	9	34	15	KFRL-200-48F2	440139
2-1/2	NW63	18	.012	10	120	7	LFRL-250-18F2	440156
2-1/2	NW63	24	.012	10	82	10	LFRL-250-24F2	440157
2-1/2	NW63	36	.012	10	67	16	LFRL-250-36F2	440158
2-1/2	NW63	48	.012	10	58	19	LFRL-250-48F2	440159
3	NW80	18	.014	11	196	13	LFRL-300-18F2	440200
3	NW80	24	.014	11	150	17	LFRL-300-24F2	440201
3	NW80	36	.014	11	108	21	LFRL-300-36F2	440202
3	NW80	48	.014	11	88	25	LFRL-300-48F2	440203
4	NW100	18	.014	13	142	18	LFRL-400-18F2	440204
4	NW100	24	.014	13	108	22	LFRL-400-24F2	440205
4	NW100	36	.014	13	73	24	LFRL-400-36F2	440206
4	NW100	48	.014	13	80	28	LFRL-400-48F2	440207

Spring rates are in pounds per inch, axial

Vacuum Roughing Hose

ISO KF and LF



Section 3.3

Medium Wall



NOMINAL TUBE O.D.	ISO REF.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	SPRING RATE	WT LB	REFERENCE	PART NUMBER
UNBRAIDED								
3/4	NW16	18	.008	2	23	3	UB-KFRL-075-18F2	441101
3/4	NW16	24	.008	2	17	3	UB-KFRL-075-24F2	441103
3/4	NW16	36	.008	2	11	4	UB-KFRL-075-36F2	441105
3/4	NW16	48	.008	2	10	4	UB-KFRL-075-48F2	441107
1	NW25	18	.009	4	34	4	UB-KFRL-100-18F2	441109
1	NW25	24	.009	4	25	4	UB-KFRL-100-24F2	441111
1	NW25	36	.009	4	16	5	UB-KFRL-100-36F2	441113
1	NW25	48	.009	4	15	6	UB-KFRL-100-48F2	441115
1-1/2	NW40	18	.011	5	51	5	UB-KFRL-150-18F2	441117
1-1/2	NW40	24	.011	5	37	6	UB-KFRL-150-24F2	441121
1-1/2	NW40	36	.011	5	24	8	UB-KFRL-150-36F2	441125
1-1/2	NW40	48	.011	5	22	9	UB-KFRL-150-48F2	441129
2	NW50	18	.012	7.75	78	6	UB-KFRL-200-18F2	441133
2	NW50	24	.012	7.75	57	9	UB-KFRL-200-24F2	441135
2	NW50	36	.012	7.75	37	13	UB-KFRL-200-36F2	441137
2	NW50	48	.012	7.75	33	15	UB-KFRL-200-48F2	441139
2-1/2	NW63	18	.012	8.25	109	7	UB-LFRL-250-18F2	441156
2-1/2	NW63	24	.012	8.25	75	10	UB-LFRL-250-24F2	441157
2-1/2	NW63	36	.012	8.25	61	16	UB-LFRL-250-36F2	441158
2-1/2	NW63	48	.012	8.25	53	19	UB-LFRL-250-48F2	441159
3	NW80	18	.014	9	186	12	UB-LFRL-300-18F2	441200
3	NW80	24	.014	9	112	16	UB-LFRL-300-24F2	441201
3	NW80	36	.014	9	93	20	UB-LFRL-300-36F2	441202
3	NW80	48	.014	9	80	24	UB-LFRL-300-48F2	441203
4	NW100	18	.014	11	131	15	UB-LFRL-400-18F2	441204
4	NW100	24	.014	11	97	19	UB-LFRL-400-24F2	441205
4	NW100	36	.014	11	65	21	UB-LFRL-400-36F2	441206
4	NW100	48	.014	11	71	25	UB-LFRL-400-48F2	441207

Spring rates are in pounds per inch, axial

Thin Wall



NOMINAL TUBE O.D.	ISO REF.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	SPRING RATE	WT LB	REFERENCE	PART NUMBER
UNBRAIDED								
3/4	NW16	18	.005	1	7	3	UB-KFRLT-075-18F2	441516
3/4	NW16	24	.005	1	5	3	UB-KFRLT-075-24F2	441517
3/4	NW16	36	.005	1	3	4	UB-KFRLT-075-36F2	441518
1	NW25	18	.005	1.4	5	4	UB-KFRLT-100-18F2	441520
1	NW25	24	.005	1.4	3	4	UB-KFRLT-100-24F2	441521
1	NW25	36	.005	1.4	2	5	UB-KFRLT-100-36F2	441522
1	NW25	48	.005	1.4	2	6	UB-KFRLT-100-48F2	441523
1-1/2	NW40	18	.006	2.36	8	5	UB-KFRLT-150-18F2	441524
1-1/2	NW40	24	.006	2.36	6	6	UB-KFRLT-150-24F2	441525
1-1/2	NW40	36	.006	2.36	4	8	UB-KFRLT-150-36F2	441526
1-1/2	NW40	48	.006	2.36	4	9	UB-KFRLT-150-48F2	441527
2	NW50	18	.006	2.5	9	6	UB-KFRLT-200-18F2	441528
2	NW50	24	.006	2.5	6	7	UB-KFRLT-200-24F2	441529
2	NW50	36	.006	2.5	4	9	UB-KFRLT-200-36F2	441530
2	NW50	48	.006	2.5	4	11	UB-KFRLT-200-48F2	441531

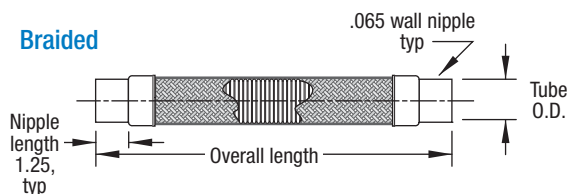
Spring rates are in pounds per inch, axial



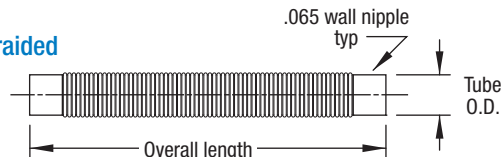
Medium Wall



Braided



Unbraided



- Weldable or hose connection
- Medium wall braided and unbraided
- Thin wall unbraided
- Other flanges, connectors and custom lengths available upon request

NOMINAL TUBE O.D.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	SPRING RATE	WT LB	REFERENCE	PART NUMBER
BRAIDED							
3/4	18	.008	3	25	2	FRL-075-18	440000
3/4	24	.008	3	19	2	FRL-075-24	440004
3/4	36	.008	3	13	3	FRL-075-36	440008
3/4	48	.008	3	11.5	4	FRL-075-48	440012
1	18	.009	4.25	38	3	FRL-100-18	440068
1	24	.009	4.25	28	3	FRL-100-24	440074
1	36	.009	4.25	18	4	FRL-100-36	440080
1	48	.009	4.25	16.5	5	FRL-100-48	440086
1-1/2	18	.011	6.5	56	4	FRL-150-18	440016
1-1/2	24	.011	6.5	40	5	FRL-150-24	440022
1-1/2	36	.011	6.5	27	7	FRL-150-36	440028
1-1/2	48	.011	6.5	25	8	FRL-150-48	440034
2	18	.012	9	85	5	FRL-200-18	440040
2	24	.012	9	63	8	FRL-200-24	440044
2	36	.012	9	40	12	FRL-200-36	440048
2	48	.012	9	34	14	FRL-200-48	440052
2-1/2	18	.012	10	120	6	FRL-250-18	440160
2-1/2	24	.012	10	82	9	FRL-250-24	440161
2-1/2	36	.012	10	67	14	FRL-250-36	440162
2-1/2	48	.012	10	58	16	FRL-250-48	440163
3	18	.014	11	196	10	FRL-300-18	440056
3	24	.014	11	150	14	FRL-300-24	440059
3	36	.014	11	108	18	FRL-300-36	440062
3	48	.014	11	88	22	FRL-300-48	440065
4	18	.014	13	142	14	FRL-400-18	440092
4	24	.014	13	108	18	FRL-400-24	440094
4	36	.014	13	73	20	FRL-400-36	440096
4	48	.014	13	80	24	FRL-400-48	440098

Spring rates are in pounds per inch, axial

Vacuum Roughing Hose

Weldable Hose Ends

Section 3.3



Medium Wall



NOMINAL TUBE O.D.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	SPRING RATE	WT LB	REFERENCE	PART NUMBER
UNBRAIDED							
3/4	18	.008	2	23	2	UB-FRL-075-18	441000
3/4	24	.008	2	17	2	UB-FRL-075-24	441004
3/4	36	.008	2	11	3	UB-FRL-075-36	441008
3/4	48	.008	2	10	4	UB-FRL-075-48	441012
1	18	.009	4	34	3	UB-FRL-100-18	441068
1	24	.009	4	25	3	UB-FRL-100-24	441074
1	36	.009	4	16	4	UB-FRL-100-36	441080
1	48	.009	4	15	5	UB-FRL-100-48	441086
1-1/2	18	.011	5	51	4	UB-FRL-150-18	441016
1-1/2	24	.011	5	37	5	UB-FRL-150-24	441022
1-1/2	36	.011	5	24	6	UB-FRL-150-36	441028
1-1/2	48	.011	5	22	8	UB-FRL-150-48	441034
2	18	.012	7.75	78	3	UB-FRL-200-18	441040
2	24	.012	7.75	57	4	UB-FRL-200-24	441044
2	36	.012	7.75	37	8	UB-FRL-200-36	441048
2	48	.012	7.75	33	9	UB-FRL-200-48	441052
2-1/2	18	.012	8.25	109	4	UB-FRL-250-18	441160
2-1/2	24	.012	8.25	75	5	UB-FRL-250-24	441161
2-1/2	36	.012	8.25	61	7	UB-FRL-250-36	441162
2-1/2	48	.012	8.25	53	9	UB-FRL-250-48	441163
3	18	.014	9	186	4	UB-FRL-300-18	441056
3	24	.014	9	112	5	UB-FRL-300-24	441059
3	36	.014	9	93	8	UB-FRL-300-36	441062
3	48	.014	9	80	10	UB-FRL-300-48	441065
4	18	.014	11	131	6	UB-FRL-400-18	441092
4	24	.014	11	97	8	UB-FRL-400-24	441094
4	36	.014	11	65	12	UB-FRL-400-36	441096
4	48	.014	11	71	16	UB-FRL-400-48	441098

Spring rates are in pounds per inch, axial

Thin Wall



NOMINAL TUBE O.D.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	SPRING RATE	WT LB	REFERENCE	PART NUMBER
UNBRAIDED							
3/4	18	.005	1	7	3	UB-FRLT-075-18	441532
3/4	24	.005	1	5	3	UB-FRLT-075-24	441533
3/4	36	.005	1	3	4	UB-FRLT-075-36	441534
1	18	.005	1.4	5	4	UB-FRLT-100-18	441536
1	24	.005	1.4	3	4	UB-FRLT-100-24	441537
1	36	.005	1.4	2	5	UB-FRLT-100-36	441538
1	48	.005	1.4	2	6	UB-FRLT-100-48	441539
1-1/2	18	.006	2.36	8	6	UB-FRLT-150-18	441540
1-1/2	24	.006	2.36	6	7	UB-FRLT-150-24	441541
1-1/2	36	.006	2.36	4	8	UB-FRLT-150-36	441542
1-1/2	48	.006	2.36	4	10	UB-FRLT-150-48	441543
2	18	.006	2.5	9	6	UB-FRLT-200-18	441544
2	24	.006	2.5	6	7	UB-FRLT-200-24	441545
2	36	.006	2.5	4	9	UB-FRLT-200-36	441546
2	48	.006	2.5	4	11	UB-FRLT-200-48	441547

Spring rates are in pounds per inch, axial





ULTRAHIGH & HIGH VACUUM SERIES

Features

- Type 321 stainless steel
- Unbraided or braided configurations
- Thin wall configuration
- Highly flexible
- Provides easy installation of process lines
- All-metal flange hose bakeable to 450°C

Description

MDC Del-Flex™ is the perfect solution for applications where process lines are not straight-line or where vibration isolation is required. The new process lines consist of a relatively thin wall formed 321 stainless steel bellows with 316L tube ends.

Our process lines are fully vacuum annealed to enhance cleanliness. Annealing also allows the line to be formed with a preset static bend for ease of installation. These convoluted lines are capable of manual compression and extension in length to a maximum of 20% of the nominal convoluted free length. This allows customization at installation without degrading performance integrity. The most severe static bend can be accomplished by bending the line until the convolutions touch at the minimum bend area and then allowing slight spring back to naturally occur, leaving the assembly in the “at rest” condition. Braided lines are available for applications where movement dynamics necessitates part contact. The braided sheath, however, does limit line flexibility.

All welds are accomplished utilizing a state of the art programmable orbital TIG welding process. During welding, argon gas is used as a purge to eliminate oxidation and ensure complete and uniform penetration.

Specifications

Material

Hose	321ss
Flanges	304ss
Gaskets	OFE copper or FKM / FPM fluoroelastomer elastomer
O-rings	FKM / FPM fluoroelastomer, Buna-N® or Silicone elastomer
Clamps, hinged & bulkhead	Aluminum

Fastening

Bolt, Clamp, Bulkhead	Refer to individual flange
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Vacuum Range

Del-Seal™ CF and Weldable Nipple	1x10 ⁻¹⁰ Torr
Kwik-Flange™ and Large-Flange™	1x10 ⁻⁸ Torr

Temperature Range

	Minimum	Intermittent	Sustained
Copper gasket	-200°C	450°C	400°C
FKM / FPM fluoroelastomer	-20°C	200°C	150°C
Buna-N®	-20°C	100°C	80°C
Silicone	-20°C	200°C	150°C

Bellows Thickness

.25" and .38" O.D. nominal	.008
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Bend Radius

See table, given in inches

Weight & Additional Dimensions

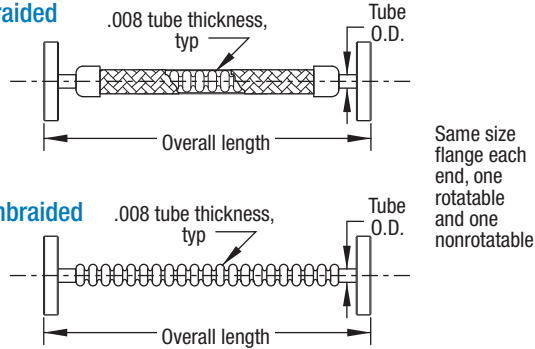
See table



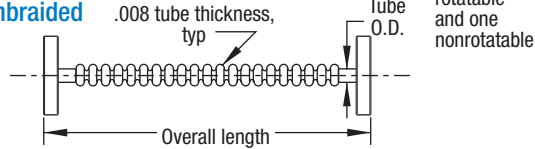
Braided



Braided



Unbraided



- 1.33 Mini Del-Seal™ CF flanges
- Thin wall braided and unbraided
- 321 stainless steel bellows
- Bakeable to 450°C
- Other flanges, connectors and custom lengths available upon request

Centerline Bend Radii

.25 Tube O.D.

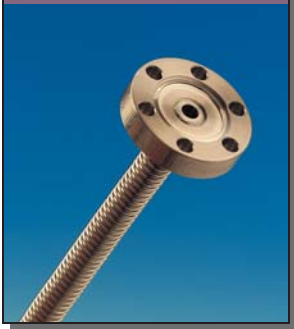
Braided, static	1.75
Braided, dynamic	5.00
Unbraided, static	1.13

.38 Tube O.D.

Braided, static	3.00
Braided, dynamic	8.00
Unbraided, static	1.88

NOMINAL TUBE O.D.	FLANGE NOM.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	WT LB	REFERENCE	PART NUMBER
BRAIDED							
1/4	1-1/3	4	.008	1.75	1/4	FRL-075-025-4F2	440313
1/4	1-1/3	8	.008	1.75	1/4	FRL-075-025-8F2	440314
1/4	1-1/3	12	.008	1.75	1/2	FRL-075-025-12F2	440315
1/4	1-1/3	18	.008	1.75	1/2	FRL-075-025-18F2	440316
1/4	1-1/3	24	.008	1.75	3/4	FRL-075-025-24F2	440317
1/4	1-1/3	36	.008	1.75	1	FRL-075-025-36F2	440318
3/8	1-1/3	4	.008	3.00	1/4	FRL-075-038-4F2	440363
3/8	1-1/3	8	.008	3.00	1/4	FRL-075-038-8F2	440364
3/8	1-1/3	12	.008	3.00	1/2	FRL-075-038-12F2	440365
3/8	1-1/3	18	.008	3.00	1/2	FRL-075-038-18F2	440366
3/8	1-1/3	24	.008	3.00	3/4	FRL-075-038-24F2	440367
3/8	1-1/3	36	.008	3.00	1	FRL-075-038-36F2	440368

Unbraided



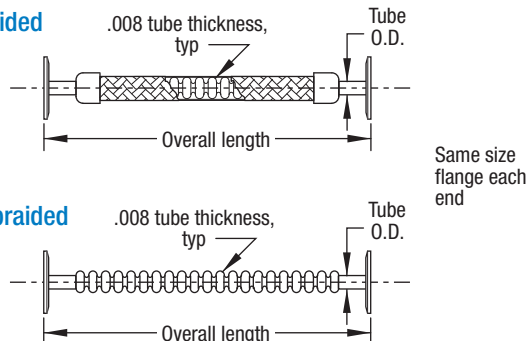
NOMINAL TUBE O.D.	FLANGE NOM.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	WT LB	REFERENCE	PART NUMBER
UNBRAIDED							
1/4	1-1/3	4	.008	1.13	1/4	UB-FRL-075-025-4F2	441313
1/4	1-1/3	8	.008	1.13	1/4	UB-FRL-075-025-8F2	441314
1/4	1-1/3	12	.008	1.13	1/2	UB-FRL-075-025-12F2	441315
1/4	1-1/3	18	.008	1.13	1/2	UB-FRL-075-025-18F2	441316
1/4	1-1/3	24	.008	1.13	3/4	UB-FRL-075-025-24F2	441317
1/4	1-1/3	36	.008	1.13	1	UB-FRL-075-025-36F2	441318
3/8	1-1/3	4	.008	1.88	1/4	UB-FRL-075-038-4F2	441363
3/8	1-1/3	8	.008	1.88	1/4	UB-FRL-075-038-8F2	441364
3/8	1-1/3	12	.008	1.88	1/2	UB-FRL-075-038-12F2	441365
3/8	1-1/3	18	.008	1.88	1/2	UB-FRL-075-038-18F2	441366
3/8	1-1/3	24	.008	1.88	3/4	UB-FRL-075-038-24F2	441367
3/8	1-1/3	36	.008	1.88	1	UB-FRL-075-038-36F2	441368



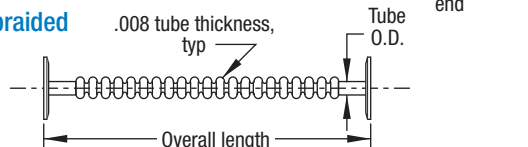
Braided



Braided



Unbraided



- Kwik-Flange™
- Thin wall braided and unbraided
- 321 stainless steel bellows
- Bakeable to 150°C sustained, 200°C intermittent
- Other flanges, connectors and custom lengths available upon request

Centerline Bend Radii

.25 Tube O.D.

Braided, static	1.75
Braided, dynamic	5.00
Unbraided, static	1.13

.38 Tube O.D.

Braided, static	3.00
Braided, dynamic	8.00
Unbraided, static	1.88

NOMINAL TUBE O.D.	ISO REF.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	WT LB	REFERENCE	PART NUMBER
BRAIDED							
1/4	NW16	4	.008	1.75	1/4	KFRL-075-025-4F2	440307
1/4	NW16	8	.008	1.75	1/4	KFRL-075-025-8F2	440308
1/4	NW16	12	.008	1.75	1/2	KFRL-075-025-12F2	440309
1/4	NW16	18	.008	1.75	1/2	KFRL-075-025-18F2	440310
1/4	NW16	24	.008	1.75	3/4	KFRL-075-025-24F2	440311
1/4	NW16	36	.008	1.75	1	KFRL-075-025-36F2	440312
3/8	NW16	4	.008	3.00	1/4	KFRL-075-038-4F2	440357
3/8	NW16	8	.008	3.00	1/4	KFRL-075-038-8F2	440358
3/8	NW16	12	.008	3.00	1/2	KFRL-075-038-12F2	440359
3/8	NW16	18	.008	3.00	1/2	KFRL-075-038-18F2	440360
3/8	NW16	24	.008	3.00	3/4	KFRL-075-038-24F2	440361
3/8	NW16	36	.008	3.00	1	KFRL-075-038-36F2	440362

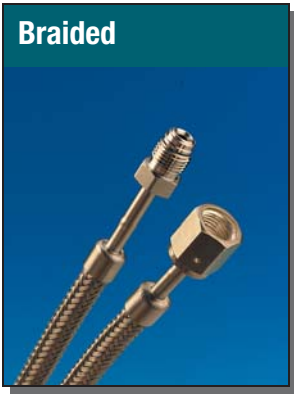
Unbraided



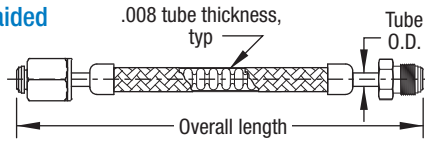
NOMINAL TUBE O.D.	ISO REF.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	WT LB	REFERENCE	PART NUMBER
UNBRAIDED							
1/4	NW16	4	.008	1.13	1/4	UB-KFRL-075-025-4F2	441307
1/4	NW16	8	.008	1.13	1/4	UB-KFRL-075-025-8F2	441308
1/4	NW16	12	.008	1.13	1/2	UB-KFRL-075-025-12F2	441309
1/4	NW16	18	.008	1.13	1/2	UB-KFRL-075-025-18F2	441310
1/4	NW16	24	.008	1.13	3/4	UB-KFRL-075-025-24F2	441311
1/4	NW16	36	.008	1.13	1	UB-KFRL-075-025-36F2	441312
3/8	NW16	4	.008	1.88	1/4	UB-KFRL-075-038-4F2	441357
3/8	NW16	8	.008	1.88	1/4	UB-KFRL-075-038-8F2	441358
3/8	NW16	12	.008	1.88	1/2	UB-KFRL-075-038-12F2	441359
3/8	NW16	18	.008	1.88	1/2	UB-KFRL-075-038-18F2	441360
3/8	NW16	24	.008	1.88	3/4	UB-KFRL-075-038-24F2	441361
3/8	NW16	36	.008	1.88	1	UB-KFRL-075-038-36F2	441362



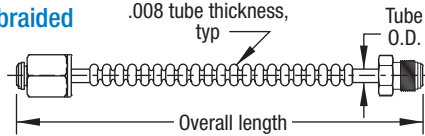
Braided



Braided



Unbraided



- VCR™ connection
- Thin wall braided and unbraided
- 321 stainless steel bellows
- Bakeable to 450°C
- Other flanges, connectors and custom lengths available upon request

Centerline Bend Radii

.25 Tube O.D.

Braided, static	1.75
Braided, dynamic	5.00

.38 Tube O.D.

Braided, static	3.00
Braided, dynamic	8.00

NOMINAL TUBE O.D.	CONNECTOR TYPE	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	WT LB	REFERENCE	PART NUMBER
BRAIDED							
MALE TO FEMALE							
1/4	1/4 VCR	8	.008	1.75	1/4	FRL-1/4VCR-8M/F	440319
1/4	1/4 VCR	12	.008	1.75	1/2	FRL-1/4VCR-12M/F	440320
1/4	1/4 VCR	18	.008	1.75	1/2	FRL-1/4VCR-18M/F	440321
1/4	1/4 VCR	24	.008	1.75	3/4	FRL-1/4VCR-24M/F	440322
1/4	1/4 VCR	36	.008	1.75	1	FRL-1/4VCR-36M/F	440323
MALE TO MALE							
1/4	1/4 VCR	8	.008	1.75	1/4	FRL-1/4MVCR-8F2	440324
1/4	1/4 VCR	12	.008	1.75	1/2	FRL-1/4MVCR-12F2	440325
1/4	1/4 VCR	18	.008	1.75	1/2	FRL-1/4MVCR-18F2	440326
1/4	1/4 VCR	24	.008	1.75	3/4	FRL-1/4MVCR-24F2	440327
1/4	1/4 VCR	36	.008	1.75	1	FRL-1/4MVCR-36F2	440328
FEMALE TO FEMALE							
1/4	1/4 VCR	8	.008	1.75	1/4	FRL-1/4FVCR-8F2	440329
1/4	1/4 VCR	12	.008	1.75	1/2	FRL-1/4FVCR-12F2	440330
1/4	1/4 VCR	18	.008	1.75	1/2	FRL-1/4FVCR-18F2	440331
1/4	1/4 VCR	24	.008	1.75	3/4	FRL-1/4FVCR-24F2	440332
1/4	1/4 VCR	36	.008	1.75	1	FRL-1/4FVCR-36F2	440333
BRAIDED							
MALE TO FEMALE							
3/8	3/8 VCR	8	.008	3.00	1/4	FRL-3/8VCR-8M/F	440369
3/8	3/8 VCR	12	.008	3.00	1/2	FRL-3/8VCR-12M/F	440370
3/8	3/8 VCR	18	.008	3.00	1/2	FRL-3/8VCR-18M/F	440371
3/8	3/8 VCR	24	.008	3.00	3/4	FRL-3/8VCR-24M/F	440372
3/8	3/8 VCR	36	.008	3.00	1	FRL-3/8VCR-36M/F	440373
MALE TO MALE							
3/8	3/8 VCR	8	.008	3.00	1/4	FRL-3/8MVCR-8F2	440374
3/8	3/8 VCR	12	.008	3.00	1/2	FRL-3/8MVCR-12F2	440375
3/8	3/8 VCR	18	.008	3.00	1/2	FRL-3/8MVCR-18F2	440376
3/8	3/8 VCR	24	.008	3.00	3/4	FRL-3/8MVCR-24F2	440377
3/8	3/8 VCR	36	.008	3.00	1	FRL-3/8MVCR-36F2	440378
FEMALE TO FEMALE							
3/8	3/8 VCR	8	.008	3.00	1/4	FRL-3/8FVCR-8F2	440379
3/8	3/8 VCR	12	.008	3.00	1/2	FRL-3/8FVCR-12F2	440380
3/8	3/8 VCR	18	.008	3.00	1/2	FRL-3/8FVCR-18F2	440381
3/8	3/8 VCR	24	.008	3.00	3/4	FRL-3/8FVCR-24F2	440382
3/8	3/8 VCR	36	.008	3.00	1	FRL-3/8FVCR-36F2	440383



Unbraided



Centerline Bend Radii

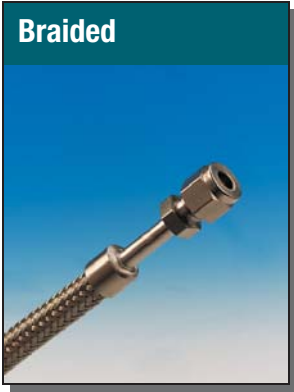
.25 Tube O.D.
Unbraided, static 1.13

.38 Tube O.D.
Unbraided, static 1.88

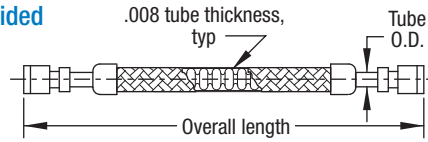
NOMINAL TUBE O.D.	CONNECTOR TYPE	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	WT LB	REFERENCE	PART NUMBER
UNBRAIDED							
MALE TO FEMALE							
1/4	1/4 VCR	4	.008	1.13	1/4	UB-FRL-1/4VCR-4M/F	441319
1/4	1/4 VCR	8	.008	1.13	1/4	UB-FRL-1/4VCR-8M/F	441320
1/4	1/4 VCR	12	.008	1.13	1/2	UB-FRL-1/4VCR-12M/F	441321
1/4	1/4 VCR	18	.008	1.13	1/2	UB-FRL-1/4VCR-18M/F	441322
1/4	1/4 VCR	24	.008	1.13	3/4	UB-FRL-1/4VCR-24M/F	441323
1/4	1/4 VCR	36	.008	1.13	1	UB-FRL-1/4VCR-36M/F	441324
MALE TO MALE							
1/4	1/4 VCR	4	.008	1.13	1/4	UB-FRL-1/4MVCR-4F2	441325
1/4	1/4 VCR	8	.008	1.13	1/4	UB-FRL-1/4MVCR-8F2	441326
1/4	1/4 VCR	12	.008	1.13	1/2	UB-FRL-1/4MVCR-12F2	441327
1/4	1/4 VCR	18	.008	1.13	1/2	UB-FRL-1/4MVCR-18F2	441328
1/4	1/4 VCR	24	.008	1.13	3/4	UB-FRL-1/4MVCR-24F2	441329
1/4	1/4 VCR	36	.008	1.13	1	UB-FRL-1/4MVCR-36F2	441330
FEMALE TO FEMALE							
1/4	1/4 VCR	4	.008	1.13	1/4	UB-FRL-1/4FVCR-4F2	441331
1/4	1/4 VCR	8	.008	1.13	1/4	UB-FRL-1/4FVCR-8F2	441332
1/4	1/4 VCR	12	.008	1.13	1/2	UB-FRL-1/4FVCR-12F2	441333
1/4	1/4 VCR	18	.008	1.13	1/2	UB-FRL-1/4FVCR-18F2	441334
1/4	1/4 VCR	24	.008	1.13	3/4	UB-FRL-1/4FVCR-24F2	441335
1/4	1/4 VCR	36	.008	1.13	1	UB-FRL-1/4FVCR-36F2	441336
UNBRAIDED							
MALE TO FEMALE							
3/8	3/8 VCR	4	.008	1.88	1/4	UB-FRL-3/8VCR-4M/F	441369
3/8	3/8 VCR	8	.008	1.88	1/4	UB-FRL-3/8VCR-8M/F	441370
3/8	3/8 VCR	12	.008	1.88	1/2	UB-FRL-3/8VCR-12M/F	441371
3/8	3/8 VCR	18	.008	1.88	1/2	UB-FRL-3/8VCR-18M/F	441372
3/8	3/8 VCR	24	.008	1.88	3/4	UB-FRL-3/8VCR-24M/F	441373
3/8	3/8 VCR	36	.008	1.88	1	UB-FRL-3/8VCR-36M/F	441374
MALE TO MALE							
3/8	3/8 VCR	4	.008	1.88	1/4	UB-FRL-3/8MVCR-4F2	441375
3/8	3/8 VCR	8	.008	1.88	1/4	UB-FRL-3/8MVCR-8F2	441376
3/8	3/8 VCR	12	.008	1.88	1/2	UB-FRL-3/8MVCR-12F2	441377
3/8	3/8 VCR	18	.008	1.88	1/2	UB-FRL-3/8MVCR-18F2	441378
3/8	3/8 VCR	24	.008	1.88	3/4	UB-FRL-3/8MVCR-24F2	441379
3/8	3/8 VCR	36	.008	1.88	1	UB-FRL-3/8MVCR-36F2	441380
FEMALE TO FEMALE							
3/8	3/8 VCR	4	.008	1.88	1/4	UB-FRL-3/8FVCR-4F2	441381
3/8	3/8 VCR	8	.008	1.88	1/4	UB-FRL-3/8FVCR-8F2	441382
3/8	3/8 VCR	12	.008	1.88	1/2	UB-FRL-3/8FVCR-12F2	441383
3/8	3/8 VCR	18	.008	1.88	1/2	UB-FRL-3/8FVCR-18F2	441384
3/8	3/8 VCR	24	.008	1.88	3/4	UB-FRL-3/8FVCR-24F2	441385
3/8	3/8 VCR	36	.008	1.88	1	UB-FRL-3/8FVCR-36F2	441386



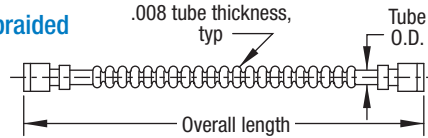
Braided



Braided



Unbraided



- Swagelok™ connection
- Thin wall braided and unbraided
- 321 stainless steel bellows
- Bakeable to 450°C
- Other flanges, connectors and custom lengths available upon request

Centerline Bend Radii

.25 Tube O.D.

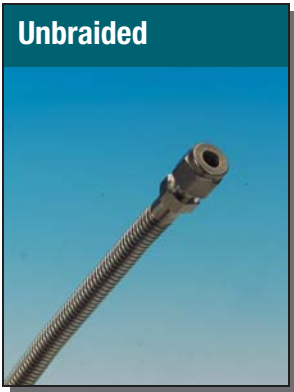
Braided, static	1.75
Braided, dynamic	5.00
Unbraided, static	1.13

.38 Tube O.D.

Braided, static	3.00
Braided, dynamic	8.00
Unbraided, static	1.88

NOMINAL TUBE O.D.	CONNECTOR TYPE	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	WT LB	REFERENCE	PART NUMBER
BRAIDED							
1/4	1/4 SWG	8	.008	1.75	1/4	FRL-1/4SWG-8F2	440334
1/4	1/4 SWG	12	.008	1.75	1/2	FRL-1/4SWG-12F2	440335
1/4	1/4 SWG	18	.008	1.75	1/2	FRL-1/4SWG-18F2	440336
1/4	1/4 SWG	24	.008	1.75	3/4	FRL-1/4SWG-24F2	440337
1/4	1/4 SWG	36	.008	1.75	1	FRL-1/4SWG-36F2	440338
3/8	3/8 SWG	8	.008	3.00	1/4	FRL-3/8SWG-8F2	440384
3/8	3/8 SWG	12	.008	3.00	1/2	FRL-3/8SWG-12F2	440385
3/8	3/8 SWG	18	.008	3.00	1/2	FRL-3/8SWG-18F2	440386
3/8	3/8 SWG	24	.008	3.00	3/4	FRL-3/8SWG-24F2	440387
3/8	3/8 SWG	36	.008	3.00	1	FRL-3/8SWG-36F2	440388

Unbraided



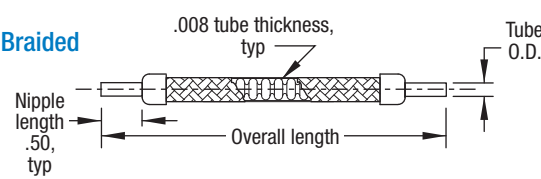
NOMINAL TUBE O.D.	CONNECTOR TYPE	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	WT LB	REFERENCE	PART NUMBER
UNBRAIDED							
1/4	1/4 SWG	4	.008	1.13	1/4	UB-FRL-1/4SWG-4F2	441337
1/4	1/4 SWG	8	.008	1.13	1/4	UB-FRL-1/4SWG-8F2	441338
1/4	1/4 SWG	12	.008	1.13	1/2	UB-FRL-1/4SWG-12F2	441339
1/4	1/4 SWG	18	.008	1.13	1/2	UB-FRL-1/4SWG-18F2	441340
1/4	1/4 SWG	24	.008	1.13	3/4	UB-FRL-1/4SWG-24F2	441341
1/4	1/4 SWG	36	.008	1.13	1	UB-FRL-1/4SWG-36F2	441342
3/8	3/8 SWG	4	.008	1.88	1/4	UB-FRL-3/8SWG-4F2	441387
3/8	3/8 SWG	8	.008	1.88	1/4	UB-FRL-3/8SWG-8F2	441388
3/8	3/8 SWG	12	.008	1.88	1/2	UB-FRL-3/8SWG-12F2	441389
3/8	3/8 SWG	18	.008	1.88	1/2	UB-FRL-3/8SWG-18F2	441390
3/8	3/8 SWG	24	.008	1.88	3/4	UB-FRL-3/8SWG-24F2	441391
3/8	3/8 SWG	36	.008	1.88	1	UB-FRL-3/8SWG-36F2	441392



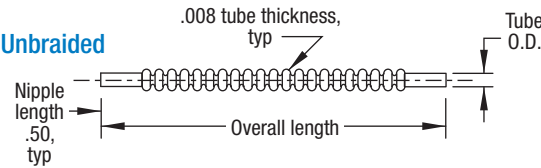
Braided



Braided



Unbraided



- Weldable or hose connection
- Thin wall braided and unbraided
- 321 stainless steel bellows and 316L tube ends
- Bakeable to 450°C
- Other flanges, connectors and custom lengths available upon request

Centerline Bend Radii

.25 Tube O.D.

Braided, static	1.75
Braided, dynamic	5.00
Unbraided, static	1.13

.38 Tube O.D.

Braided, static	3.00
Braided, dynamic	8.00
Unbraided, static	1.88

NOMINAL TUBE O.D.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	WT LB	REFERENCE	PART NUMBER
BRAIDED						
1/4	4	.008	1.75	1/4	FRL-025-4	440301
1/4	8	.008	1.75	1/4	FRL-025-8	440302
1/4	12	.008	1.75	1/2	FRL-025-12	440303
1/4	18	.008	1.75	1/2	FRL-025-18	440304
1/4	24	.008	1.75	3/4	FRL-025-24	440305
1/4	36	.008	1.75	1	FRL-025-36	440306
3/8	4	.008	3.00	1/4	FRL-038-4	440351
3/8	8	.008	3.00	1/4	FRL-038-8	440352
3/8	12	.008	3.00	1/2	FRL-038-12	440353
3/8	18	.008	3.00	1/2	FRL-038-18	440354
3/8	24	.008	3.00	3/4	FRL-038-24	440355
3/8	36	.008	3.00	1	FRL-038-36	440356

Unbraided



NOMINAL TUBE O.D.	OVERALL LENGTH	WALL THK.	STATIC BEND RAD.	WT LB	REFERENCE	PART NUMBER
UNBRAIDED						
1/4	4	.008	1.13	1/4	UB-FRL-025-4	441301
1/4	8	.008	1.13	1/4	UB-FRL-025-8	441302
1/4	12	.008	1.13	1/2	UB-FRL-025-12	441303
1/4	18	.008	1.13	1/2	UB-FRL-025-18	441304
1/4	24	.008	1.13	3/4	UB-FRL-025-24	441305
1/4	36	.008	1.13	1	UB-FRL-025-36	441306
3/8	4	.008	1.88	1/4	UB-FRL-038-4	441351
3/8	8	.008	1.88	1/4	UB-FRL-038-8	441352
3/8	12	.008	1.88	1/2	UB-FRL-038-12	441353
3/8	18	.008	1.88	1/2	UB-FRL-038-18	441354
3/8	24	.008	1.88	3/4	UB-FRL-038-24	441355
3/8	36	.008	1.88	1	UB-FRL-038-36	441356



PVC Kwik-Flange™ ISO KF

Specifications

Material	
Flanges	PVC
Tubing	Type 1 Grade PVC, ASTM D-1785, Sched 80
O-rings	FKM / FPM fluoroelastomer, Buna-N®
Centering rings	Stainless steel
Clamps	Aluminum
Fastening	
Clamps	Hinged
Thread Size	10-32 UNC
Torque	Finger-tight
Vacuum Range	5x10 ⁻³ Torr
Temperature Range	Ambient to 60°C maximum
Weight and Dimensions	See table

Low Vacuum

Features

- Low vacuum rated to 5x10⁻³ Torr
- Temperature rated to 60°C maximum
- ISO compatible design
- Corrosion resistant material
- Applications include extended length roughing lines and mechanical pump venting

Description

Polyvinyl chloride (PVC) components offer an economical solution to lengthy vacuum pump exhaust lines and rough vacuum lines. The light weight and flexibility of PVC makes it easy to cut and assemble custom configurations on-site.

Another major advantage of PVC is its resistance to most wet, corrosive environments. Kwik-Flange™ PVC components are preferred for use in corrosive environment applications where exposed metal surfaces are subject to deterioration.

Note that many mechanical vacuum pumps are supplied with integral ISO type fittings on both inlet and outlet ports. Kwik-Flange™ PVC components can be quickly and easily connected to these ports with standard ISO centering rings and hinged clamps.

PVC tubing and fittings are assembled by using a primer and cement. Follow all instructions on containers for leak tight joints.

Inch-Metric Comparison

MDC	O.D.	ISO	I.D.	Inches
	Inches		mm	
K075	.75	NW16	16	.63
K100	1.00	NW25	25	.98
K150	1.50	NW40	40	1.57
K200	2.00	NW50	50	1.97

Primer & Cement



DESCRIPTION

PVC PRIMER 1000
PVC CEMENT 1000

REFERENCE

PVCP-1000
PVCC-1000

PART NUMBER

728032
728033

PVC Primer 1000

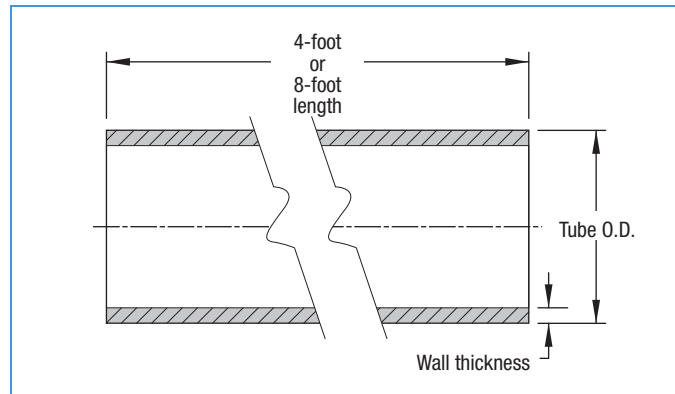
- Fast acting clear primer
- Softens and prepares PVC tube and flange
- To be used with PVC Cement 1000

PVC CEMENT 1000

- For all sizes and types of PVC
- Sets up rapidly and provides strong leak-tight weld
- Hundreds of PVC welds in each can



Tube

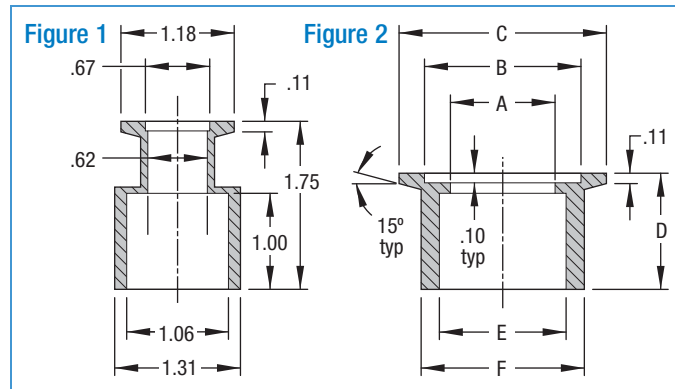


- Conforms to ASTM D-1785, Type 1
- Refer to table for exact dimensions
- High chemical resistance
- 60°C (140°F) maximum working temperature
- 4-ft and 8-ft standard lengths

PVC NOM.	LENGTH	USE WITH REF. ISO	TUBE O.D.	WALL THICKNESS	WT LB
1	4	NW25	1.05	.18	2
1	8	NW25	1.05	.18	4
1-1/2	4	NW40	1.31	.20	2-1/2
1-1/2	8	NW40	1.31	.20	5
2	4	NW50	1.90	.22	4
2	8	NW50	1.90	.22	8

REFERENCE	PART NUMBER
PVCT-100-4	728041
PVCT-100-8	728042
PVCT-150-4	728043
PVCT-150-8	728044
PVCT-200-4	728045
PVCT-200-8	728046

Weld Flange



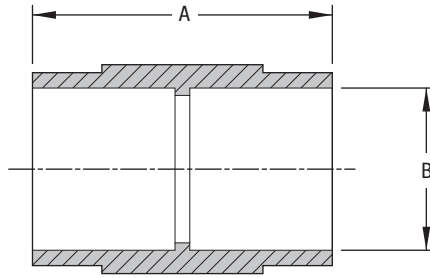
- Mates with standard Kwik-Flange™ ISO KF hardware
- Use with PVC tubing
- Requires cementing

PVC NOM.	FIG.	ISO NOM.	A	B	C	D	E	F	WT LB
1	1	NW16	-	-	See Dimensions on Figure 1	-	-	-	1/4
1	2	NW25	.80	1.03	1.57	1.17	1.06	1.20	1/4
1-1/2	2	NW40	1.09	1.62	2.16	1.21	1.32	1.70	1/4
2	2	NW50	1.62	2.06	2.95	1.23	1.91	2.20	1/4

REFERENCE	PART NUMBER
PVC-K075-W	728004
PVC-K100-W	728005
PVC-K150-W	728006
PVC-K200-W	728007



Coupling

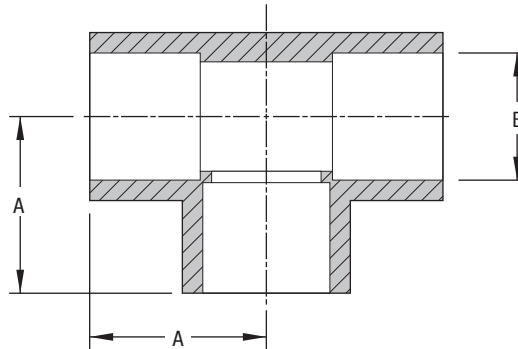


- Use with PVC tubing
- Requires cementing

FLANGE REF. ISO	FLANGE O.D.	PVC NOM. SIZE	COUPLING O.D.	A	B	WT LB
NW25	1.57	1	1.50	2.18	1.06	1/2
NW40	2.16	1-1/2	1.82	2.44	1.32	1/2
NW50	2.95	2	2.52	2.98	1.91	1/2

REFERENCE	PART NUMBER
PVC-K100-C	728008
PVC-K150-C	728009
PVC-K200-C	728010

Tee



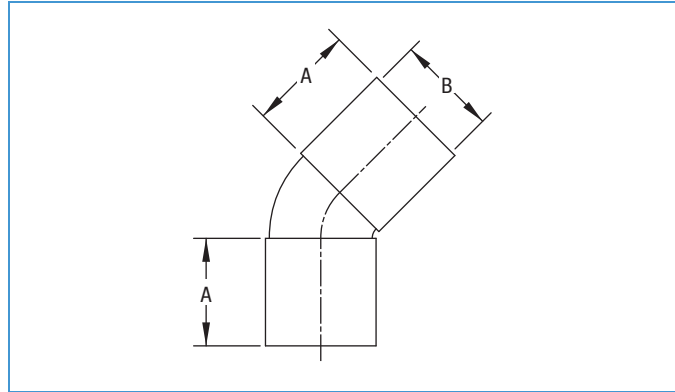
- Use with PVC tubing
- Requires cementing

FLANGE REF. ISO	FLANGE O.D.	PVC NOM. SIZE	TEE O.D.	A	B	WT LB
NW25	1.57	1	1.50	1.60	1.06	3/4
NW40	2.16	1-1/2	1.82	2.10	1.32	1-1/2
NW50	2.95	2	2.52	2.40	1.91	1-1/2

REFERENCE	PART NUMBER
PVC-K100-3	728017
PVC-K150-3	728018
PVC-K200-3	728019



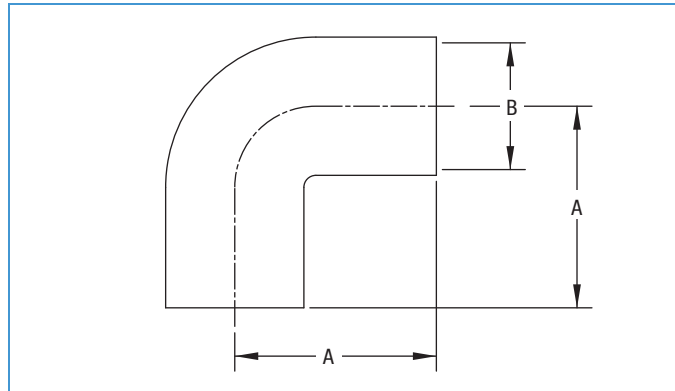
45° Elbow



- Use with PVC tubing
- Requires cementing

FLANGE REF. ISO	FLANGE O.D.	PVC NOM. SIZE	ELBOW O.D.	A	B	WT LB	REFERENCE	PART NUMBER
NW25	1.57	1	1.50	1.50	1.06	1/2	PVC-K100-45L	728011
NW40	2.16	1-1/2	1.82	1.75	1.32	3/4	PVC-K150-45L	728012
NW50	2.95	2	2.52	2.15	1.91	3/4	PVC-K200-45L	728013

90° Elbow



- Use with PVC tubing
- Requires cementing

FLANGE REF. ISO	FLANGE O.D.	PVC NOM. SIZE	ELBOW O.D.	A	B	WT LB	REFERENCE	PART NUMBER
NW25	1.57	1	1.50	1.60	1.06	1/2	PVC-K100-90L	728014
NW40	2.16	1-1/2	1.82	1.65	1.32	3/4	PVC-K150-90L	728015
NW50	2.95	2	2.52	2.35	1.91	3/4	PVC-K200-90L	728016



Features

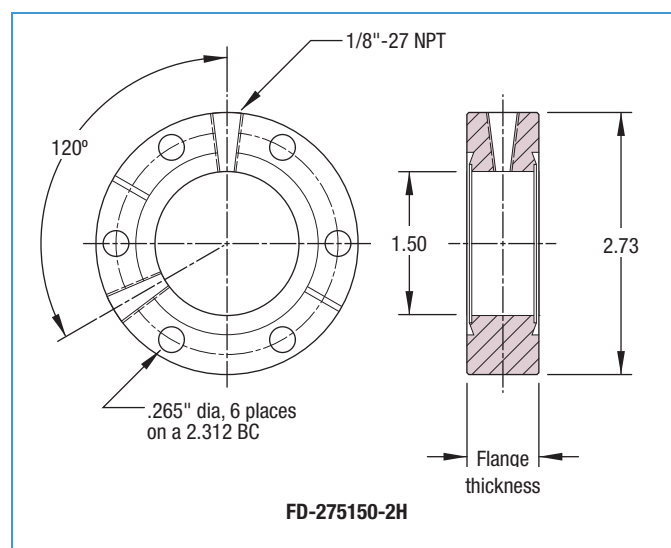
- Allows access to vacuum chambers by adding a minimum thickness to an existing port
- High vacuum rated to 10^{-8} Torr
- Temperature rated to 150°C maximum
- Useable with any combination of valves and gauge tubes

HIGH VACUUM SERIES

Description

Del-Seal™ CF 2-3/4 inch Double Sided Flanges are supplied with no accessory holes or with one or two radial 1/8"-27 NPT tapped holes. These holes can accommodate thermocouple gauge tubes, Up-to-Air valves, or a combination of a tube and a valve. Custom configurations are available on request.

Note that vacuum ratings and temperature maximums are limited by the method used to seal the pipe threads.



DOUBLE SIDED FLANGE 2 NPT TAPPED HOLES



PART NUMBER 420002

T/C GAUGE TUBE SINGLE NPT TAPPED HOLE



PART NUMBER 420003

UP-TO-AIR VALVE SINGLE NPT TAPPED HOLE



PART NUMBER 420004

TUBE & VALVE WITH CENTER BAFFLE



PART NUMBER 420005

PLUGS STAINLESS STEEL 1/8"-27 NPT



PART NUMBER 420008

DOUBLE-SIDED	FLANGE THICKNESS	NO. OF HOLES 1/8"-27 NPT	ATTACHMENT #1	ATTACHMENT #2	WT LB	REFERENCE	PART NUMBER
2-3/4	0.75	0	-	-	3/4	FD-275150	140013
2-3/4	0.75	1	-	-	3/4	FD-275150-1H	420001
2-3/4	0.75	2	-	-	3/4	FD-275150-2H	420002
2-3/4	0.75	1	ELASTOMER STOPPER	-	3/4	FD-275150-GV	420015
2-3/4	0.75	1	1518 T/C GAUGE TUBE	-	1	FD-275150-TC	420003
2-3/4	0.75	1	1/4" UP-TO-AIR VALVE	-	1-1/2	FD-275150-V	420004
2-3/4	0.75	2	1/4" UP-TO-AIR VALVE	1518 T/C GAUGE TUBE	1-1/2	FD-275150-VTC	420005
2-3/4	1.00	0	-	-	1	FD-275150-1	140014
2-3/4	-	-	1/8"-27 NPT STAINLESS STEEL PLUGS, SET OF 2	-	1/8	PLG-112	420008



ULTRAHIGH & HIGH VACUUM SERIES

Description

MDC Up-to-Air Valves are welded directly to a flange. The valves are 1/4 inch, bellows sealed, manually activated, and have a 1/4-inch O.D. tube termination. They are designed for use on any type of vacuum system for venting and back fill.

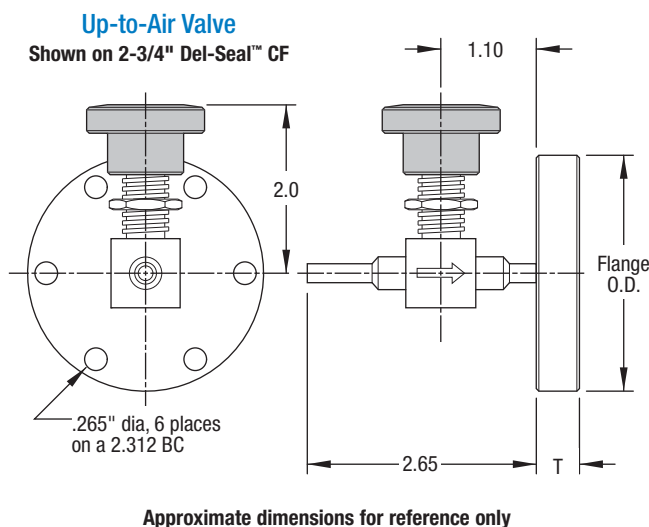
Temperature range:

Del-Seal™ CF configuration: -60° to 315°C (-80° to 600°F)

Kwik-Flange™ ISO KF configuration: -20° to 150°C (-5° to 300°F)

Features

- Allows venting or back fill of vacuum chambers
- High vacuum rated to 10^{-8} Torr
- Temperature rated to 315°C maximum with Del-Seal™ CF configuration
- Standard 1/4" tube end



NOMINAL FLANGE	FLANGE REF.	FLANGE O.D.	T	DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3	F133000	1.33	.285	DEL-SEAL FLANGE WITH 1/4" UP-TO-AIR VALVE	3/4	F133000-V	420009
2-1/8	F218000	2.12	.470	DEL-SEAL FLANGE WITH 1/4" UP-TO-AIR VALVE	1	F218000-V	420011
2-3/4	F275000	2.73	.500	DEL-SEAL FLANGE WITH 1/4" UP-TO-AIR VALVE	1-1/2	F275000-V	420006

NOMINAL FLANGE	FLANGE REF.	FLANGE O.D.	T	DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW16	K075	1.18	.200	KWIK-FLANGE WITH 1/4" UP-TO-AIR VALVE	3/4	K075-V	420010
NW25	K100	1.57	.200	KWIK-FLANGE WITH 1/4" UP-TO-AIR VALVE	3/4	K100-V	420012
NW40	K150	2.16	.200	KWIK-FLANGE WITH 1/4" UP-TO-AIR VALVE	1	K150-V	420013
NW50	K200	2.95	.200	KWIK-FLANGE WITH 1/4" UP-TO-AIR VALVE	1-1/2	K200-V	420014

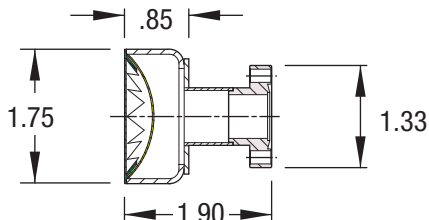


Pressure Burst Disc

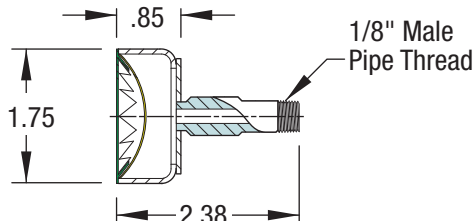


- Positive pressure relief
- Leak tight to 2×10^{-10} std. cc/sec of Helium
- Stainless steel body
- Compact design with no moving parts

BDA-M
Flanged



BDA-P
Pipe Thread



Description

MDC Burst Discs have been developed as a safety device to protect vacuum systems against back fill over-pressure. They can be used on any type of system where over-pressurization is undesirable.

When over-pressure occurs, the thin diaphragm comes in contact with the sharp edges of the housing and ruptures, relieving the pressure in the system. Once ruptured, the unit must be discarded and replaced.

The disc is designed to burst at a positive pressure anywhere in the range from over atmosphere to 25 psig, with rupture certain to occur before 25 psig.

DESCRIPTION	WT LB
1-1/3" DEL-SEAL FLANGE WITH PRESSURE BURST DISC	3/4

REFERENCE	PART NUMBER
BDA-M	420030

DESCRIPTION	WT LB
1/8"-27 MALE PIPE THREAD WITH PRESSURE BURST DISC	1/4

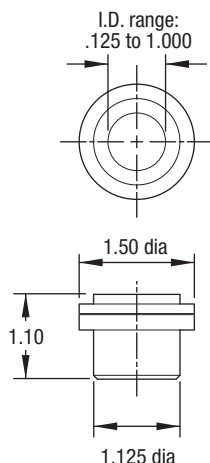
REFERENCE	PART NUMBER
BDA-P	420031

Test Port Kit

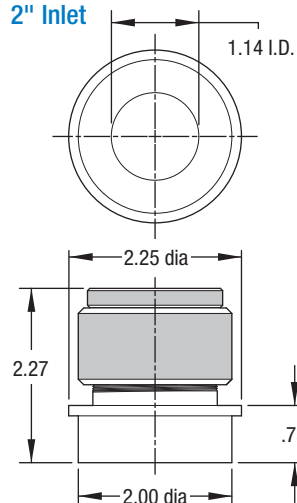


- Lightweight all-aluminum construction
- Choice of 1-1/8" and 2" inlet kits
- Ten different sizes, 1/8" through 1"
- Sturdy complete-set carrying case for convenience and safety

1-1/8" Inlet



2" Inlet



Description

MDC Test Port Reducer Kits offer a set of ten different size aluminum reducing adapters for either 1-1/8 or 2 inch inlets. They can be used with leak detectors and other devices with an internal O-ring seal. The kits provide a quick, simple, and inexpensive method for reducing the two standard inlets to tube sizes 1, 7/8, 3/4, 5/8, 1/2, 3/8, 5/16, 1/4, 3/16 and 1/8 inch O.D.

In the 2 inch kit, the small test ports fit inside the large adapter. Note that the 1-1/8 inch kit does not include the 2-inch adapter.

Each set is supplied in a durable carrying and storage case.

DESCRIPTION	WT LB
1-1/8" TEST PORT REDUCER KIT	3
2" TEST PORT REDUCER KIT	3-1/2

REFERENCE	PART NUMBER
TPR-112	651000
TPR-200	651001



Lubricant, Thread



DESCRIPTION	WT OZ	REFERENCE	PART NUMBER
FEL-PRO® C-102	1	FEL-PRO C-102	432030

- Anti-galling lubricant for threads
- High temperature lubricant
- Temperature range to 1315°C
- Lead-free petroleum distillate
- Contains calcium fluoride and graphite
- 1 oz. tube

Lubricant, Vacuum



DESCRIPTION	WT OZ	REFERENCE	PART NUMBER
DOW CORNING VACUUM GREASE DC-150	5.3	DOW DC-150	432031

- Elastomer gasket sealant
- Gear and bearing lubricant
- Heat stable
- Temperature range -40°C to +260°C
- Low vapor pressure
- Inert, resists most chemicals
- 5.3 oz. tube

Lubricant, Vacuum



DESCRIPTION	WT OZ	REFERENCE	PART NUMBER
APIEZON® VACUUM GREASE TYPE L	.9	TYPE L	432032
APIEZON® VACUUM GREASE TYPE M	.9	TYPE M	432033

- Elastomer gasket sealant
- Gear and bearing lubricant
- Approximate melting point Type L 47°C Type M 44°C
- Vapor pressure, Torr at 20°C Type L 8×10^{-11} Type M 2×10^{-9}
- Hydrocarbon base allows easy clean-up with common solvents
- 0.9 oz. tube (25g)

Lubricant, Vacuum



DESCRIPTION	WT OZ	REFERENCE	PART NUMBER
KRYTOX® LVP	2	KRYTOX LVP	432035

- Elastomer gasket sealant
- Gear and bearing lubricant
- High vacuum grease
- Temperature range -20°C to +300°C
- Vapor pressure, Torr at 20°C $< 10^{-13}$
- Fluorinated oil with fluorocarbon thickener
- 2 oz. tube

Sealant

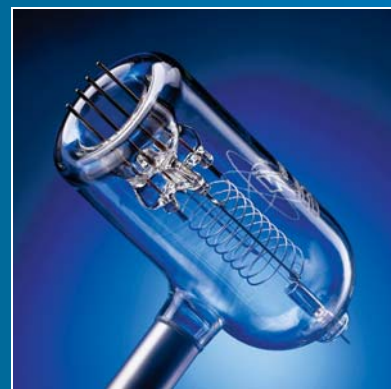


DESCRIPTION	WT OZ	REFERENCE	PART NUMBER
EPOXY PATCH	4	EP-1	432037

- Low vapor pressure resin sealant
- Seals without solvent evaporation
- Temperature range -45°C to +125°C
- Vacuum range 10^{-8} Torr
- Epoxy cement in two tubes:
 - a. Resin 2.8 oz.
 - b. Hardener 1.2 oz.

Vacuum Measurement

4



Section 4

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MDC vacuum gauge tubes

- Bourdon gauge
- Thermocouple gauge tube
- Enclosed ionization gauge tube
- Nude ionization gauge tube

Bourdon Gauge

Deflection gauges measure true pressure via deflection of a bourdon tube, independent of the type of gas in a system. Bourdon tubes are constructed in either C-tube or helical coil geometries and of these two, helical Bourdon tubes provide the greatest sensitivity.

MDC Bourdon gauges are designed for rough vacuum measurements in the range of 30 inches of mercury and positive pressures to 30psig. As a general rule, all vacuum components and chambers are rated for vacuum service and should never be internally pressurized. Bourdon gauges are offered with Del-Seal™ CF metal seal flanges, Kwik-Flange™ ISO KF flanges and male NPT pipe thread fittings.

Thermocouple Gauge Tube

MDC thermocouple gauge tubes offer fast and reliable vacuum measurement from 1 to 1×10^{-4} Torr.

Thermocouple gauge tubes consist of two basic components, a resistive filament and a thermocouple junction used to measure its temperature. Thermocouple gauge tubes operate on the thermal conductivity principle. Basically, they measure the thermal conductivity of a residual gas inside a vacuum system, or its ability to conduct heat away from a heated filament. The higher the pressure inside a vacuum system the cooler the filament or conversely, the lower the gas pressure the hotter the filament becomes. The thermocouple junction inside the gauge tube is positioned on the heated filament and is used to monitor its temperature during system evacuation. A temperature rise or drop in the filament produces a potential rise or drop in the

thermocouple junction. This potential in millivolts, is then calibrated to microns in a thermocouple gauge controller.

Because thermocouple gauge tubes and control electronics are available from a multitude of manufacturers, it is important to note that individual thermocouple gauge tubes are designed to operate at specific filament current ratings, which should be carefully matched with a control instrument's specifications. Always refer to the control electronics manufacturer for specifications on filament current requirements before purchasing or installing a thermocouple gauge tube.

MDC UHV gauge tubes feature all-welded construction and stainless steel casing tubes that are bakeable to 150°C. Electrical connections are glass insulated and employ a standard eight pin interface with a polarized center post. They are offered with Del-Seal™ CF flanges and Swagelok's VCR® fittings. HV gauge tubes are supplied with male NPT pipe thread fittings and a nickel plated steel shell assembly for maximum corrosion resistance and bakeable to 150°C.

Thermocouple gauge tubes are expendable vacuum components and must be replaced periodically. Most gauges are typically calibrated for service in air (nitrogen) and experience extreme variations in calibration when in the presence of other gases, subsequently leading to erroneous vacuum measurement readings. An inexpensive solution would be to include a non-gas-dependent gauge such as a Bourdon gauge to verify calibration.

Glass Enclosed Ionization Gauge Tube

MDC glass enclosed ionization gauge tubes are designed for high and ultrahigh vacuum

All dimensions in this catalog are given in inches unless specified otherwise.



Bourdon type gauges

page 290



Thermocouple gauge tube

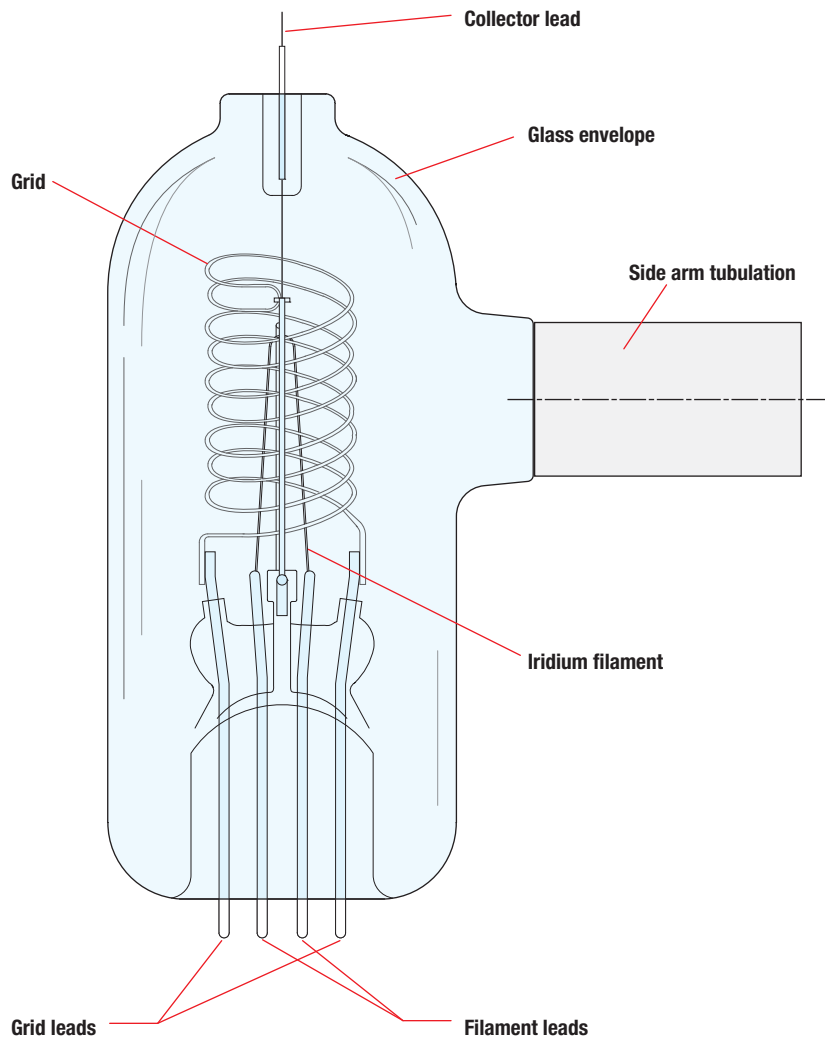
page 291

measurements between 1×10^{-3} to 2×10^{-10} Torr. Glass enclosed ionization tubes, commonly referred to as a Bayard-Alpert gauge tubes, consist of several components including a resistive filament, a positively charged grid and a negatively charged collector. The resistive filament is heated to incandescence for the purpose of emitting electrons. The grid, a positively charged wire, coiled in the shape of a spiral, attracts and accelerates filament emitted electrons. The collector, a negatively charged wire, is strategically placed in the path of oncoming electrons. As electrons collide with air molecules inside the tube, the air molecules lose an electron and become positively charged or ionized and thus attracted to the negatively charged collector. Upon colliding with the collector air molecules regain their lost electron and return to their original neutral charge. The flow of electrons from the collector to air molecules is measured and calibrated for vacuum measurement. The number of air molecules is directly proportional to their ionization and in direct proportion to the flow of electrons surrendered by the collector.

Nude Ionization Gauge Tube

MDC nude ionization gauge tubes are designed for high and ultrahigh vacuum measurements between 1×10^{-3} to 2×10^{-11} Torr. Like their glass enclosed counterparts, these are also hot cathode ionization types. The main difference being their method of construction. Nude gauges allow for easy replacement of perishable filaments and the added durability of ceramic-to-metal electrical feedthrough insulation which makes them bakeable to 450°C. Two nude gauge styles are offered, these are resistive heating or electron bombardment degas.

Typical Glass Envelope Ionization Gauge Tube
Shown with Kovar® side arm



Nude ionization gauge tube

page 294



Glass enclosed ionization gauge tube

page 298



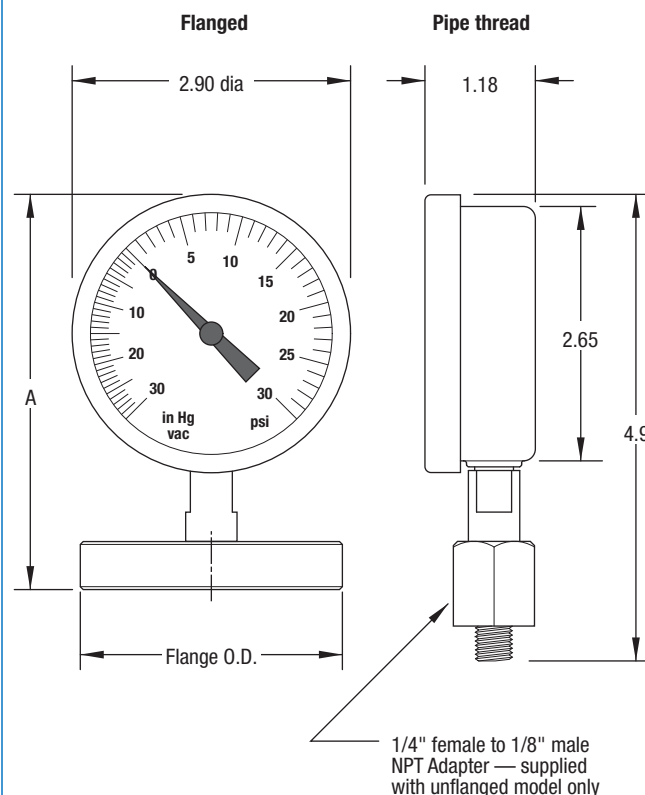
Replacement filaments

page 294



LOW VACUUM SERIES

Pressure / Vacuum Gauge



- 2-1/2" diameter gauge face
- On NPT model only, removable adapter allows either 1/8" or 1/4" NPT thread mounting

Features

- Large easy-to-read dial
- 30 inch Hg to 30 PSIG range
- Del-Seal™ CF, Kwik-Flange™ or NPT mounting
- Stainless steel construction
- 150°F maximum bakeout temperature

Description

Provides a quick visual check of roughing line pressures.

Note that these gauges are intended for vacuum use with other MDC components and as such are not rated for oxygen service.

NOMINAL FLANGE	FLANGE REFERENCE	FLANGE O.D.	A	WT LBS	REFERENCE	PART NUMBER
FLANGED						
1-1/3	F133000	1.33	4.0	1/2	075-VG	432014
2-1/8	F218000	2.11	4.2	3/4	100-VG	432015
2-3/4	F275000	2.73	4.2	3/4	150-VG	432016
NW16	K075	1.18	4.2	1/2	K075-VG	432010
NW25	K100	1.57	4.2	1/2	K100-VG	432011
NW40	K150	2.16	4.2	3/4	K150-VG	432012
NW50	K200	2.95	4.2	3/4	K200-VG	432013
PIPE THREAD						
NPT THREAD	Includes one 1/4" FEMALE TO 1/8" MALE air fitting			1/2	VG	432020



ULTRAHIGH & HIGH VACUUM SERIES

Features

- 0.1 micron to 1000 micron Hg range
- UHV and HV tubes
- Interchangeable with other brands
- Choice of connectors



Thermocouple Gauge Tubes

General Description

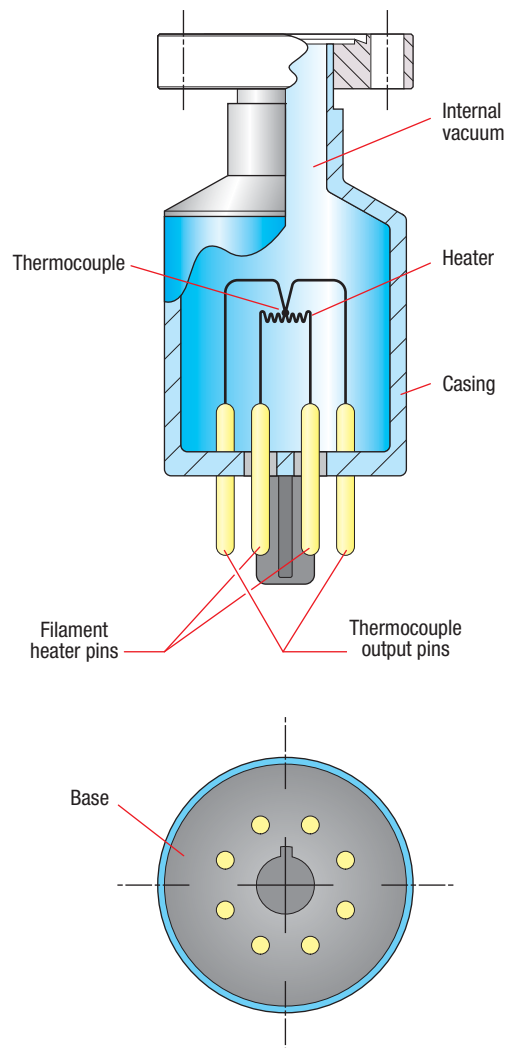
MDC Thermocouple Gauge Tubes offer a fast and reliable means of measuring vacuum from 0.1 to 1000 micron Hg. They can be read continuously and remotely under severe operating conditions.

Individual thermocouple gauges operate with specific heater current ratings. Gauge tubes must be matched to the instrument's specifications. Refer to the manufacturer's instructions for heater current and thermocouple output. Note that although some units are fitted with eight pins, only four pins are actively used. See tube pin-out configurations on page 292.

UHV Series Tubes feature all-welded construction, stainless steel casings, and are bakeable to 150°C. Electrical connections are glass insulated. They are offered with Del-Seal™ CF mini-flanges and Cajon VCR® fittings.

HV Series Tubes are supplied with nickel plated steel shell and stem assemblies for corrosion resistance. They are bakeable to 150°C.

Thermocouple Gauge Parts Simplified TGT-2AM shown





Tube Interchange / Cross Reference Table

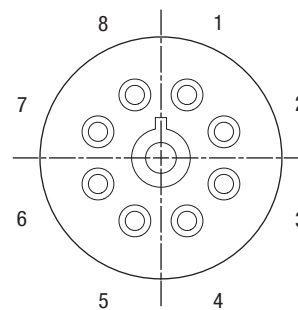
Several of the MDC tubes will directly interchange with models of various manufacturers as noted in the Cross Reference Table. Standard Series tubes are equal or superior in performance while the High Temperature / UHV Series offer even higher specifications. Other models are available on request. Note that although some units are fitted with eight pins, only four pins are actively used.

MANUFACTURER	MODEL NUMBER	MDC REFERENCE	MDC PART NUMBER
TELEVAC	2A	TGT-2A	511013
VARIAN / NRC	531	TGT-5310	511008
VARIAN / NRC	531	TGT-531M	511001
VARIAN / NRC	531	TGT-531W	511003
CONSOLIDATED CVC	GTC-004	TGT-1504	511005
VEECO INSTRUMENTS	DV-1M	TGT-1000	511006
HASTINGS-RAYDIST	DV-6M	TGT-6000	511007

Tube Pin-Out

Generally, for all thermocouple gauge tubes the pin out patterns employ four active pins. Two of the pins supply current to the heater inside the gauge head and two of the pins provide a return signal which is dependent on pressure inside the vacuum vessel. In the case of gauge tubes having eight pins, four of the pins are active and the other four are used for support only.

Thermocouple Gauge Tube Pin-Out



REFERENCE	PART NUMBER	HEATER PINS		THERMOCOUPLE PINS	
		TC+	TC-		
TGT-2A	511013	1	8	7	2
TGT-2AM	511010	1	8	7	2
TGT-1518	511004	1	7	5	3
TGT-1518M	511000	1	7	5	3
TGT-1518W	511002	1	7	5	3
TGT-5310	511008	1	3	5	7
TGT-531M	511001	1	3	5	7
TGT-531W	511003	1	3	5	7
TGT-531S	511009	1	3	5	7
TGT-1504	511005	1	7	5	3
TGT-1000 ¹	511006	3	5	7	-
TGT-6000 ¹	511007	3	5	7	-

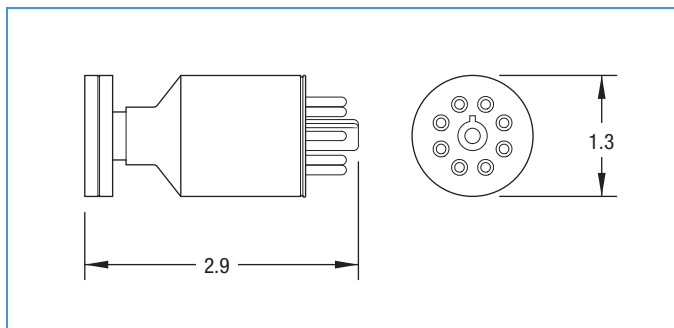
¹ AC connection on heater pins; DC connection on TC pins



1-1/3" Del-Seal™ CF



• TGT-2AM



- 150°C bakeout
- UHV compatible
- Del-Seal™ CF flange
- Stainless steel construction

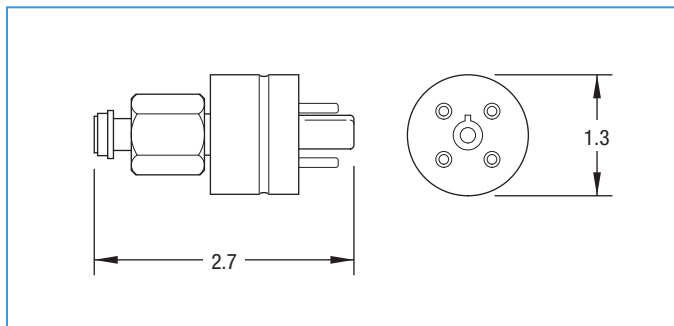
NOMINAL FLANGE	PRESSURE RANGE (μHg)	HEATER CURRENT (mA)	RESPONSE TIME (sec)	OUTPUT @ 55Ω and .01μHg (mV)	WT LB
1-1/3	0.1 - 1000	95	< 0.2	9.1	1/4
1-1/3	0.1 - 1000	15 - 18.5	< 0.1	10	1/4
1-1/3	0.1 - 2500	163	< 0.1	13.5 - 14.5	1/4

REFERENCE	---PART NUMBER
TGT-2AM	511010
TGT-1518M	511000
TGT-531M	511001

3/4" Hex VCR®



• TGT-1518W



- 150°C bakeout
- UHV compatible
- 1/4" Hex VCR® fitting
- Stainless steel construction

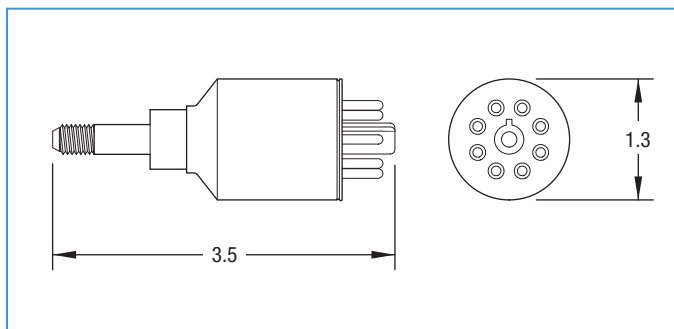
NOMINAL FITTING	PRESSURE RANGE (μHg)	HEATER CURRENT (mA)	RESPONSE TIME (sec)	OUTPUT @ 55Ω and .01μHg (mV)	WT LB
3/4" VCR®	0.1 - 1000	15 - 18.5	< 0.1	10	1/4
3/4" VCR®	0.1 - 2500	163	< 0.1	13.5 - 14.5	1/4

REFERENCE	PART NUMBER
TGT-1518W	511002
TGT-531W	511003

1/8" NPT



• TGT-2A



- 150°C bakeout
- HV compatible
- Nickel plated steel construction
- Stainless steel construction on TGT-531S

THREAD SIZE (NPT)	PRESSURE RANGE (μHg)	HEATER CURRENT (mA)	RESPONSE TIME (sec)	OUTPUT @ 55Ω and .01μHg (mV)	WT LB
1/8"	0.1 - 1000	95	< 0.2	9.1	1/4
1/8"	0.1 - 1000	15 - 18.5	< 0.1	10	1/4
1/8"	0.1 - 2500	163	< 0.1	13.5 - 14.5	1/4
1/8"	0.1 - 2500	163	< 0.1	13.5 - 14.5	1/4
1/8"	0.1 - 1000	15 - 18.5	< 0.1	9.6	1/4
1/8"	0.1 - 1000	130 - 135	< 0.1	10	1/4
1/8"	0.1 - 1000	20	< 0.1	10	1/4

REFERENCE	PART NUMBER
TGT-2A	511013
TGT-1518	511004
TGT-5310	511008
TGT-531S	511009
TGT-1504	511005
TGT-1000	511006
TGT-6000	511007



Nude Ionization Gauge Tubes

ULTRAHIGH VACUUM SERIES

Features

- 10^{-3} to 10^{-10} Torr range
- 2-3/4" Del-Seal™ CF flange mounted
- Resistive heating degas
- Replaceable filament assemblies
- Mount in any position
- Bayard-Alpert type tube

Vacuum Specifications

Vacuum Range	10^{-3} to 4×10^{-10} Torr
Maximum Operating Pressure	1×10^{-3} Torr
Sensitivity $\pm 20\%$	10 Torr
X-ray Limit	4×10^{-10} Torr

Construction Specifications

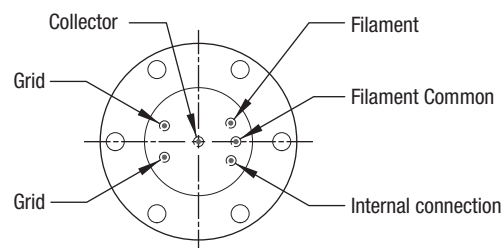
Flange	304ss
Grid	Molybdenum-clad Platinum
Filament	Single: Iridium Dual: Tungsten
Collector	Tungsten
Shield Coating	Platinum
Base Leads	Soft Nickel, 0.060" dia.
Collector Lead	Soft Nickel, 0.040" dia.

Operating Specifications

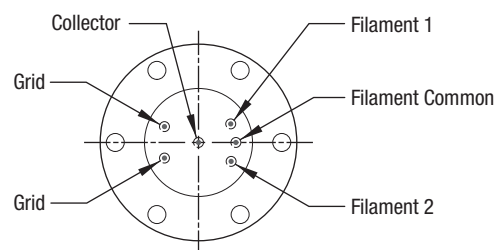
Collector	-30 Volts DC
Grid	+150 Volts DC
Filament	+30 Volts DC
Filament Voltage	3 - 5 Volts
Filament Current	4 - 6 Amps
Degas by I ² R	70 Watts
Emission	10 mA
Maximum Bakeout Temperature	450°C

Pin-Out Pattern

Single Filament



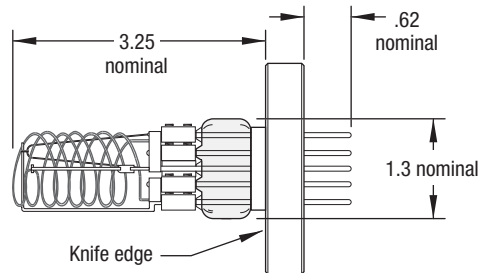
Dual Filament



- All pins 0.060 diameter
- Requires minimum 1.37" I.D. clearance for installation



I²R degas



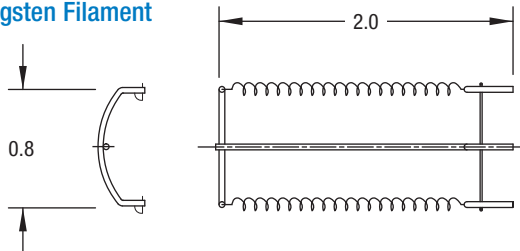
- High Temperature
- UHV compatible
- Del-Seal™ CF flange
- Replaceable filaments

NOMINAL FLANGE	DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4	TWIN TUNGSTEN FILAMENT, BAYARD-ALPERT GAUGE	3/4	BATT	432000
2-3/4	SINGLE IRIIDIUM FILAMENT, BAYARD-ALPERT GAUGE	3/4	BAIR	432002

Filaments



Twin Tungsten Filament



- High Temperature
- UHV compatible
- Replacement filament assemblies for above ionization gauge tubes

REPLACEMENT FOR	DESCRIPTION	WT LB	REFERENCE	PART NUMBER
BATT	TWIN TUNGSTEN FILAMENT, BAYARD-ALPERT GAUGE	3/4	BART	432001
BAIR	SINGLE IRIIDIUM FILAMENT, BAYARD-ALPERT GAUGE	3/4	BARI	432003

Tube Interchange / Cross Reference Table

Several of the MDC tubes will directly interchange with models of various manufacturers as noted in the Cross Reference Table. While tubes may have identical electrical specifications with tubes from other manufacturers not listed, pin-out dimensions may vary.

DESCRIPTION	REPLACEMENT FOR			MDC REFERENCE	MDC PART NUMBER
	GRANVILLE-PHILLIPS	PERKIN-ELMER	VARIAN		
SINGLE IRIIDIUM FILAMENT, BA GAUGE TUBE	274028	-	-	BAIR	432002
REPLACEMENT FILAMENT FOR 432002	274029	-	-	BARI	432003



ULTRAHIGH VACUUM SERIES

Features

- 10^{-3} to 10^{-11} Torr range
- 2-3/4" Del-Seal™ CF flange mounted
- Electron Bombardment degas
- Replaceable filament assemblies
- Mount in any position



Ionization Gauge Tubes

Vacuum Specifications

Vacuum Range	10^{-3} to 2×10^{-11} Torr
Maximum Operating Pressure	1×10^{-3} Torr
Sensitivity $\pm 20\%$	25 Torr
X-ray Limit	2×10^{-11} Torr

Construction Specifications

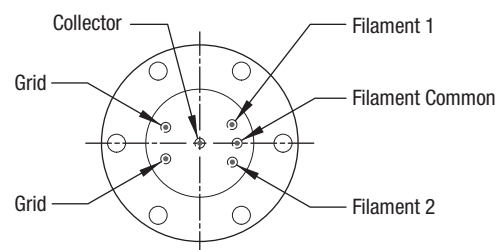
Flange	304ss
Grid	Tungsten
Filament	Dual: Tungsten or Iridium
Collector	Tungsten
Shield Coating	Platinum
Base Leads	Soft Nickel, 0.060" dia.
Collector Lead	Soft Nickel, 0.040" dia.

Operating Specifications

Collector	0 Volts DC
Grid	+180 Volts DC
Filament	+30 Volts DC
Filament Voltage	3 - 4.5 Volts
Filament Current	2 - 4 Amps
Degas by EB	30-40 Watts
Emission	4 mA
Maximum Bakeout Temperature	450°C

Pin-Out Pattern

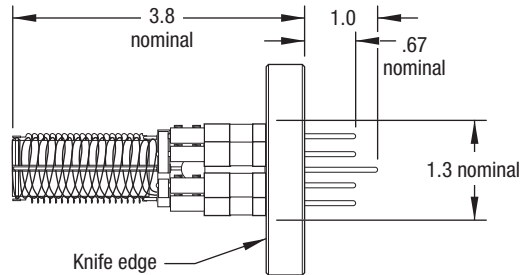
Dual Filament



- All pins 0.060 diameter
- Requires minimum 1.37" I.D. clearance for installation



EB degas



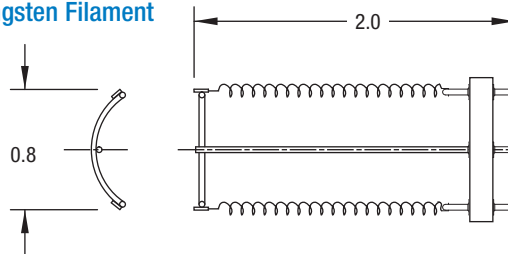
- High Temperature
- UHV compatible
- Del-Seal™ CF flange
- Stainless steel construction

NOMINAL FLANGE	DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4	TWIN TUNGSTEN FILAMENT, UHV GAUGE	3/4	UHTT	432004
2-3/4	TWIN IRIIDIUM FILAMENT, UHV GAUGE	3/4	UHIR	432006

Filaments



Twin Tungsten Filament



- High Temperature
- UHV compatible
- Replacement filament assemblies for above ionization gauge tubes

REPLACEMENT FOR	DESCRIPTION	WT LB	REFERENCE	PART NUMBER
UHTT	TWIN TUNGSTEN FILAMENT, UHV GAUGE	3/4	UHRT	432005
UHIR	TWIN IRIIDIUM FILAMENT, UHV GAUGE	3/4	UHRI	432007

Tube Interchange / Cross Reference Table

Several of the MDC tubes will directly interchange with models of various manufacturers as noted in the Cross Reference Table. While tubes may have identical electrical specifications with tubes from other manufacturers not listed, pin-out dimensions may vary.

DESCRIPTION	REPLACEMENT FOR			MDC REFERENCE	MDC PART NUMBER
	GRANVILLE-PHILLIPS	PERKIN-ELMER	VARIAN		
TWIN TUNGSTEN FILAMENT, UHV GAUGE TUBE	274022	605-7673	-	UHTT	432004
REPLACEMENT FILAMENT FOR 432004	274024	605-7671	-	UHRT	432005
TWIN IRIIDIUM FILAMENT, UHV GAUGE TUBE	274023	605-7672	-	UHIR	432006
REPLACEMENT FILAMENT FOR 432006	274025	605-7676	-	UHRI	432007



Side Arm Glass Envelope Ionization Gauge Tubes

ULTRAHIGH & HIGH VACUUM SERIES

Features

- Non-burnout design allows momentary exposure to atmosphere
- Choice of Pyrex®, Kovar® and Del-Seal™ CF flange
- ISO Kwik-Flange™ optional

Vacuum Specifications

Vacuum Range	10^{-3} to 2×10^{-10} Torr
Maximum Operating Pressure	1×10^{-3} Torr
Pumping Speed (Ionic)	0.06 liters/sec - N ₂ (1 mA)
X-ray Limit	2×10^{-10} Torr - N ₂ (approx.)

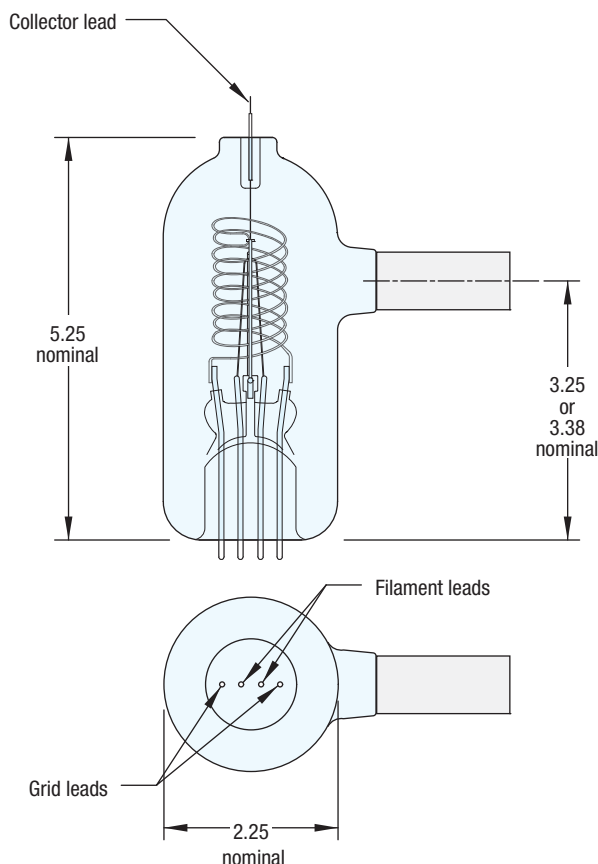
Construction Specifications

Envelope	Nonex
Grid	"Non-Sag" Tungsten 0.025" dia.
Filament	Hairpin thoriated-iridium
Collector	Tungsten, 0.010" dia.
Shield Coating	Platinum, internally connected to filament
Base Leads	Soft Nickel, 0.060" dia.
Collector Lead	Soft Nickel, 0.040" dia.
Internal Volume	220cc (not including tubulation)

Operating Ratings

Collector	0 Volts DC (ground)
Shield	Internally connected to filament
Grid	+150 Volts DC to ground
Filament	+30 Volts DC to ground
Filament Volts (AC)	4.0 Volts
Filament Current (AC)	3.5 Amps (1 mA grid current)
Absolute Max. Fil. Volts (AC)	6.0 Volts
Absolute Max. Fil. Current (AC)	6.0 Amps
Absolute Max. Fil. Temperature	1400°C

Pin-Out Pattern



- For both Grid and Filament leads, one is positive and the other is ground - It does not matter which lead is positive and which lead is ground.
- All four bottom leads are in a single line.
- Pin-out pattern is the same industry-wide.

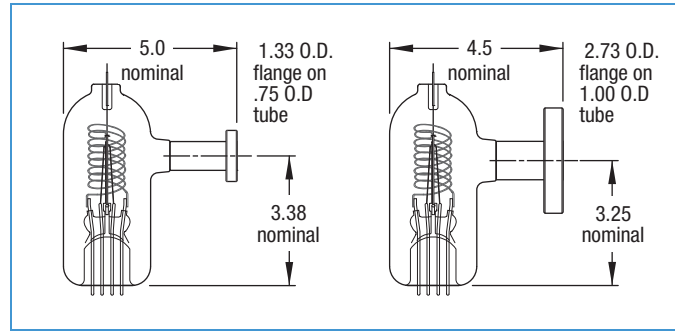
Vacuum Measurement

Glass Envelope Ionization Gauge Tube

Section 4.3



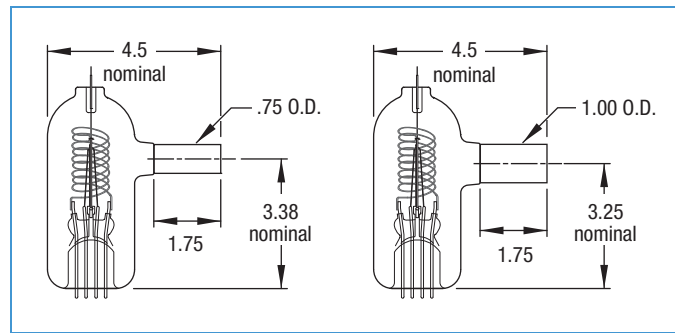
Del-Seal™ CF Flange



- UHV compatible
- Del-Seal™ CF flange

NOMINAL FLANGE	DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3	.75" TUBE WITH 1-1/3" DEL-SEAL FLANGE	1/2	IGT-075-D	432023
2-3/4	1.00" TUBE WITH 2-3/4" DEL-SEAL FLANGE	1/2	IGT-100-D	432026

Tubulated



- HV compatible
- Pyrex® tube or Kovar® sleeve

METHOD OF CONNECTION	DESCRIPTION	WT LB	REFERENCE	PART NUMBER
PYREX® TUBE				
3/4	.75" TUBE	1/2	IGT-075-P	432021
1	1.00" TUBE	1/2	IGT-100-P	432024
KOVAR® SLEEVE				
3/4	.75" TUBE	1/2	IGT-075-K	432022
1	1.00" TUBE	1/2	IGT-100-K	432025

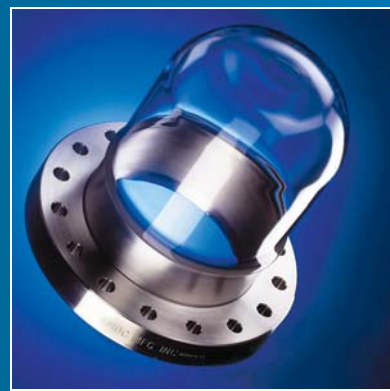
Tube Interchange / Cross Reference Table

Several of the MDC tubes will directly interchange with models of various manufacturers as noted in the Cross Reference Table. Exact pin-out dimensions may vary, but the pattern is the same industry-wide.

DESCRIPTION	REPLACEMENT FOR			MDC REFERENCE	MDC PART NUMBER
	GRANVILLE-PHILLIPS	PERKIN-ELMER	VARIAN		
DEL-SEAL, 1-1/3" NOMINAL SIZE	274020	-	-	IGT-075-D	432023
DEL-SEAL, 2-3/4" NOMINAL SIZE	274008	605-7152	571-K2471-303	IGT-100-D	432026
PYREX WITH GRADED SEAL, 3/4" TUBE	274002	-	-	IGT-075-P	432021
PYREX WITH GRADED SEAL, 1" TUBE	274005	-	-	IGT-100-P	432024
KOVAR WITH GRADED SEAL, 3/4" TUBE	274003	605-7000	571-K2471-305	IGT-075-K	432022
KOVAR WITH GRADED SEAL, 1" TUBE	274006	-	571-K2471-302	IGT-100-K	432025

5

Viewports & Glass Components



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MDC viewports and glass components

- Corning type 7056 glass
- Fused Quartz
- UV grade synthetic Sapphire
- Zero length geometry
- Magnetic and non magnetic construction

Glass Viewports

Glass viewports are an economical, practical and common solution for vacuum observation ports. Glass viewports are typically sealed to low expansion nickel-iron alloys or 300 series stainless steel metal sleeves using the latest in glass-to-metal bonding technology. The material in MDC glass viewports is Corning type 7056 glass, the most commonly used vacuum window material in the industry. MDC glass viewports provide high and ultrahigh vacuum compatibility for basic optical applications. Glass viewports are available on MDC's standard vacuum mounts including Del-Seal™ CF, Kwik-Flange™ and Large-Flange™ ISO flanges with clear apertures from 5/8 to 5-3/8 inch diameters. Since glass is susceptible to scratching and weak under point stresses, caution must be exercised when heating or cooling glass viewport assemblies. Thermal gradients in excess of 10°C per minute must be avoided. Because of implosion hazard, glass viewports with scratches or nicks should be replaced. For customers desiring a viewport with a replaceable glass substrate, MDC offers a weldable 4 inch view diameter Pyrex® viewport assembly. These viewports are constructed with Corning type 7740 glass and are sealed in place using an elastomer gasket and suitable for service to 1x10⁻⁸ Torr.

Quartz Viewports

Quartz viewports are designed and rated for high and ultrahigh vacuum applications. They are constructed using vacuum grade

materials including high purity silicon dioxide, fused quartz, 304 stainless steel for all metal components, and vacuum tube grade braze alloys. UV grade fused silica viewports are available from MDC's Insulator Seal division in Sarasota, Florida. Suprasil™ 1 and Suprasil™ 2 ultraviolet grade fused silica materials are standard catalog viewports at ISI. Fused silica and quartz are polycrystalline, isotropic materials with no crystal orientation. Their physical, thermal, dielectric and optical properties are uniform in all directions of measurement. Optical grade fused quartz is suitable for all but the most demanding optical applications. This material is guaranteed to be grade B or better. Natural impurities in fused quartz cause a blue-violet fluorescence when exposed to ultraviolet radiation at 253.7µm. This fluorescence is not evident in synthetic fused silica, which is manufactured by flame hydrolysis of silicon tetrachloride. Quartz viewports are available up to 7.78 inch view diameters. Fused quartz and fused silica viewports are preferred over glass viewports because of their transparency to ultraviolet radiation. Other advantages include a higher abrasion resistance and a low coefficient of thermal expansion, making them very resistant to thermal shock. The main limitation with fused quartz or fused silica viewports is that they cannot be heated to temperatures over 200°C. The lead-silver alloy used to seal and bond the window to a stainless steel sleeve melts at 305°C.

Sapphire Viewports

Sapphire is a synthetic, hexagonal single crystal anisotropic material which displays

For more information on VacOptix® and other MDC specialty viewports, please visit www.mdcvacuum.com.

VIEWPORT TYPE	PROPERTIES ZERO LENGTH	MAGNETIC	BAKEOUT MAX DEL-SEAL™ CF	ISO	MAXIMUM THERMAL GRADIENT	MATERIALS WINDOW	SLEEVE
GLASS	YES	YES	400°C	200°C	10°C/MIN	BOROSILICATE	NiFe
GLASS	NO	NO	400°C	200°C	10°C/MIN	BOROSILICATE	304ss
QUARTZ	YES	NO	200°C	200°C	25°C/MIN	SiO ₂	304ss
SAPPHIRE	YES	YES	450°C	200°C	25°C/MIN	Al ₂ O ₃	NiFe



Glass viewport family

page 306



Quartz viewport family

page 308

substantially different physical, thermal, dielectric and optical characteristics when measured along different axes. MDC sapphire viewports are constructed using 90° crystal orientation, where the crystal orientation is parallel to a window's surface. Viewports with crystal orientation parallel to the optical axis, or 0° orientation, can be custom ordered from Insulator Seal. MDC offers a wide selection of sapphire viewport assemblies suitable for high and ultrahigh vacuum applications. The use of high purity sapphire and nickel-iron low expansion alloys enables these viewports to be repeatedly baked to temperatures as high as 450°C. All sapphire viewports up to 1 inch in diameter use ultraviolet grade sapphire material. Those exceeding 1 inch diameters are supplied with regular grade sapphire. Please reference the transmission curves on this page for transmission characteristics and comparisons. Also note that limitations in current sapphire crystal growth technology make it difficult to guarantee constant transmission performance at wavelengths below 0.25µm

In general, poor surface finish can contribute as much as 10% to a window's total transmission losses. The sapphire viewports offered in this catalog are supplied with flat faces polished to a 50-20 scratch-dig while quartz viewports are 80-50 scratch-dig. Although these finishes are suitable for most optical applications, the optics industry recommends a 20-10 scratch-dig finish for wavelengths below 0.25µm.

Note: Visible light is 4,000 (violet) to 7,000 (red) Ångstroms (1 Å = 10⁻⁸ cm)

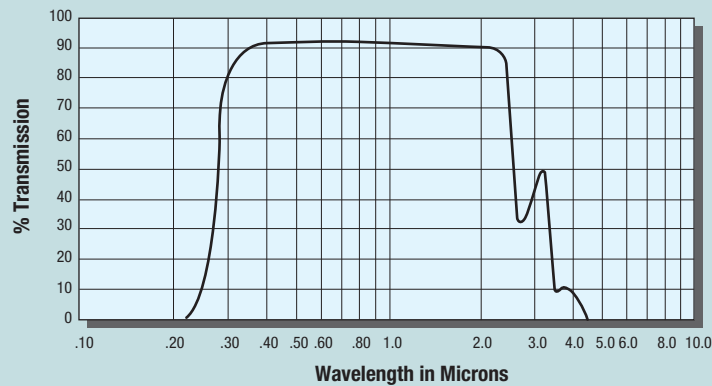
BRAZE	COMMENTS
FUSED	MATCHED EXPANSION SEAL
FUSED	HOUSEKEEPER SEAL
PbAg	BRAZE ALLOY MELTS AT 305°C
AgCu	BRAZE ALLOY MELTS AT 800°C



Sapphire viewport family

page 309

Glass Transmission Curve

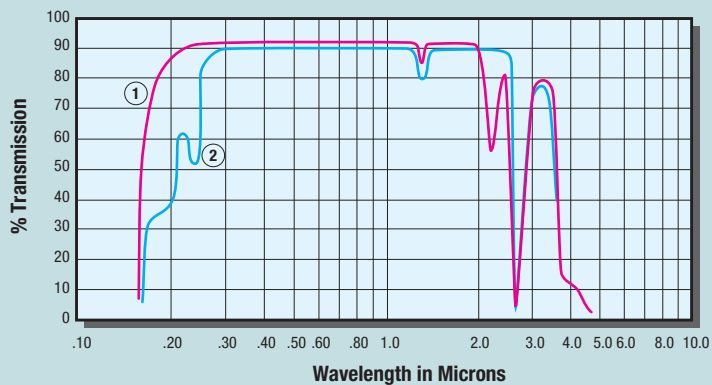


Glass

1 mm thick
Reflection
Losses
Included

7056 Borosilicate

Quartz Transmission Curve



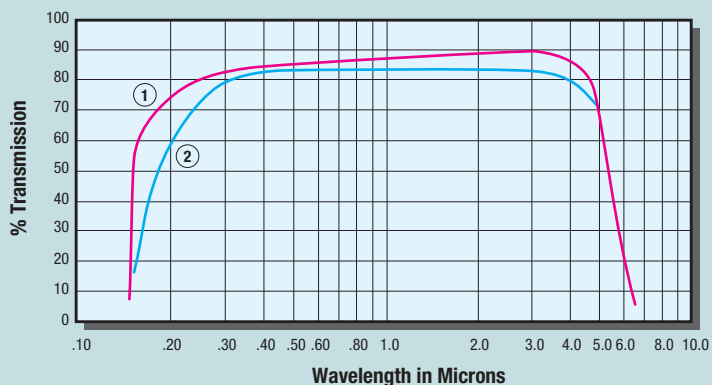
Quartz

10 mm thick
Reflection
Losses
Included

(1) UV Grade
Fused Silica

(2) Regular Grade
Fused Quartz

Sapphire Transmission Curve



Sapphire

1 mm thick
Reflection
Losses
Included

(1) UV Grade

(2) Regular Grade



MDC viewports and glass components

- Pyrex® Viewports
- Rotary shutter assemblies
- Single ended glass adapters
- Double ended glass adapters
- Sealed end glass adapters
- Flexible glass adapters

Pyrex® Viewports

MDC Pyrex® viewports provide a convenient and economical solution for high vacuum systems requiring periodic glass substrate replacement. Some applications like vacuum coating will deposit coating materials on system viewports which will eventually render them useless. The Pyrex® substrate is sealed against an elastomer gasket and clamped in place with an aluminum retaining flange. It is important to note that most glass materials are susceptible to point stressing if clamped directly against a metal surface. For this reason MDC Pyrex® viewport retaining flanges are fitted with a cushion gasket that prevents metal to glass contact. These viewports are offered in a weldable 4 inch view diameter half-nipple geometry. They are constructed with Corning type 7740 glass and are suitable for service to 1×10^{-8} Torr.

Viewport Shutter Assemblies

MDC manually actuated rotary shutters allow quick and easy shielding of standard viewports fitted with Del-Seal™ CF metal seal flanges. These shutters are ideally suited for vacuum coating applications where viewports are not easily replaced or too expensive to do so. Shutters are mounted on double-sided Del-Seal™ CF flanges and fitted with reliable, bellows sealed UHV rotary motion feedthrough actuation. MDC standard rotary motion feedthroughs are a popular and economical solution for in-vacuum sample or device rotation. They are constructed of the highest grade vacuum compatible materials. Position is measured along a 360° laser etched black-anodized barrel graduated in 5° increments. Welded stainless steel bellows, a unique off-axis wobble design and the use of rotary shaft bearing supports provide devices

of unsurpassed reliability and performance.

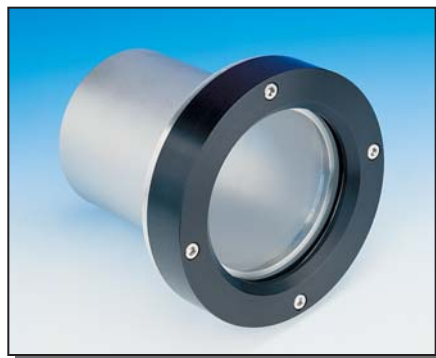
Positive position locks are included on each assembly to prevent over swinging the shutter mechanism. The swing angle of these shutters is dependent on the flange to tube size combination selected. For all practical purposes the shutter swing angles given in this catalog are for shutters mounted on standard half-nipple tube diameters. Every shutter purchased will be shipped with these default swing angles. If the mounting port is welded directly to a chamber wall and is not restricted by a long access tube, greater swing angles will be possible.

Glass Adapters

MDC glass to metal adapters provide a means of attaching glass components to a metal vacuum system and or metal hardware to a glass system. These glass adapters are produced with the latest in glass-to-metal seal technology and are available in either Pyrex® code 7740 or Borosilicate code 7052 glass.

Five glass seal geometries are offered, these include flange to glass with open end, flange to flange with glass transition, flange to glass with sealed end, flange to glass with open end and flexible bellows transition and glass to glass with flexible bellows transition. Most are offered on 1-1/3 to 8 inch Del-Seal™ CF flanges with glass tube from 1/8 to 6 inch diameters. All overall lengths and glass lengths are nominal $\pm 1/8"$. Products fitted with Kwik-Flange™ ISO KF flanges are available for tube diameters of 3/4, 1, 1-1/2 and 2 inches.

The flange to glass with open end versions are designed for installation to a flanged system on one end and to either a quick



Pyrex® viewports

page 310



Rotary shutter assembly

page 311

disconnect elastomer sealed compression fitting or for fusing directly to a glass tube, apparatus or system. The flange to flange glass transition versions allow mounting between two flanged systems. They can also be used as low voltage electrical breaks on vacuum tube lines. Flange to glass adapters with a sealed glass end can be mounted to a flanged system and provide a bell jar like glass enclosure that is ideally suited for experiments requiring the transparency of glass. Flexible glass adapters are fitted with formed bellows and are specifically designed for joining metal flanged systems or glass tubed systems with misaligned components.

VacOptix®

To further extend vacuum optics capabilities, Insulator Seal offers an exclusive line of viewports using its patented VacOptix® seal technology. This proprietary sealing technique allows the sealing of exotic optical materials previously unavailable to the ultrahigh vacuum industry. VacOptix® materials include magnesium fluoride, calcium fluoride, crystal quartz, fused silica, borosilicate glass, sapphire, silicon, germanium, zinc sulfide and zinc selenide. These viewports provide the largest available transmission spectrum in the industry. VacOptix® are laser optics quality viewports for transmission of spectral energy from deep ultraviolet to far infrared wavelengths.

All dimensions in this catalog are given in inches unless specified otherwise.



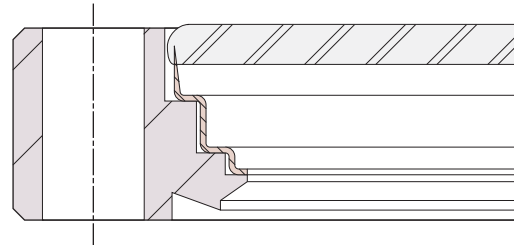
Glass adapters

beginning page 312

Viewport Sealing Methods

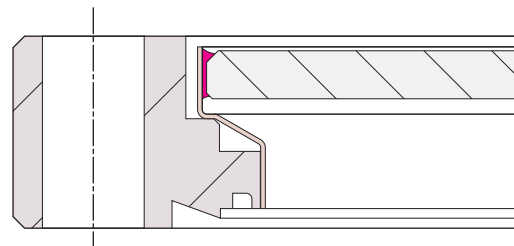
Glass

Glass is fused to a thin nickel-iron metal transition



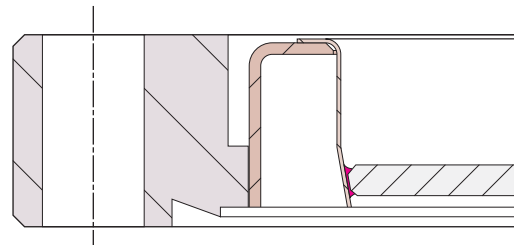
Quartz

Quartz is metalized and brazed directly to stainless steel using a lead-silver braze alloy



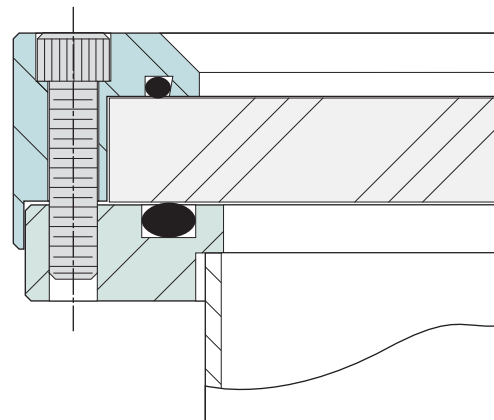
Sapphire

Sapphire is metalized and vacuum brazed to a nickel-iron sleeve using a tapered seal interface



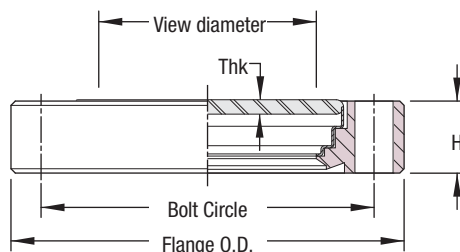
Pyrex®

A Pyrex® substrate is sandwiched between two elastomer seals. The outer elastomer (top in drawing) is for cushioning and the inner elastomer (bottom in drawing) makes the vacuum seal.





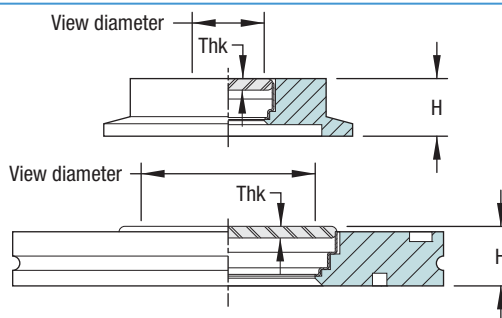
Del-Seal™ CF



- 7056 Glass
- Zero Profile
- Del-Seal™ CF flange
- Kovar sleeve

NOMINAL FLANGE	FLANGE O.D.	BOLT CIRCLE	VIEW DIA.	GLASS THICKNESS	H	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	1.062	.62	.070	.285	1/2	VP-075	450000
2-1/8	2.12	1.625	.90	.070	.470	3/4	VP-100	450041
2-3/4	2.73	2.312	1.50	.105	.500	1-1/2	VP-150	450002
3-3/8	3.37	2.850	2.00	.170	.625	1-1/2	VP-200	450003
4-1/2	4.47	3.628	2.69	.170	.680	2-1/2	VP-250	450004
4-5/8	4.62	4.030	2.69	.170	.750	2-1/2	VP-300	450005
6	5.97	5.128	3.88	.200	.780	3-1/2	VP-400	450006
6-3/4	6.75	5.969	3.88	.200	.840	5	VP-500	450007
8	7.97	7.128	5.38	.375	.880	6	VP-600	450008
10	9.97	9.128	5.38	.375	.970	8	VP-800	450009

ISO KF & ISO LF



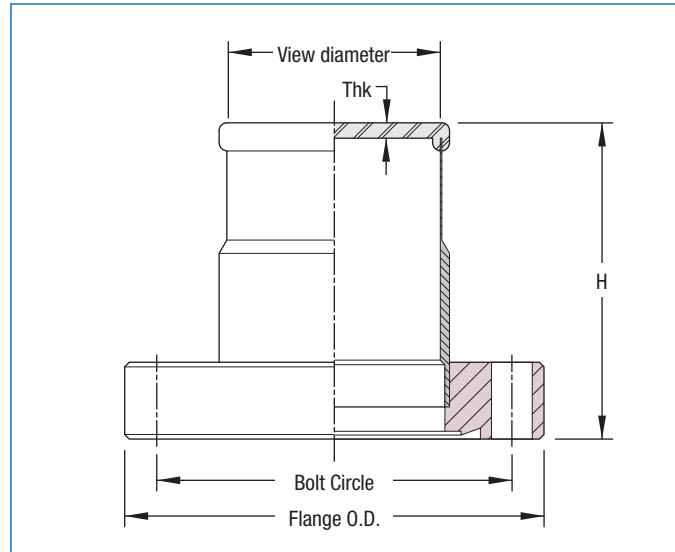
- 7056 Glass
- Zero Profile
- Kwik-Flange™ ISO KF
- Large-Flange™ ISO LF
- Kovar sleeve

NOMINAL ISO REF.	FLANGE O.D.	BOLT CIRCLE	VIEW DIA.	GLASS THICKNESS	H	WT LB	REFERENCE	PART NUMBER
KWIK-FLANGE™ ISO KF								
NW16	1.18	-	.62	.070	.363	1/2	KVP-075	450030
NW25	1.57	-	.90	.070	.580 ¹	1/2	KVP-100	450042
NW40	2.16	-	.90	.105	.500 ¹	1/2	KVP-150	450043
NW50	2.95	-	1.50	.105	.625	1/2	KVP-200	450033
LARGE-FLANGE™ ISO LF								
NW63	3.74	-	2.00	.170	.470	1	LVP-250	450011
NW80	4.33	-	2.00	.170	.470	2	LVP-300	450012
NW100	5.12	-	2.69	.170	.688	2	LVP-400	450013
NW160	7.09	-	3.88	.200	.790	4	LVP-600	450014
NW200	9.45	-	5.38	.375	.875	7	LVP-800	450015
NW250	11.42	-	5.38	.375	.875	11	LVP-1000	450016
NW320	14.57	-	5.38	.375	.875	12	LVP-1200	450017
NW400	17.72	-	5.38	.375	.875	40	LVP-1600	450018
NW500	21.65	-	5.38	.375	.875	47	LVP-2000	450019

¹ Glass extends beyond thickness of flange



Del-Seal™ CF



- Nonmagnetic construction
- Del-Seal™ CF flange
- Stainless steel sleeve

NOMINAL FLANGE	FLANGE O.D.	BOLT CIRCLE	VIEW DIA.	GLASS THICKNESS	H	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	1.062	.50	.070	1.12	1/2	VP-075N	451004
2-3/4	2.73	2.312	1.25	.125	2.00	1	VP-150N	451000
3-3/8	3.37	2.850	1.62	.170	2.12	2	VP-200N	451005
4-1/2	4.47	3.628	2.00	.170	2.12	2-1/2	VP-250N	451001
6	5.97	5.128	3.50	.200	2.12	3-1/2	VP-400N	451002
8	7.97	7.128	5.38	.375	2.75	6	VP-600N	451003

Construction Note

Non-magnetic construction requires longer transition length between seal joints and weld joints. The stainless steel sleeve is thinned out to give maximum flexibility at the glass to metal seal.



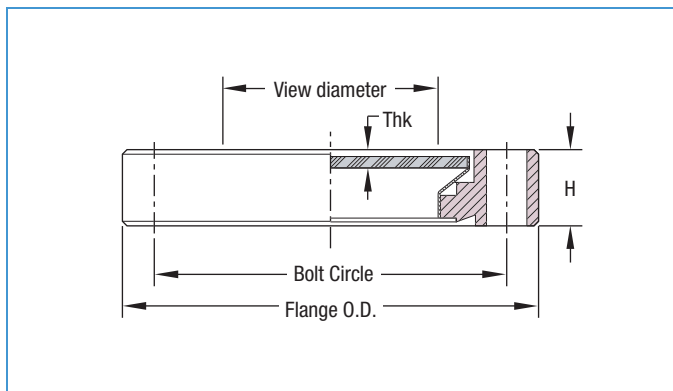
Quick-Access Doors

Quick-Access Doors with viewports are available in Section 7.2, pages 438-439.

Viewports are constructed of Corning type 7056 glass fused to a Kovar® nickel-iron transition sleeve.



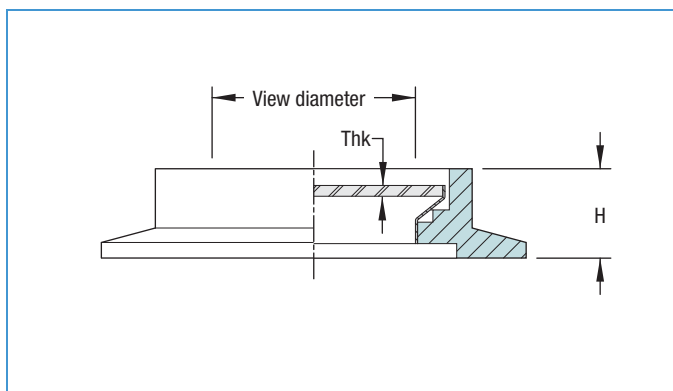
Del-Seal™ CF



- Fused quartz
- Zero profile
- Del-Seal™ CF flange
- Stainless steel sleeve

NOMINAL FLANGE	FLANGE O.D.	BOLT CIRCLE	VIEW DIA.	QUARTZ THICKNESS	H	WT LB	REFERENCE	PART NUMBER
2-3/4	2.73	2.312	1.40	.125	.500	1	VP-150QZ	450020
3-3/8	3.37	2.850	1.40	.125	.620	1	VP-200QZ	450021
4-1/2	4.47	3.628	2.69	.250	.680	2-1/2	VP-250QZ	450022
4-5/8	4.62	4.030	2.69	.250	.750	2-1/2	VP-300QZ	450023
6	5.97	5.128	3.88	.250	.780	3	VP-400QZ	450024
6-3/4	6.75	5.969	3.88	.250	.840	3	VP-500QZ	450025
8	7.97	7.128	5.38	.375	.880	3-1/2	VP-600QZ	450026
10	9.97	9.128	7.78	.375	.970	6	VP-800QZ	450027

Kwik-Flange™ KF

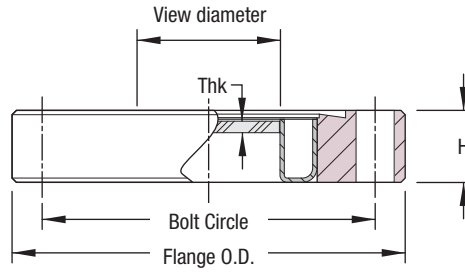


- Fused quartz
- Zero profile
- Kwik-Flange™ ISO KF flange
- Stainless steel sleeve

NOMINAL FLANGE	FLANGE O.D.	BOLT CIRCLE	VIEW DIA.	QUARTZ THICKNESS	H	WT LB	REFERENCE	PART NUMBER
NW50	2.95	-	1.40	.125	.620	1/2	KVP-200QZ	450028



Del-Seal™ CF



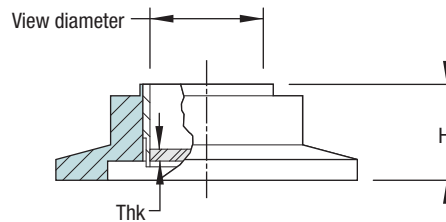
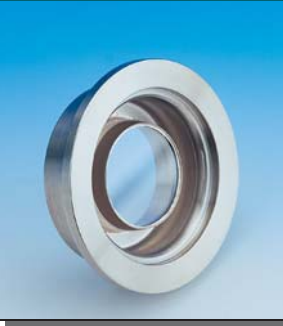
- Regular grade and UV grade sapphire material¹
- Zero profile
- Del-Seal™ CF flange
- Kovar sleeve

NOMINAL FLANGE	FLANGE O.D.	BOLT CIRCLE	VIEW DIA.	SAPPHIRE THICKNESS	H	WT LB
1-1/3	1.33	1.062	.59 ¹	.062	.500	1/2
2-3/4	2.73	2.312	.94 ¹	.080	.500	1
4-1/2	4.47	3.628	1.94	.094	.680	1-1/2

REFERENCE	PART NUMBER
VP-075S	453000
VP-100S	453001
VP-200S	453002

¹ Note: UV grade sapphire, all other sizes are regular grade sapphire

Kwik-Flange™ KF

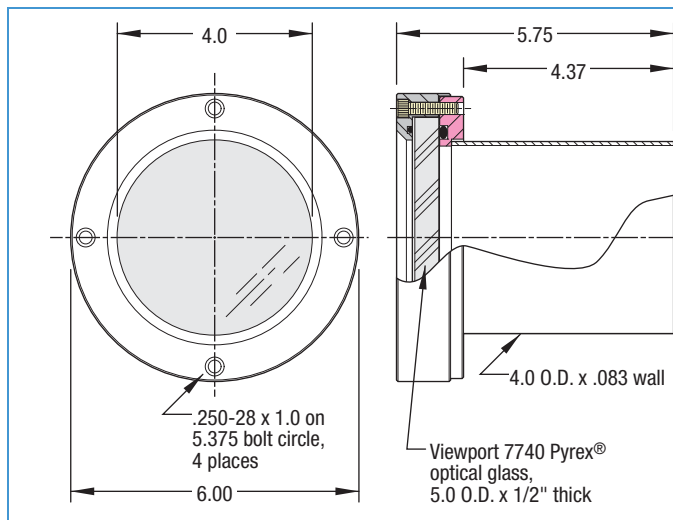


- Regular grade and UV grade sapphire material¹
- Zero profile
- Kwik-Flange™ ISO KF flange
- Kovar sleeve

NOMINAL FLANGE	FLANGE O.D.	BOLT CIRCLE	VIEW DIA.	SAPPHIRE THICKNESS	H	WT LB
NW16	1.18	-	.59 ¹	.062	.500	1/2
NW25	1.57	-	.59 ¹	.062	.500	1/2
NW40	2.16	-	.94	.080	.500	1/2
NW50	2.95	-	.94	.080	.500	1/2

REFERENCE	PART NUMBER
KVP-075S	453020
KVP-100S	453021
KVP-150S	453022
KVP-200S	453023

¹ Note: UV grade sapphire, all other sizes are regular grade sapphire



- Weld neck, 4-inch O.D.
- Pyrex® 7740 borosilicate optical glass
- 4-inch diameter nominal viewing area
- Type 304 stainless steel mounting
- FKM / FPM fluoroelastomer O-ring seal
- Replaceable glass

Description

Economical visual quality viewport used on high vacuum chambers. Weldable configuration allows installation on a custom built stainless steel chamber. The replaceable viewport glass is captured between two elastomer O-rings. The viewport can be easily disassembled by removing four screws from the retainer ring.

The Pyrex® viewport is installed as a standard component on MDC stainless steel bell jars found in Chambers, Section 8.

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
PYREX VIEWPORT WITH 4" O.D. WELD NECK	3	PVP-4	450010



DESCRIPTION	WT LB	REFERENCE	PART NUMBER
REPLACEMENT GLASS, 7740 PYREX OPTICAL 5" O.D.	1	-	045010
BOLT, SOCKET HEAD, STAINLESS STEEL, .250-28 x 1" LONG (Pkg of 4)	1/4	-	190166
O-RING, GLASS-TO-FLANGE	1/4	-	041346
O-RING, GLASS-TO-RETAINER	1/4	-	041243



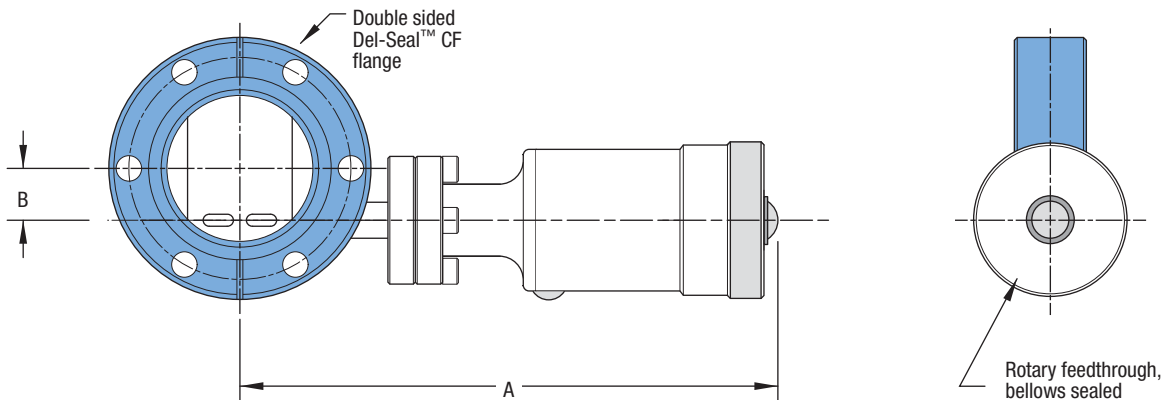
ULTRAHIGH VACUUM SERIES

Description

VPS Series viewport shutters provide quick and efficient shielding for all standard viewports. These shutters are ideally suited for service in high and ultrahigh vacuum coating applications. These swing type pivoting shutters feature a double-sided sealing design and are designed to mount between a port flange and the viewport. The shape of each shutter takes advantage of the maximum aperture of the inside of a standard port tube. The actual amount of shutter swing is dependent on the mating chamber's tube port diameter. The table below gives the maximum swing angle for each shutter when mounted on a standard Del-Seal™ flanged half nipple. To provide maximum shielding of viewports each shutter body has a step machined to match the shape and contour of the shutter's flapper plate. Actuation of the shutter is provided through an MDC bellows sealed rotary drive. Improved design features include all stainless steel body allowing for bakeout up to 230°C. A positive click-stop action has also been added to the rotary driver that allows for partial opening of the shutter's flapper plate between the fully opened and fully closed positions.

Features

- 100% viewport shielding
- Double-sided flange mount
- Del-Seal™ CF metal seal interface
- Actuated with bellows sealed rotary feedthrough
- Bakeable to 230°C
- Six flange sizes



- Viewport shutter flange is installed between viewport and chamber flanges
- Positive detent for travel stops and positioning
- Bolt holes straddle vertical centerline on flange sizes 2-3/4" to 6"; bolt holes located on vertical centerline on flange size 8"

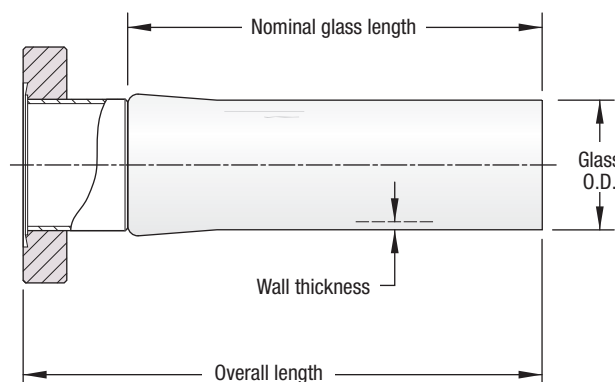
NOMINAL FLANGE	FLANGE O.D.	BOLT CIRCLE	FLANGE THICKNESS	A	B	SHUTTER ANGLE	WT LB	REFERENCE	PART NUMBER
2-3/4	2.73	2.312	.75	5.59	.54	85°	1-1/2	VPS-275	454000
3-3/8	3.37	2.850	.62	5.95	.94	72°	2	VPS-338	454004
4-1/2	4.47	3.628	.68	7.06	1.07	72°	3	VPS-450	454001
6	5.97	5.128	.78	7.39	1.78	75°	4-1/2	VPS-600	454002
6-3/4	6.75	5.969	.84	7.78	1.53	76°	6-1/2	VPS-675	454005
8	7.97	7.128	.87	8.14	2.49	78°	9-1/2	VPS-800	454003

Refer to individual double sided flange size for mounting hardware, Section 1.1, page 56

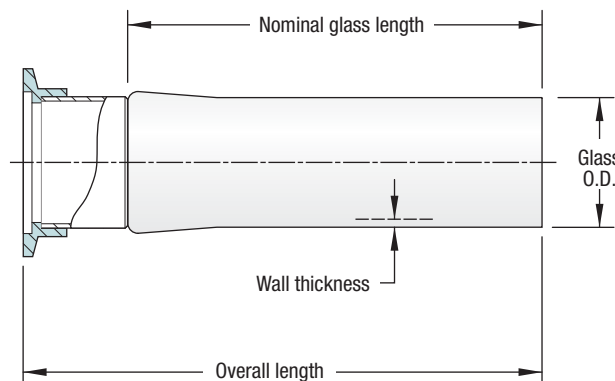


ULTRAHIGH & HIGH VACUUM SERIES

Del-Seal™ CF



Kwik-Flange™ KF



• Nominal lengths $\pm 1/8"$

Features

- 7740 Pyrex® or optional type 7052 glass
- Type 304ss flange material
- Metal or O-ring seal geometries
- Kovar® or stainless steel sleeve
- Custom lengths available on request
- Other configurations available on request

Description

MDC Glass to Metal Adapters facilitate the attachment of glass accessories to metal high vacuum systems and to attach UHV flange mounted devices to glass systems.

Standard adapters are offered with a choice of 7740 Pyrex® to Kovar® sleeve or 7740 Pyrex® to Type 304 stainless steel sleeve nonmagnetic combination. Stainless steel is recommended for cryo temperature applications. Adapters with Kovar® sleeve material have a lower temperature limitation of -80°C .

Del-Seal™ CF flange mounted units are bakeable to 400°C and useable to below 10^{-10} Torr. Kwik-Flange™ mounted adapters are bakeable to 200°C intermittent and can be used at 150°C sustained temperature. Overall lengths and glass lengths for all glass components are nominal $\pm 1/8"$.

All sizes are also available with 7052 glass.



KOVAR TO 7740 PYREX®



DEL-SEAL™ CF

Dimensions given in the table below apply to both the Kovar® adapters on the left and the 304 stainless steel adapters on the right. Over-all tolerance is $\pm 1/8"$.

304SS TO 7740 PYREX®



PART NUMBER	REFERENCE	KOVAR-TO-PYREX OVERALL LENGTH	NOMINAL GLASS O.D.	WALL THICKNESS	NOMINAL FLANGE	FLANGE O.D.	SS-TO-PYREX OVERALL LENGTH	REFERENCE	PART NUMBER
461000	GA-012P	5-3/8	1/8	.032	1-1/3	1.33	4-7/8	GA-012P-S	460000
461001	GA-018P	5-3/8	3/16	.032	1-1/3	1.33	4-7/8	GA-018P-S	460001
461002	GA-025P	5-3/8	1/4	.040	1-1/3	1.33	4-7/8	GA-025P-S	460002
461003	GA-031P	5-3/8	5/16	.040	1-1/3	1.33	4-7/8	GA-031P-S	460003
461004	GA-037P	5-3/8	3/8	.040	1-1/3	1.33	4-7/8	GA-037P-S	460004
461005	GA-050P	5-3/8	1/2	.050	1-1/3	1.33	4-7/8	GA-050P-S	460005
461006	GA-062P	5-3/8	5/8	.050	1-1/3	1.33	4-7/8	GA-062P-S	460006
461007	GA-075P	5-3/8	3/4	.050	1-1/3	1.33	5-1/4	GA-075P-S	460007
461008	GA-087P	5-3/8	7/8	.060	2-1/8	2.12	4-7/8	GA-087P-S	460008
461009	GA-100P	5-3/8	1	.060	2-1/8	2.12	4-7/8	GA-100P-S	460009
461010	GA-112P	5-3/8	1-1/8	.060	2-3/4	2.73	4-7/8	GA-112P-S	460010
461011	GA-125P	5-3/8	1-1/4	.070	2-3/4	2.73	4-7/8	GA-125P-S	460011
461023	GA-137P	5-3/8	1-3/8	.080	2-3/4	2.73	4-7/8	GA-137P-S	460012
461012	GA-150P	5-3/8	1-1/2	.080	2-3/4	2.73	4-7/8	GA-150P-S	460013
-	-	-	1-5/8	.080	3-3/8	3.37	4-7/8	GA-162P-S	460014
-	-	-	1-3/4	.080	3-3/8	3.37	4-7/8	GA-175P-S	460015
461013	GA-200P	5-7/8	2	.080	3-3/8	3.37	5-1/2	GA-200P-S	460016
461014	GA-225P	5-7/8	2-1/4	.100	4-1/2	4.47	5-3/8	GA-225P-S	460017
461015	GA-250P	7-1/2	2-1/2	.100	4-1/2	4.47	5-5/8	GA-250P-S	460018
-	-	-	2-3/4	.100	4-5/8	4.62	5-3/8	GA-275P-S	460019
461016	GA-300P	7-1/2	3	.100	4-5/8	4.62	6-3/8	GA-300P-S	460020
-	-	-	3-1/4	.100	6	5.97	6-3/8	GA-325P-S	460021
-	-	-	3-1/2	.100	6	5.97	6-3/8	GA-350P-S	460022
-	-	-	3-3/4	.100	6	5.97	6-3/8	GA-375P-S	460023
461020	GA-400P	10-1/8	4	.100	6	5.97	6-3/8	GA-400P-S	460024
461021	GA-500P	10-5/8	5	.120	6-3/4	6.75	8-1/4	GA-500P-S	460025
461022	GA-600P	10-5/8	6	.140	8	7.97	8-1/4	GA-600P-S	460026

KOVAR TO 7740 PYREX®



KWIK-FLANGE™ KF

Dimensions given in the table below apply to both the Kovar® adapters on the left and the 304 stainless steel adapters on the right.

304SS TO 7740 PYREX®



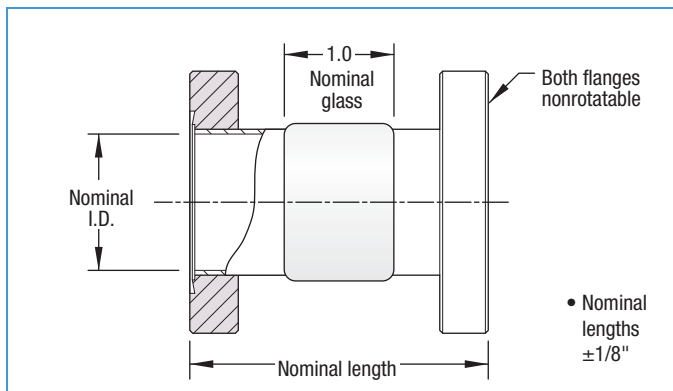
PART NUMBER	REFERENCE	KOVAR-TO-PYREX OVERALL LENGTH	NOMINAL GLASS O.D.	WALL THICKNESS	NOMINAL FLANGE	FLANGE O.D.	SS-TO-PYREX OVERALL LENGTH	REFERENCE	PART NUMBER
461040	KGA-075P	5-3/4	3/4	.050	NW16	1.18	5-1/4	KGA-075P-S	460040
461041	KGA-100P	5-1/2	1	.060	NW25	1.57	4-7/8	KGA-100P-S	460041
461042	KGA-150P	5-1/2	1-1/2	.080	NW40	2.16	5	KGA-150P-S	460042
461043	KGA-200P	6	2	.080	NW50	2.95	5-1/2	KGA-200P-S	460043



Del-Seal™ CF



• 400°C maximum bakeout



- 7052 Glass
- Kovar sleeve material
- Optional Pyrex® to stainless steel
- 304ss nonrotatable flange
- Custom lengths available on request
- Other configurations available on request

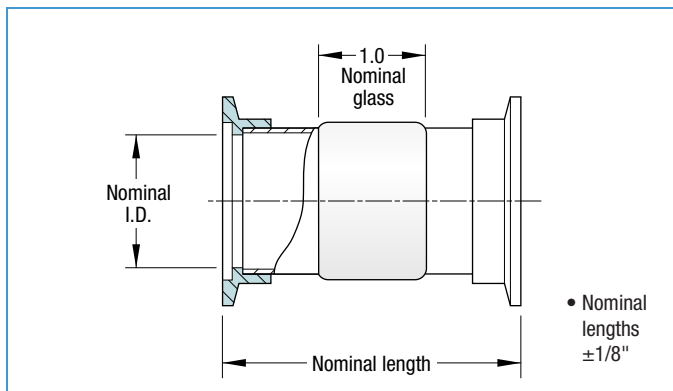
NOMINAL I.D.	FLANGE SIZE	FLANGE O.D.	BOLT CIRCLE	NOMINAL LENGTH	WT LB
9/16	1-1/3	1.33	1.062	3.00	1/2
13/16	2-1/8	2.12	1.625	3.22	3/4
1-5/16	2-3/4	2.73	2.312	2.98	3/4
1-13/16	3-3/8	3.37	2.850	3.83	1
2-3/16	4-1/2	4.47	3.628	5.13	2
2-11/16	4-5/8	4.62	4.030	5.13	2-1/2
3-11/16	6	5.97	5.128	5.25	4
4-1/2	6-3/4	6.75	5.969	5.30	5
5-1/2	8	7.97	7.128	5.38	7

REFERENCE	PART NUMBER
DEG-075	462000
DEG-100	462001
DEG-150	462002
DEG-200	462003
DEG-250	462004
DEG-300	462005
DEG-400	462006
DEG-500	462007
DEG-600	462008

Kwik-Flange™



• 200°C maximum bakeout



- 7052 Glass
- Kovar sleeve material
- Optional Pyrex® to stainless steel
- 304ss flange
- Custom lengths available on request
- Other configurations available on request

NOMINAL I.D.	FLANGE SIZE	FLANGE O.D.	ISO REF.	NOMINAL LENGTH	WT LB
9/16	K-075	1.18	NW16	3.00	1/2
13/16	K-100	1.57	NW25	3.20	3/4
1-5/16	K-150	2.16	NW40	3.30	1
1-13/16	K-200	2.95	NW50	3.80	1-1/2

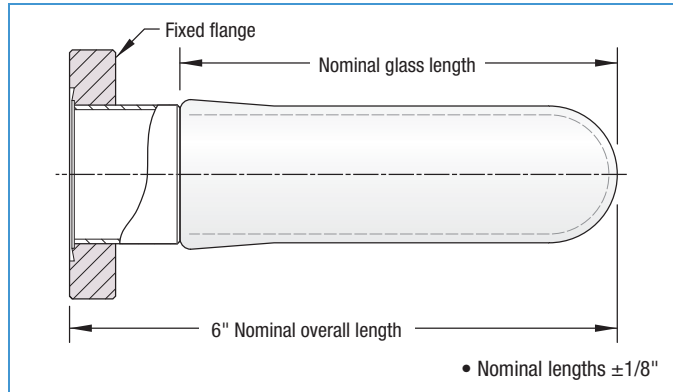
REFERENCE	PART NUMBER
KDEG-075	462020
KDEG-100	462021
KDEG-150	462022
KDEG-200	462023



Del-Seal™ CF



• 400°C maximum bakeout



- 7052 Glass
- Kovar sleeve material
- Optional Pyrex® to stainless steel
- 304ss nonrotatable flange
- Custom lengths available on request
- Other configurations available on request

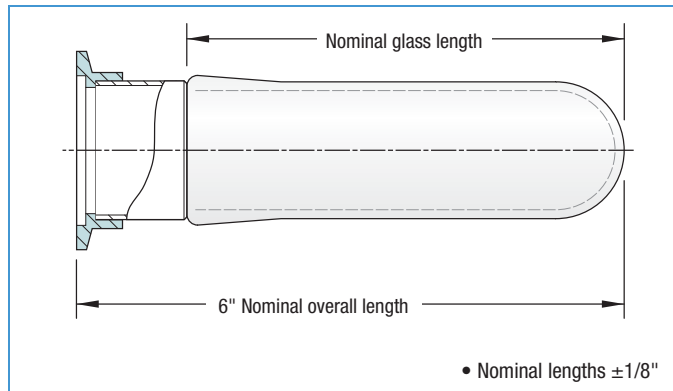
NOMINAL I.D.	FLANGE SIZE	FLANGE O.D.	BOLT CIRCLE	NOMINAL GLASS LENGTH	WT LB
9/16	1-1/3	1.33	1.062	4-3/8	1/2
13/16	2-1/8	2.12	1.625	4-3/4	3/4
1-5/16	2-3/4	2.73	2.312	4-3/4	1
1-13/16	3-3/8	3.37	2.850	4-1/4	1-1/4
2-3/16	4-1/2	4.47	3.628	4-1/4	1-3/4
2-11/16	4-5/8	4.62	4.030	4-1/4	2
3-11/16	6	5.97	5.128	3-7/8	3
4-1/2	6-3/4	6.75	5.969	3-7/8	4
5-1/2	8	7.97	7.128	3-7/8	5

REFERENCE	PART NUMBER
SEG-075	463000
SEG-100	463001
SEG-150	463002
SEG-200	463003
SEG-250	463004
SEG-300	463005
SEG-400	463006
SEG-500	463007
SEG-600	463008

Kwik-Flange™



• 200°C maximum bakeout



- 7052 Glass
- Kovar sleeve material
- Optional Pyrex® to stainless steel
- 304ss flange
- Custom lengths available on request
- Other configurations available on request

NOMINAL I.D.	FLANGE SIZE	FLANGE O.D.	ISO REF.	NOMINAL GLASS LENGTH	WT LB
9/16	K075	1.18	NW16	4-3/8	1/2
13/16	K100	1.57	NW25	4-3/8	3/4
1-5/16	K150	2.16	NW40	4-3/8	1
1-13/16	K200	2.95	NW50	4-1/4	1

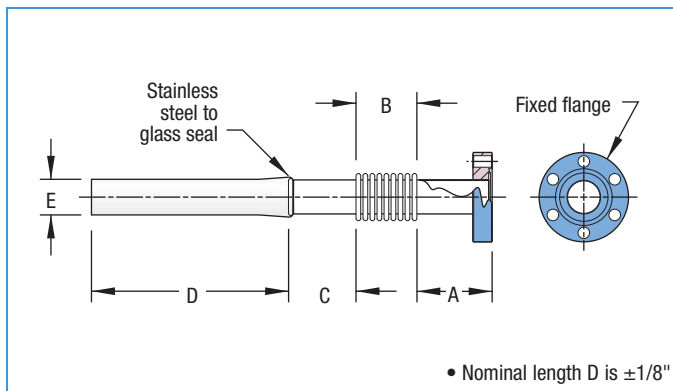
REFERENCE	PART NUMBER
KSEG-075	463020
KSEG-100	463021
KSEG-150	463022
KSEG-200	463023



Del-Seal™ CF to Glass



- 400°C maximum bakeout



- Excellent vibrational absorption
- Ideal for high heat and cryogenics
- 7740 Pyrex®
- 321ss bellows material
- 304ss flange material

FLANGE SIZE	A	BELLOWS B ¹	C	D	E	MAX. BEND	WT LB	REFERENCE	PART NUMBER
1-1/3	.87	2.00	.75	3.00	.250	180°	1/2	FGA-025-2	466000
1-1/3	.87	1.00	.75	3.00	.375	90°	1/2	FGA-037-1	466007
1-1/3	.87	3.00	.75	3.00	.375	225°	1/2	FGA-037-3	466008
1-1/3	1.12	1.00	1.00	3.00	.500	45°	1/2	FGA-050-1	466001
1-1/3	1.12	3.00	1.00	3.00	.500	180°	1/2	FGA-050-3	466002
2-3/4	1.12	1.00	1.00	3.00	.750	30°	1-1/2	FGA-075-1	466003
2-3/4	1.12	3.00	1.00	3.00	.750	90°	1-1/2	FGA-075-3	466004
2-3/4	1.12	1.00	1.00	3.00	1.000	20°	2	FGA-100-1	466009
2-3/4	1.12	3.00	1.00	3.00	1.000	90°	2	FGA-100-3	466010
2-3/4	1.12	1.00	1.00	3.00	1.500	15°	2	FGA-150-1	466005
2-3/4	1.12	3.00	1.00	3.00	1.500	60°	2	FGA-150-3	466006

¹ Allows up to 50% expansion and 20% compression of bellows length



6

Electrical & Fluid Feedthroughs



Section 6

Electrical Feedthroughs

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MDC's ceramic-to-metal business unit is located in the beautiful city of Sarasota, Florida

Ceramic Seals...

Since MDC and Insulator Seal (ISI) join forces in March of 1998, MDC Precision, LLC provide the scientific and industrial vacuum community with the best possible quality, service and price for vacuum solutions and components.

In the vacuum components industry there can be few more specialized technologies than the production of ceramic-to-metal seals. Ceramic-to-metal seals, the bonding of metals to ceramics, are fundamental to the manufacture of thousands of components in applications where electricity and optics must interface with high and ultrahigh vacuum environments. MDC's single goal is to provide leading edge solutions for this growing range of electrical and optical vacuum applications. In a relatively short period of time, MDC's product line has attained a global reputation for high quality manufacturing and fast delivery of thousands of electrical and optical vacuum components.

Our Ceramic Seals scientists, engineers and technicians have been perfecting the science and art of ceramic-to-metal bonding for over twenty years. Using time

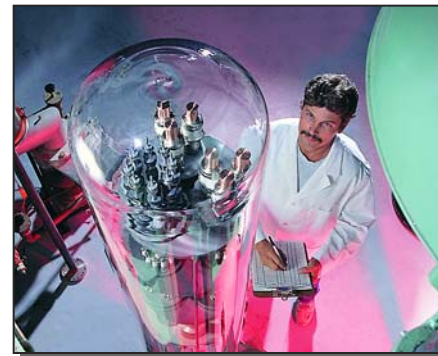
tested proprietary vacuum bonding techniques and advanced vacuum brazing systems MDC Ceramic Seals business unit provides the scientific and industrial vacuum community with ceramic-to-metal products of unsurpassed quality and performance. Over the past two decades MDC's Ceramic Seals business unit has assembled the industry's most comprehensive line of hermetically sealed electrical and optical ceramic-to-metal components. Our manufacturing process is geared for the batch production of standard components for stock. A closely monitored inventory allows them to meet customer expectations of fast delivery to national and global destinations.

The sealing and bonding process begin with the careful specification, selection, testing and qualification of vacuum grade materials to be used in the design and manufacturing of all MDC ceramic-to-metal products. A proprietary active-alloy metalization process is at the heart of all seal production. High purity alumina ceramics are routinely bonded and sealed to low expansion metals in vacuum furnace

To preview the complete MDC Precision product line, prices, availability and order, log onto www.mdcvacuum.com



Metalization application and assembly process



Vacuum furnace, high temperature brazing

...MDC's Electrical and Optical Ceramic-to-Metal Seal Business Unit

environments using precious and semiprecious high temperature vacuum tube-grade braze alloys. This method of fabrication produces products suitable for service in UHV applications and thermal cycling as high as 450°C.

MDC's electrical feedthroughs, electrical breaks and envelopes, sapphire and quartz viewports are all manufactured by MDC's Ceramic Seals business unit. The MDC product line is now a key component in MDC's drive for leadership in high and ultrahigh vacuum technology. MDC has offerings of electrical and viewport components that include the most popular and commonly used products. Concurrently, a full complement of electrical feedthroughs, optical grade viewports and other ceramic-to-metal components are available on our website www.mdcprecision.com.

Some of the additional products available in the MDC product line include a complete line of thermocouple feedthroughs, single and double-ended multipin instrumentation feedthroughs, an extensive selection of industry standard coaxial instrumentation and power

feedthroughs, high frequency RF power feedthroughs with patented cooling geometry, electrical breaks suitable for cryogenic service, VacOptix® patented viewports for deep ultraviolet and far infrared optical applications as well as custom engineered products for exotic or demanding applications. Please note that in most cases, custom ceramic-to-metal requests not found in either the MDC, MDC catalog or at www.mdcprecision.com should be directed to MDC's Ceramic Seals Technical Sales for consideration.

MDC's Ceramic Seals business unit is staffed with sales, design and manufacturing engineers dedicated exclusively to the promotion, production, implementation and support of standard ceramic-to-metal seal solutions for the high and ultrahigh vacuum industry. Our staff can also handle custom solution inquiries which go beyond either divisions' standard catalog offerings.

MDC and it's Ceramic Seals business unit are ISO-9001-2008 certified as a means to better serve its customers and the industries they serve. The care taken in every aspect of manufacturing is carried all

the way down the line, even to the double-packing of each component for maximum protection during transit.

MDC's complete product line is featured in a separate comprehensive catalog. You can see the most up to date MDC product line, the latest prices, availability or order the catalog at www.mdcprecision.com.

MDC's Ceramic Seals Technical Sales may be contacted directly for custom quotes or technical questions at...

Tech Questions 941-807-7334
Custom Quotes 941-807-7334

Telephone 941-751-2880
Toll-Free 800-548-9509
Facsimile 941-751-3841
Email sales@mdcprecision.com
Web www.mdcprecision.com



ISO-9001 certified company



The industry's largest inventory



Fast delivery to national and global destinations



Feedthrough family

- Coaxial
- Power
- High current
- High voltage
- Breaks and envelopes
- Instrumentation
- Accessories

To see the complete MDC Precision product line, prices, availability and order a free copy of the MDC Precision catalog, please visit www.mdcvacuum.com

In the vacuum components industry there can be few more specialized technologies than the production of ceramic-to-metal seals. Ceramic-to-metal seals, the bonding of metals to ceramics are fundamental to the manufacture of thousands of components in applications where electricity and optics must interface with high and ultrahigh vacuum environments.

The electrical feedthroughs offered in this catalog are electrically rated for operation with one side in dry atmospheric conditions while the opposite end is in a stable vacuum environment with a maximum system pressure of 1×10^{-4} Torr. We recommend that users make allowances for deviations from these stated operating parameters and take adequate safety precautions when working with high voltages or currents.

Coaxial

Coaxial feedthroughs are those products constructed with two concentric conductor paths. One outer metal tube or shield path, concentric with, and enclosing, a cylindrical center conductor path. The inner and outer paths are separated and insulated with a high purity alumina ceramic dielectric. In this catalog, MDC offers coaxial components with military and industry standard BNC, MHV, SHV, Type N and SHV Bakeable connector interfaces.

The BNC coaxial connection, also referred to as the bayonet naval connection, is commonly used in 50 and 75 ohm low power instrumentation lines. Due to restrictions in geometry and the relatively high dielectric constant of alumina ceramics, BNC feedthroughs offered in this catalog are not impedance matched or rated.

The MHV coaxial connection, also referred to as miniature high voltage or high voltage BNC's, are ideally suited for medium to high power applications with higher voltage requirements. Caution should be exercised in electrical systems fitted with both BNC and MHV connections. BNC and MHV connections are almost identical in appearance and geometry and should never be cross-mated since their electrical ratings are not compatible. BNC connections are rated for 500VDC while MHV connections can handle voltages as high as 5000VDC.

The SHV coaxial connection, also referred to as safe high voltage connections, are also rated for service to 5000VDC. The difference between these feedthroughs and their MHV counterparts are the pin and contact geometry. SHV cable connectors have recessed female contacts with the male mating pin located in the feedthrough. The exact opposite is true with BNC and MHV connections. SHV cable-connector center contacts do not protrude beyond connector ends as they do on an MHV. This makes the SHV safer if accidentally powered while disconnected. Additional coaxial feedthroughs, including SMA, SMB, SHV-15, SHV-20, Triaxial, Microdot type and various others, can be purchased from www.mdcvacuum.com.

Power

Power feedthroughs are used to transmit either high voltage, high current or a combination of both. These products can be used for a multitude of vacuum applications including vacuum furnaces, sample heating or biasing, in-vacuum coating applications such as electron-beam evaporation, resistive heating evaporation, and DC plasma sputtering. Proven and time tested designs



Coaxial feedthroughs

page 324



Power feedthroughs, medium current

page 332

are employed to optimize the electrical performance of MDC power feedthroughs. Where space is not a limitation, ceramic surfaces are made as long as possible to maximize strike and creep distances. If space is limited, ceramics are convoluted in order to achieve increased surface distances with minimal impact on an insulator's overall length. Convoluted or fluted ceramics are recommended for environments where moisture or other surface contaminant may hinder electrical performance of conventional straight wall insulators. All power feedthrough air-side ceramic surfaces are glazed with a high temperature glass coating. This glass coating reduces ceramic surface roughness and minimizes surface contamination thus enhancing an insulator's electrical surface tracking characteristics. The power feedthroughs offered in this catalog are constructed with exposed, bare metal conductors on both the air and vacuum sides. Connectors for these feedthroughs are available, but must be purchased separately.

Included in the MDC product line are tubular conductor feedthroughs that can be used to transmit both power and coolants simultaneously. These products are referred to herein as watercooled feedthroughs. Watercooled electrical components should be used with grounded, closed-loop cooling systems and / or the use of nonconductive coolants such as deionized water or ethylene glycol. Although inefficiently, tap water will conduct electricity. Water cooling lines must therefore be electrically grounded and constructed of nonconductive material such as polypropylene tubing. Properly grounded water lines will provide a safe dissipation path for any power conducted by the water.

Watercooled power feedthroughs can carry

higher current loads than solid conductors of equal size and material when adequately cooled. Current or power ratings are not given for watercooled feedthroughs because these ratings are dependent on a coolant's flow rate and its heat dissipating capacity. Since tap water temperatures can vary dramatically from one location to another, so too will water's heat dissipation capacity. Users are advised to establish safe and practical coolant flow rates based on the power requirements for their specific application and coolant heat dissipation capacity

Breaks & Envelopes

Breaks and envelopes are tube like adapters with metal tube hardware bonded to the ends of a ceramic tube. Components with diameters below and including 2.50 inches are referred to as vacuum breaks, while those above are referred to as vacuum envelopes. The bonded metal tube ends provide a means of attaching the breaks and envelopes to vacuum tube lines using flange mounts or welding. The central ceramic portion of a break or envelope provides electrical insulation between the two conductive metal ends. In other words, the ceramic produces an electrical break in an otherwise continuous and conductive metal tube geometry.

The joining of ceramics to metals is a compromise between materials with dissimilar expansion coefficients. Low expansion metals combined with careful joint design bring expansion coefficients to an acceptable match and effectively minimize the stresses caused by differential expansion between the ceramic and metal components being bonded. Minute variations in expansion coefficients can be detrimental

if ceramic to metal seals are subjected to severe thermal gradients. The maximum recommended thermal gradient for any ceramic to metal seal should not exceed 25°C per minute.

Multipin

Multipin instrumentation refers to any feedthrough product containing more than one conductor path or pin that is also fitted with fastening air-side connectors. These feedthroughs are commonly used for the transmission of signal voltages and currents. They are commonly referred to as instrumentation feedthroughs because of their use in instrument control applications such as electron microscopes, electron-beam evaporation, electron microscopy, surface science analysis and semiconductor process controls. MDC multipin instrumentation feedthroughs are fitted with industry standard MS threaded circular connectors which comply with MIL-C-5015 specifications.

Complete air and vacuum connectivity are standard with MDC's new D-Subminiature instrumentation feedthroughs. Nine, fifteen and twenty-five pin geometries are hermetically sealed using the latest in glass-ceramic bonding technology. Air side connections are designed to interface with standard off-the-shelf serial cable connectors. Vacuum connectivity is made possible with MDC's unique UHV compatible connectors and ribbon cables. These instrumentation feedthroughs provide the same conveniences of circular type multipin products, but offer higher pin density in a smaller footprint.

Connector accessories are available for most electrical feedthroughs at the end of this section.



Power feedthroughs, high voltage

page 336



Breaks and envelopes

page 342



Type-D Subminiature

page 348



Features

- Noise shield for low power instrumentation transmission
- Bayonet style threadless connection
- Grounded or floating shield
- Air side connector provided
- Additional configurations available through MDC - see pages 320-321 for MDC Ceramic Seals contact information

Specifications

Application	Used in 50Ω and 75Ω low power instrumentation transmission lines
Configuration	Single ended coaxial, either Grounded or Floating shield
Voltage	Grounded shield: 500V DC maximum Floating shield: 2500V DC maximum, ground to floating shield
Current	3 Amperes maximum
Impedance Rating	Not constant
Material	
Flanges	304ss
Coaxial conductor	304ss
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: -200°C to 450°C maximum, without connector HV: -20°C to 150°C maximum, without connector Connector: -65° to 165°C maximum Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table
Connector	All feedthroughs supplied with air-side mating connector for use with RG 58/U cable

ULTRAHIGH & HIGH VACUUM SERIES

Figure 1

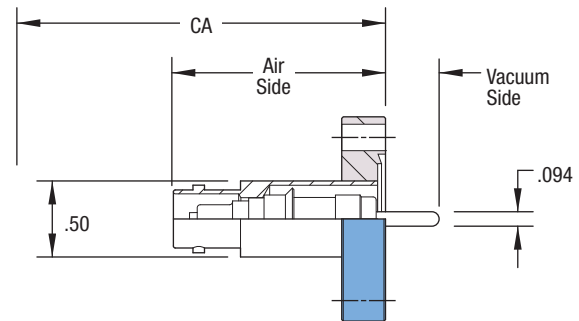


Figure 2

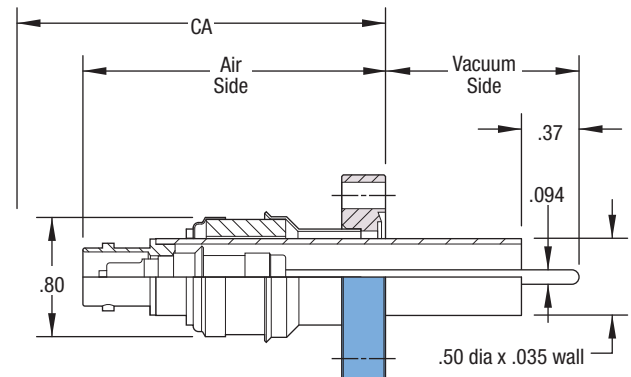
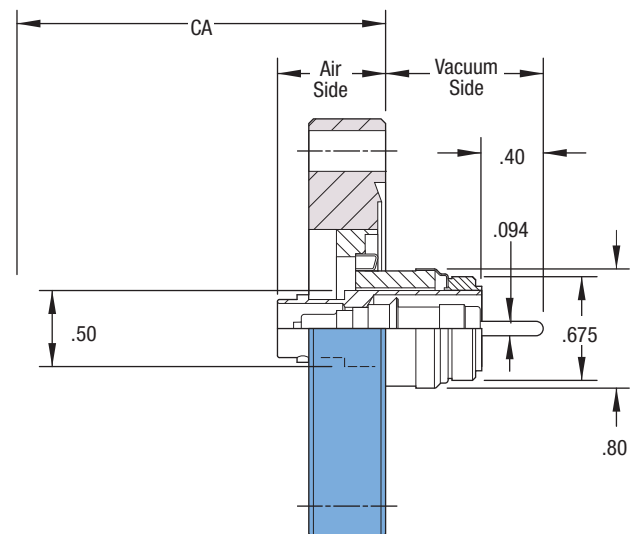
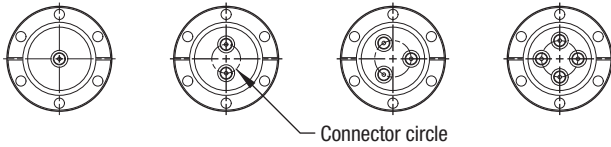


Figure 3

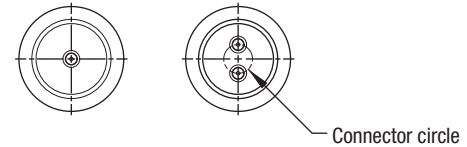


End Views - Vacuum Side

Del-Seal™ CF



Kwik-Flange™ KF



Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	FLANGE O.D.	FIG.	NO. OF CONN.	CONN. CIRCLE	AIR SIDE	VAC SIDE	CA	WT LB	REFERENCE	PART NUMBER
GROUNDING SHIELD											
1-1/3	1.062	1.33	1	1	-	1.38	.35	2.05	3/4	BNC-133	630000
2-3/4	2.312	2.73	1	1	-	1.38	.35	2.05	1	BNC-275	630001
2-3/4	2.312	2.73	1	2	.95	1.38	.35	2.05	1	BNC-275-2	630002
2-3/4	2.312	2.73	1	3	.95	1.38	.35	2.05	1	BNC-275-3	630003
2-3/4	2.312	2.73	1	4	.95	1.38	.35	2.05	1	BNC-275-4	630004
FLOATING SHIELD											
1-1/3	1.062	1.33	2	1	-	2.00	1.25	2.67	3/4	FBNC-133	630006
2-3/4	2.312	2.73	3	1	-	.70	1.05	1.37	1	FBNC-275	630005

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	FLANGE O.D.	FIG.	NO. OF CONN.	CONN. CIRCLE	AIR SIDE	VAC SIDE	CA	WT LB	REFERENCE	PART NUMBER
GROUNDING SHIELD											
K075	NW16	1.18	1	1	-	1.43	.30	2.10	1/2	K075-BNC	630020
K100	NW25	1.57	1	1	-	1.33	.40	2.00	1/2	K100-BNC	630021
K150	NW40	2.16	1	1	-	1.33	.40	2.00	1/2	K150-BNC	630022
K200	NW50	2.95	1	1	-	1.33	.40	2.00	1/2	K200-BNC	630023
K150	NW40	2.16	1	2	.75	1.33	.40	2.00	3/4	K150-BNC-2	630024
K200	NW50	2.95	1	2	.75	1.33	.40	2.00	3/4	K200-BNC-2	630025
FLOATING SHIELD											
K150	NW40	2.16	3	1	-	.65	1.08	1.30	1/2	K150-FBNC	630026
K200	NW50	2.95	3	1	-	.65	1.08	1.30	1/2	K200-FBNC	630027

Connectors



DESCRIPTION	LENGTH INCH	PIN DIA.	QTY PER PKG.	WT LBS	REFERENCE	PART NUMBER
PUSH-ON, WITH SET SCREW ¹	-	.094	10	1/4	POEC-094	991539-01
GROUNDING COAXIAL ²	19	.094	1	1/2	CCG-094-19	640080
GROUNDING COAXIAL ²	39	.094	1	1/2	CCG-094-39	640081
FLOATING COAXIAL ²	19	.094	1	1/2	CCF-094-19	640082
FLOATING COAXIAL ²	39	.094	1	1/2	CCF-094-39	640083

¹ Wrench included with Push-On connector

² **In-Vacuum Coaxial Connectors** Grounded vacuum connectors are fitted with a central BeCu push-on contact designed to mate with a .094" diameter pin. The 304ss coaxial shell is slotted for a spring fit into the cavity between a BNC's central conductor and its shell. Floating connectors include a radial set screw located in the shell. Both styles are prewired with MDC KAP5 in-vacuum coaxial cable (see page 352). User ends of cables are terminated with a coaxial geometry for installation into customer applications and can be grounded using 2-56 thread (see page 341 for product drawing). Contact accepts up to 50 mil wire. Choice of either 19" or 39" nominal length.



Features

- Noise shield for medium power applications
- Bayonet style threadless connection
- Grounded shield
- Air side connector provided
- Additional configurations available through MDC - see pages 320-321 for MDC Ceramic Seals contact information

Specifications

Application	Used in medium power applications with higher voltage requirements than BNC. Does not intermate with BNC connectors.
Configuration	Single ended coaxial, either Grounded or Floating shield
Voltage	Grounded shield: 5000V DC maximum Floating shield: 2500V DC maximum, ground to floating shield
Current	3 Amperes maximum
Impedance Rating	Not constant
Material	
Flanges	304ss
Coaxial conductor	304ss
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: -200° to 450°C maximum, without connector HV: -20° to 150°C maximum, without connector Connector: -65° to 165°C maximum Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table
Connector	All feedthroughs supplied with air-side mating connector for use with RG 59/U cable

ULTRAHIGH & HIGH VACUUM SERIES

Figure 1

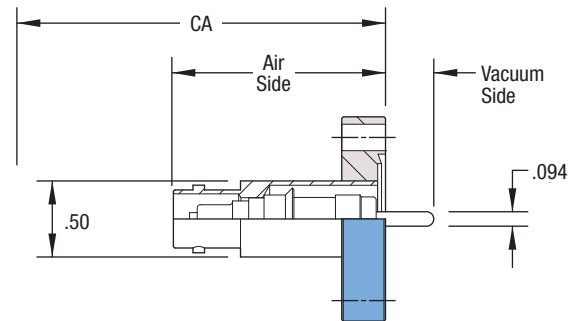


Figure 2

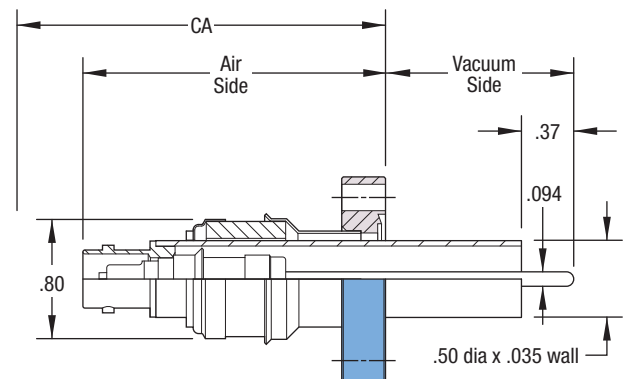
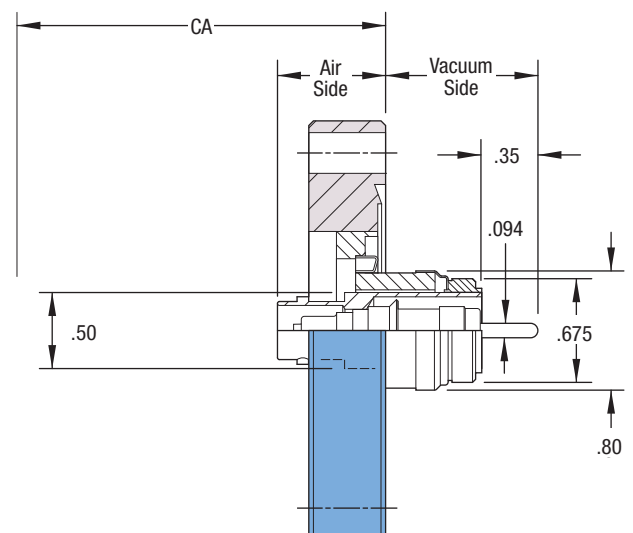
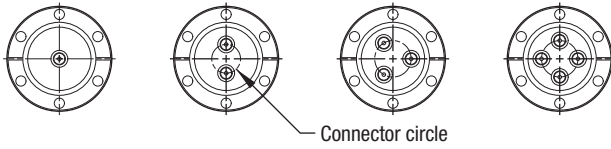


Figure 3



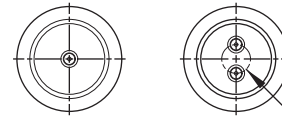
End Views - Vacuum Side

Del-Seal™ CF



Connector circle

Kwik-Flange™ KF



Connector circle

Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	FLANGE O.D.	FIG.	NO. OF CONN.	CONN. CIRCLE	AIR SIDE	VAC SIDE	CA	WT LB	REFERENCE	PART NUMBER
GROUNDING SHIELD											
1-1/3	1.062	1.33	1	1	-	1.38	.30	2.53	3/4	MHV-133	632000
2-3/4	2.312	2.73	1	1	-	1.38	.30	2.53	1	MHV-275	632001
2-3/4	2.312	2.73	1	2	.95	1.38	.30	2.53	1	MHV-275-2	632002
2-3/4	2.312	2.73	1	3	.95	1.38	.30	2.53	1	MHV-275-3	632003
2-3/4	2.312	2.73	1	4	.95	1.38	.30	2.53	1	MHV-275-4	632004
FLOATING SHIELD											
1-1/3	1.062	1.33	2	1	-	2.00	1.25	3.15	3/4	FMHV-133	632006
2-3/4	2.312	2.73	3	1	-	.70	.98	1.85	1	FMHV-275	632005

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	FLANGE O.D.	FIG.	NO. OF CONN.	CONN. CIRCLE	AIR SIDE	VAC SIDE	CA	WT LB	REFERENCE	PART NUMBER
GROUNDING SHIELD											
K075	NW16	1.18	1	1	-	1.43	.25	2.58	1/2	K075-MHV	632020
K100	NW25	1.57	1	1	-	1.33	.35	2.48	1/2	K100-MHV	632021
K150	NW40	2.16	1	1	-	1.33	.35	2.48	1/2	K150-MHV	632022
K200	NW50	2.95	1	1	-	1.33	.35	2.48	1/2	K200-MHV	632023
K150	NW40	2.16	1	2	.75	1.33	.35	2.48	3/4	K150-MHV-2	632024
K200	NW50	2.95	1	2	.75	1.33	.35	2.48	3/4	K200-MHV-2	632025
FLOATING SHIELD											
K150	NW40	2.16	3	1	-	.65	1.03	1.80	1/2	K150-FMHV	632026
K200	NW50	2.95	3	1	-	.65	1.03	1.80	1/2	K200-FMHV	632027

Connectors



DESCRIPTION	PIN DIA.	QTY PER PKG.	WT LBS	REFERENCE	PART NUMBER
PUSH-ON, WITH SET SCREW ¹	.094	10	1/2	POEC-094	991539-01

¹ Wrench included with Push-On connector



Features

- Noise shield for medium power applications
- Safe disconnect configuration
- Bayonet style threadless connection
- Grounded shield
- Air side connector provided
- Additional configurations available through MDC - see pages 320-321 for MDC Ceramic Seals contact information

Specifications

Application	Used in medium power applications. Similar to MHV, but reverses the male/female pin/contact on the air-side connection. Does not intermate with BNC or MHV connectors.
Configuration	Single ended coaxial
Voltage	5000V DC maximum
Current	5 Amperes maximum
Impedance Rating	Not constant
Material	
Flanges	304ss
Coaxial conductor	Nickel
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: -200° to 450°C maximum, without connector HV: -20° to 150°C maximum, without connector Connector: -65° to 165°C maximum Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table
Connector	All feedthroughs supplied with air-side mating connector for use with RG 59/U cable

ULTRAHIGH & HIGH VACUUM SERIES

Figure 1

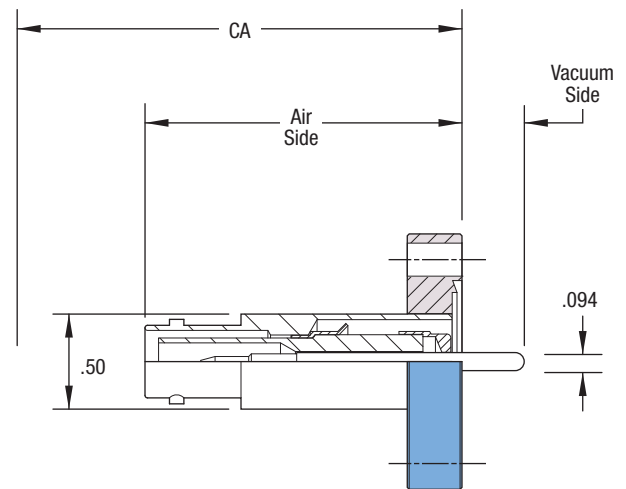
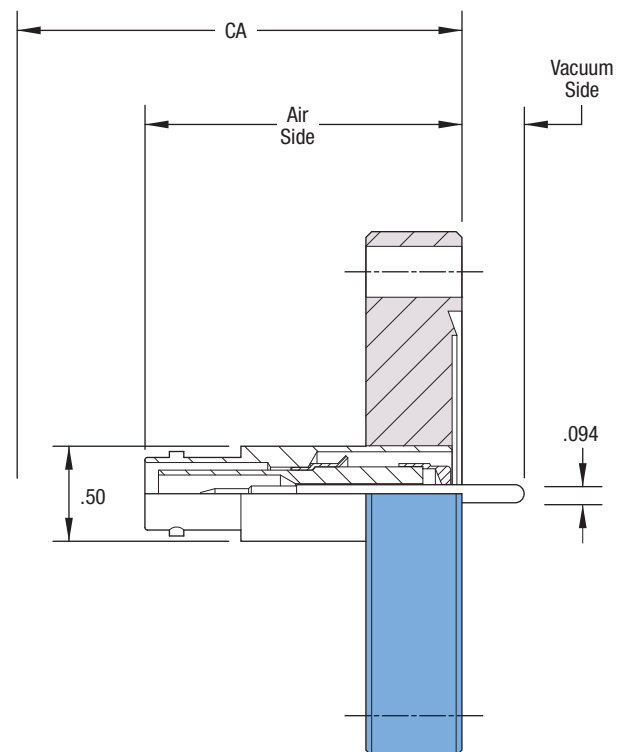
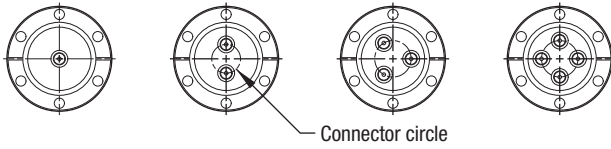


Figure 2



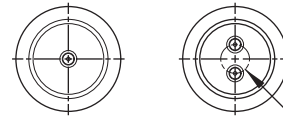
End Views - Vacuum Side

Del-Seal™ CF



Connector circle

Kwik-Flange™ KF



Connector circle

Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	FLANGE O.D.	FIG.	NO. OF CONN.	CONN. CIRCLE	AIR SIDE	VAC SIDE	CA	WT LB	REFERENCE	PART NUMBER
GROUND SHIELD											
1-1/3	1.062	1.33	1	1	-	1.65	.32	2.78	3/4	SHV-133	634000
2-3/4	2.312	2.73	2	1	-	1.65	.32	2.78	1	SHV-275	634001
2-3/4	2.312	2.73	2	2	.95	1.65	.32	2.78	1	SHV-275-2	634002
2-3/4	2.312	2.73	2	3	.95	1.65	.32	2.78	1	SHV-275-3	634003
2-3/4	2.312	2.73	2	4	.95	1.65	.32	2.78	1	SHV-275-4	634004

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	FLANGE O.D.	FIG.	NO. OF CONN.	CONN. CIRCLE	AIR SIDE	VAC SIDE	CA	WT LB	REFERENCE	PART NUMBER
GROUND SHIELD											
K075	NW16	1.18	1	1	-	1.70	.27	2.83	1/2	K075-SHV	634020
K100	NW25	1.57	1	1	-	1.60	.37	2.73	1/2	K100-SHV	634021
K150	NW40	2.16	1	1	-	1.60	.37	2.73	1/2	K150-SHV	634022
K200	NW50	2.95	1	1	-	1.60	.37	2.73	1/2	K200-SHV	634023
K150	NW40	2.16	1	2	.75	1.60	.37	2.73	3/4	K150-SHV-2	634024
K200	NW50	2.95	1	2	.75	1.60	.37	2.73	3/4	K200-SHV-2	634025

Connectors



DESCRIPTION	PIN DIA.	QTY PER PKG.	WT LBS	REFERENCE	PART NUMBER
PUSH-ON, WITH SET SCREW ¹	.094	10	1/2	POEC-094	991539-01

¹ Wrench included with Push-On connector



Features

- Noise shield for low power applications
- 50 Ohm impedance rating
- Threaded connection
- Grounded shield
- Air side connector provided
- Additional configurations available through MDC - see pages 320-321 for MDC Ceramic Seals contact information

Specifications

Application	Used in 50Ω low power instrumentation transmission lines Does not intermate with other connectors.
Configuration	Single ended coaxial, Grounded shield
Voltage	500V DC maximum
Current	3 Amperes maximum
Impedance Rating	50 Ohm style
Material	
Flanges	304ss
Coaxial conductor	Nickel
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: -200° to 450°C maximum, without connector HV: -20° to 200°C maximum, intermittent -20°C to 150°C maximum, sustained Connector: -65° to 165°C maximum Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table
Connector	All feedthroughs supplied with air-side mating connector

ULTRAHIGH & HIGH VACUUM SERIES

Figure 1

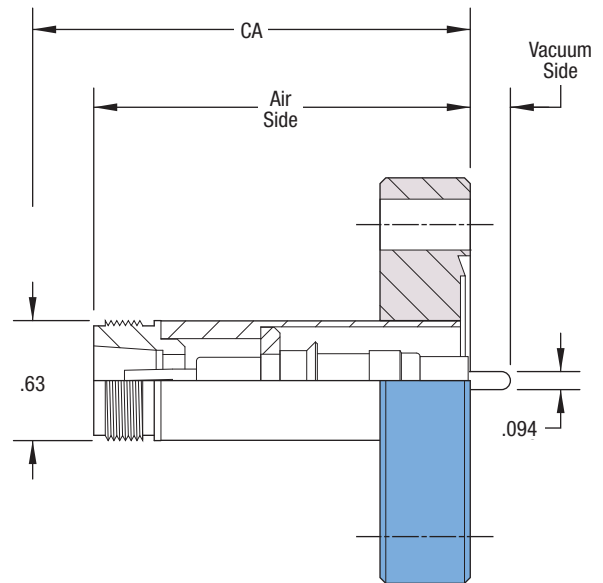
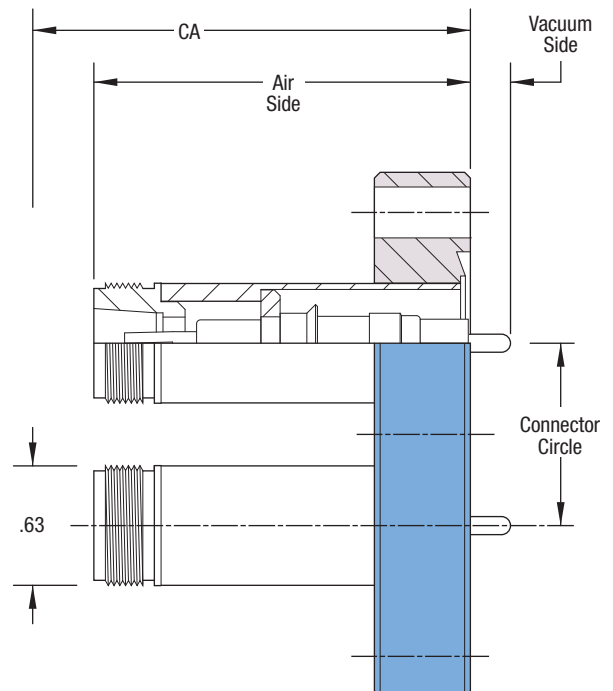


Figure 2



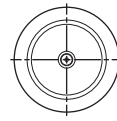
End Views - Vacuum Side

Del-Seal™ CF



Connector circle

Kwik-Flange™ KF



Connector circle

Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	FLANGE O.D.	FIG.	NO. OF CONN.	CONN. CIRCLE	AIR SIDE	VAC SIDE	CA	WT LB	REFERENCE	PART NUMBER
GROUND SHIELD											
1-1/3	1.062	1.33	1	1	-	1.96	.22	3.06	3/4	IM50-133	636000
2-3/4	2.312	2.73	1	1	-	1.96	.22	3.06	1	IM50-275	636001
2-3/4	2.312	2.73	2	2	.95	1.96	.22	3.06	1	IM50-275-2	636002

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	FLANGE O.D.	FIG.	NO. OF CONN.	CONN. CIRCLE	AIR SIDE	VAC SIDE	CA	WT LB	REFERENCE	PART NUMBER
GROUND SHIELD											
K075	NW16	1.18	1	1	-	2.01	.17	3.11	1/2	K075-IM	636020
K100	NW25	1.57	1	1	-	1.91	.27	3.01	1/2	K100-IM	636021
K150	NW40	2.16	1	1	-	1.91	.27	3.01	1/2	K150-IM	636022
K200	NW50	2.95	1	1	-	1.91	.27	3.01	1/2	K200-IM	636023
K150	NW40	2.16	2	2	.95	2.01	.17	3.11	3/4	K150-2-IM	636024
K200	NW50	2.95	2	2	.95	1.91	.27	3.01	3/4	K200-2-IM	636025

Connectors



DESCRIPTION	PIN DIA.	QTY PER PKG.	WT LBS	REFERENCE	PART NUMBER
PUSH-ON, WITH SET SCREW ¹	.094	10	1/2	POEC-094	991539-01

¹ Wrench included with Push-On connector



Features

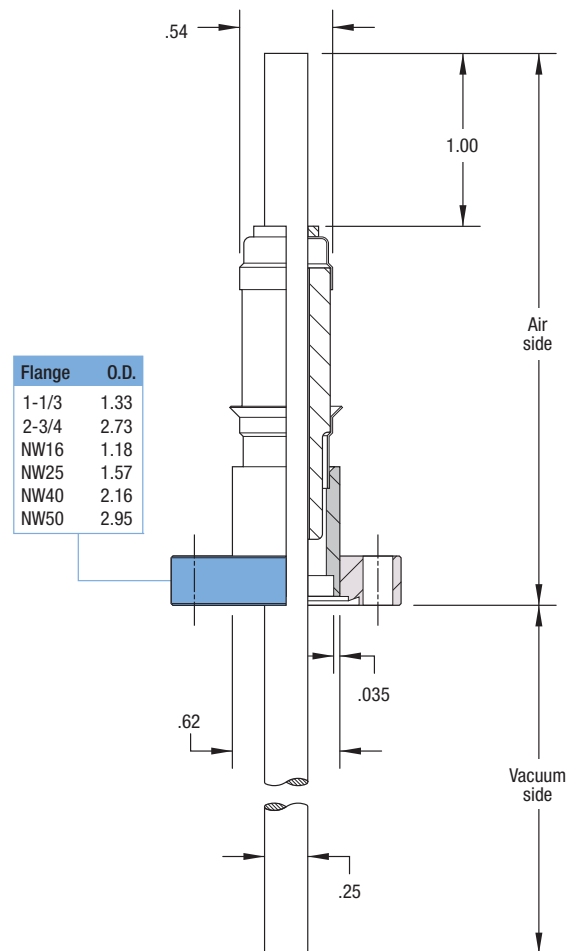
- Medium and high current applications
- Solid or tube conductor
- One to four conductors
- Copper conductor material
- Additional configurations available through MDC - see pages 320-321 for MDC Ceramic Seals contact information

Specifications

Application	Used in a variety of applications including electron beam or resistive evaporation, sample heating and biasing.
Configuration	Solid conductor, ceramic insulated Hollow tube, ceramic insulated
Voltage	5000V DC maximum
Current	Solid Conductor: 150 Amperes maximum Tubular Conductor: Unspecified ¹
Material	
Flanges	304ss
Conductor	OFE copper
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: 450°C maximum HV: 150°C maximum Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table
Connector	Purchased separately

¹ With proper cooling, tubular conductor high current feedthroughs are capable of exceeding solid conductor current ratings.

ULTRAHIGH & HIGH VACUUM SERIES



- Shown with solid conductor on 1-1/3" Del-Seal™ CF Mini-flange
- Tubular conductors have 1/4" tubes with .032" walls

End Views - Air Side

Del-Seal™ CF

Fig. 1



Fig. 2

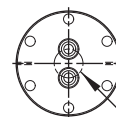


Fig. 3

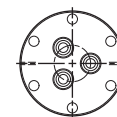


Fig. 4



Connector circle

Kwik-Flange™ KF

Fig. 5



Fig. 6



Fig. 7

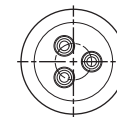


Fig. 8



Connector circle

Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	FIG.	NO. OF CONN.	CONN. CIRCLE	AIR SIDE	VAC SIDE	WT LB	REFERENCE	PART NUMBER
SOLID CONDUCTOR									
1-1/3	1.062	1	1	-	3.18	4.07	1/2	MMC-150	640000
2-3/4	2.312	1	1	-	3.18	4.07	1	MC-150	640001
2-3/4	2.312	2	2	.95	3.18	4.07	1	MC-152	640002
2-3/4	2.312	3	3	.95	3.18	4.07	1	MC-153	640003
2-3/4	2.312	4	4	.95	3.18	4.07	1	MC-154	640004

TUBULAR CONDUCTOR

1-1/3	1.062	1	1	-	3.18	4.07	1/2	MMCT-150	644000
2-3/4	2.312	1	1	-	3.18	4.07	1	MCT-150	644001
2-3/4	2.312	2	2	.95	3.18	4.07	1	MCT-152	644002
2-3/4	2.312	3	3	.95	3.18	4.07	1	MCT-153	644003
2-3/4	2.312	4	4	.95	3.18	4.07	1	MCT-154	644004

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	FIG.	NO. OF CONN.	CONN. CIRCLE	AIR SIDE	VAC SIDE	WT LB	REFERENCE	PART NUMBER
SOLID CONDUCTOR									
K075	NW16	5	1	-	3.23	4.02	1/2	K075-MC	640020
K100	NW25	5	1	-	3.13	4.12	1/2	K100-MC	640021
K150	NW40	5	1	-	3.13	4.12	1/2	K150-MC	640022
K200	NW50	5	1	-	3.13	4.12	1/2	K200-MC	640023
K150	NW40	6	2	.75	3.13	4.12	1	K150-MC-2	640024
K200	NW50	6	2	.75	3.13	4.12	1	K200-MC-2	640025
K150	NW40	7	3	.95	3.23	4.02	1	K150-MC-3	640026
K200	NW50	7	3	.95	3.13	4.12	1	K200-MC-3	640027
K200	NW50	8	4	.95	3.13	4.12	1	K200-MC-4	640028

TUBULAR CONDUCTOR

K075	NW16	5	1	-	3.23	4.02	1/2	K075-MCT	644020
K100	NW25	5	1	-	3.13	4.12	1/2	K100-MCT	644021
K150	NW40	5	1	-	3.13	4.12	1/2	K150-MCT	644022
K200	NW50	5	1	-	3.13	4.12	1/2	K200-MCT	644023
K150	NW40	6	2	.75	3.13	4.12	1	K150-MCT-2	644024
K200	NW50	6	2	.75	3.13	4.12	1	K200-MCT-2	644025
K150	NW40	7	3	.95	3.23	4.02	1	K150-MCT-3	644026
K200	NW50	7	3	.95	3.13	4.12	1	K200-MCT-3	644027
K200	NW50	8	4	.95	3.13	4.12	1	K200-MCT-4	644028

Connectors



DESCRIPTION	PIN DIA. or CORD RANGE	QTY PER PKG.	WT LBS	REFERENCE	PART NUMBER
INLINE ELECTRICAL CONNECTOR	.250	10	1/4	ILEC-260	991540
INLINE POWER CLAMP	.250	1	1/4	ILPC	991536
RIGHT ANGLE POWER CLAMP	.250	1	1/4	RAPC	991537
PUSH ON	.250	2	1/4	POEC-250	680360
HIGH VOLTAGE SHIELD	0.15 - 0.32	1	2	HVE-1	640050
HIGH VOLTAGE SHIELD	0.23 - 0.47	1	2	HVE-2	640051
HIGH VOLTAGE SHIELD	0.35 - 0.63	1	2	HVE-3	640052
HIGH VOLTAGE SHIELD	0.51 - 0.71	1	2	HVE-4	640053



Features

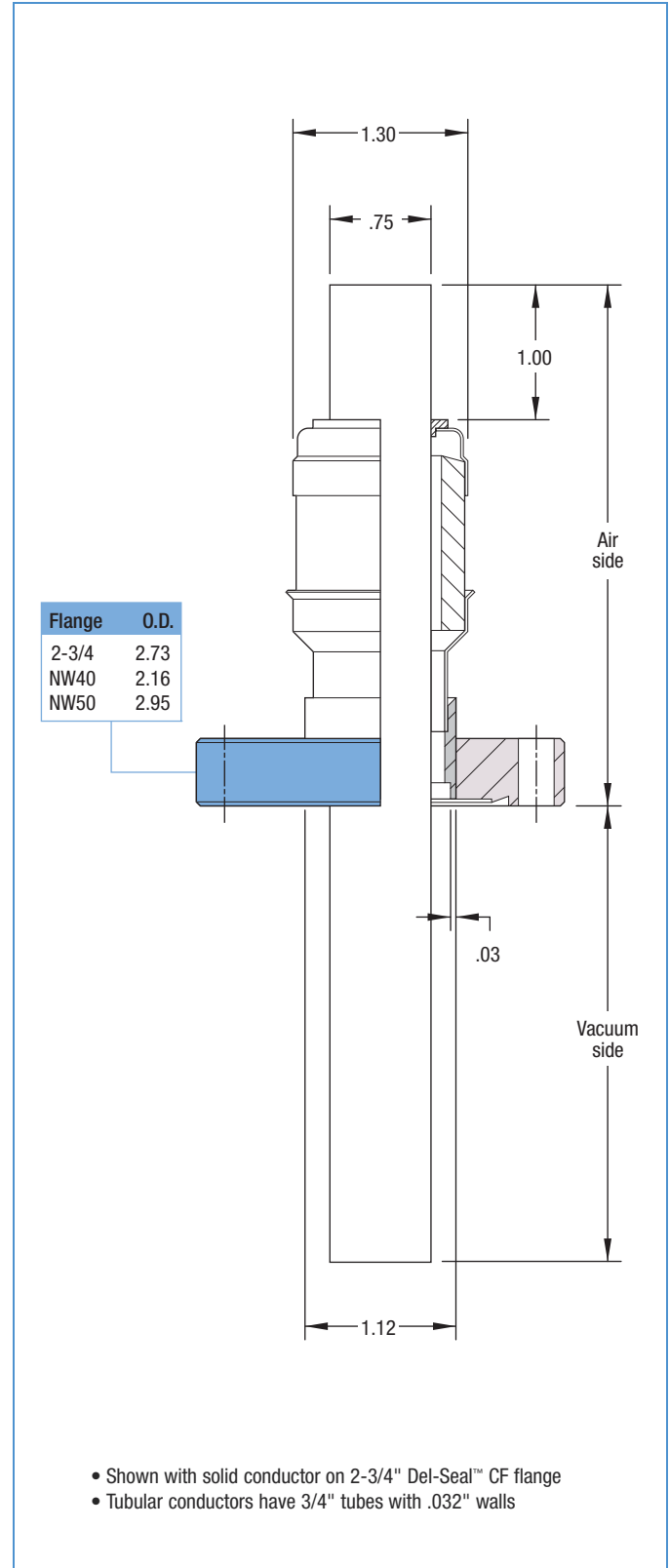
- High current applications
- Solid or tube conductor
- Single conductor
- Copper conductor material
- Additional configurations available through MDC - see pages 320-321 for MDC Ceramic Seals contact information

Specifications

Configuration	Solid conductor, ceramic insulated Hollow tube, ceramic insulated
Voltage	3000V DC maximum
Current	Solid conductor: 600 Amperes maximum Tubular conductor: Unspecified ¹
Material	
Flanges	304ss
Conductor	OFE copper
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: 450°C maximum HV: 150°C maximum Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table
Connector	Purchased separately

¹ With proper cooling, tubular conductor high current feedthroughs are capable of exceeding solid conductor current ratings.

ULTRAHIGH & HIGH VACUUM SERIES



Del-Seal™ CF



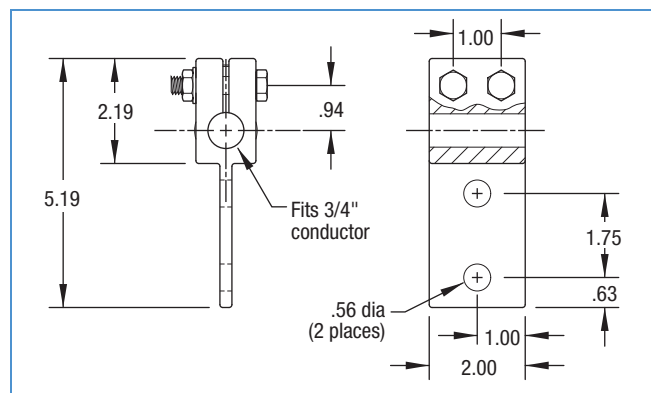
FLANGE SIZE	BOLT CIRCLE	AIR SIDE	VAC SIDE	WT LB	REFERENCE	PART NUMBER
SOLID CONDUCTOR						
2-3/4	2.312	3.90	3.35	1-1/2	MC-600	641000
TUBULAR CONDUCTOR						
2-3/4	2.312	3.90	3.35	1-1/2	MCT-600	645000

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	AIR SIDE	VAC SIDE	WT LB	REFERENCE	PART NUMBER
SOLID CONDUCTOR						
K150	NW40	3.85	3.40	1-1/2	K150-MC600	641020
K200	NW50	3.85	3.40	1-1/2	K200-MC600	641021
TUBULAR CONDUCTOR						
K150	NW40	3.85	3.40	1-1/2	K150-MCT600	645020
K200	NW50	3.85	3.40	1-1/2	K200-MCT600	645021

Connector



REFERENCE	PART NUMBER
HCC-750	640070

Clamp connectors for high current power feedthroughs are made of OFE copper and are silver plated to minimize oxidation and contact resistance. Each connector includes two .375-16 stainless steel hex-head bolts and nuts. They are designed for use with .750" diameter conductors and have two 9/16" holes used for fastening eyelet-fitted input power cables. Sold individually.



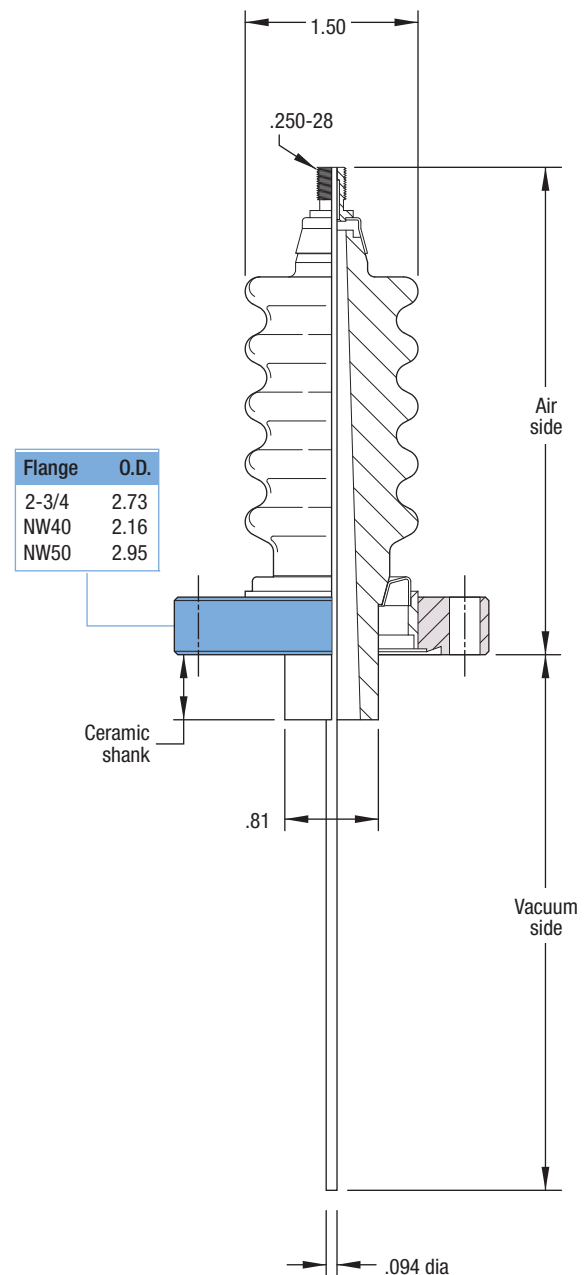
Features

- High voltage applications
- Single solid conductor
- Stainless steel conductor material
- Additional configurations available through MDC - see pages 320-321 for MDC Ceramic Seals contact information

Specifications

Configuration	Solid conductor, ceramic insulated
Voltage	30000V DC maximum
Current	1 Amperes maximum
Material	
Flanges	304ss
Conductor	Stainless steel
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: 450°C maximum HV: 150°C maximum Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table
Connector	Purchased separately

ULTRAHIGH & HIGH VACUUM SERIES



• Shown on 2-3/4" Del-Seal™ CF flange

Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	AIR SIDE	VAC SIDE	CERAMIC SHANK	WT LB	REFERENCE	PART NUMBER
2-3/4	2.312	4.12	4.76	.64	1	HVC-150	642000

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	AIR SIDE	VAC SIDE	CERAMIC SHANK	WT LB	REFERENCE	PART NUMBER
K150	NW40	4.17	4.71	.59	1	K150-HVC	642020
K200	NW50	4.07	4.81	.69	1	K200-HVC	642021

Connectors



DESCRIPTION	PIN DIA. or CORD RANGE	QTY PER PKG.	WT LBS	REFERENCE	PART NUMBER
PUSH ON, WITH SET SCREW	.094	10	1/4	POEC-094	991539-01
HIGH VOLTAGE SHIELD	0.15 - 0.32	1	2	HVE-1	640050
HIGH VOLTAGE SHIELD	0.23 - 0.47	1	2	HVE-2	640051
HIGH VOLTAGE SHIELD	0.35 - 0.63	1	2	HVE-3	640052
HIGH VOLTAGE SHIELD	0.51 - 0.71	1	2	HVE-4	640053



Features

- Solid conductor
- 400 Ampere, 50 Volt maximum
- Standard 1" diameter baseplate mounting
- Air and vacuum connectors included
- Bakeable to 200°C

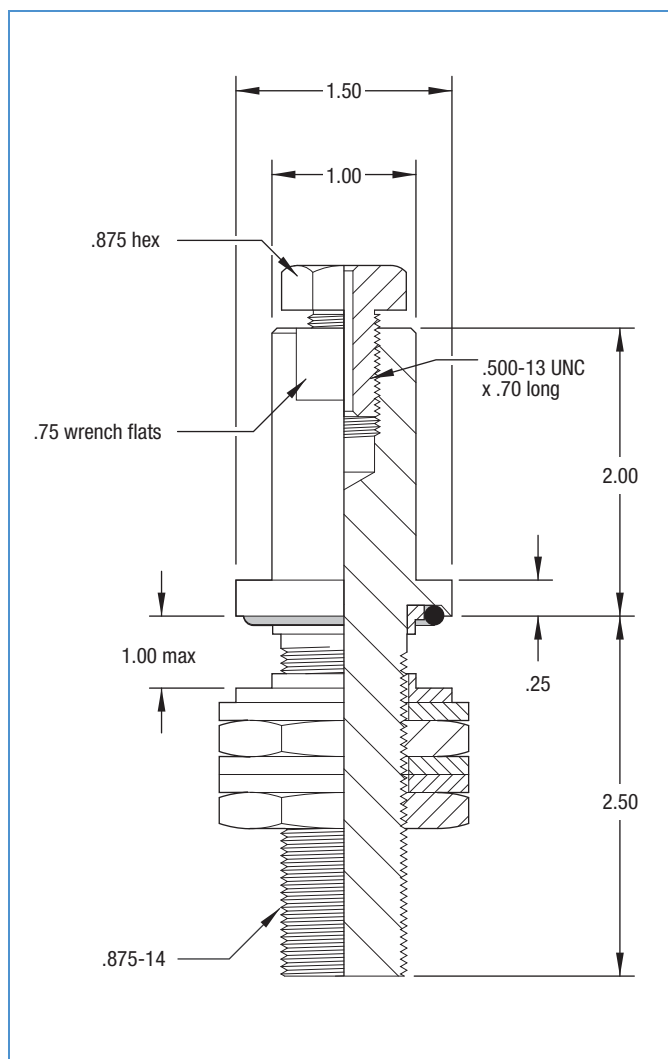
Specifications

Configuration	Solid conductor, ceramic insulated
Voltage	50V DC maximum
Current	400 Amperes maximum
Material	
Baseplate mount	Brass
Conductor	OFE Copper
Vacuum Range	1×10^{-4} to 1×10^{-8} Torr
Temperature Range	200°C maximum, intermittent, 150°C maximum, sustained Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table
Connector	Air and vacuum connectors included

HIGH VACUUM SERIES

Description

The FHC-400 is designed for the transmission of up to 400 amps at 50 volts into a vacuum system with standard one-inch diameter baseplate through-hole mounting. Water cooling is not required. Units are constructed of oxygen-free copper and brass with Teflon® insulators for strength and durability. Bakeable to 200°C.



DESCRIPTION	WT LB	REFERENCE	PART NUMBER
400 AMP	1	FHC-400	648001



Features

- Watercooled conductor
- 1000 Ampere, 50 Volt maximum
- Standard 1" diameter baseplate mounting
- Accepts 1/4" polypropylene tubing
- Air and vacuum connectors included
- Bakeable to 200°C

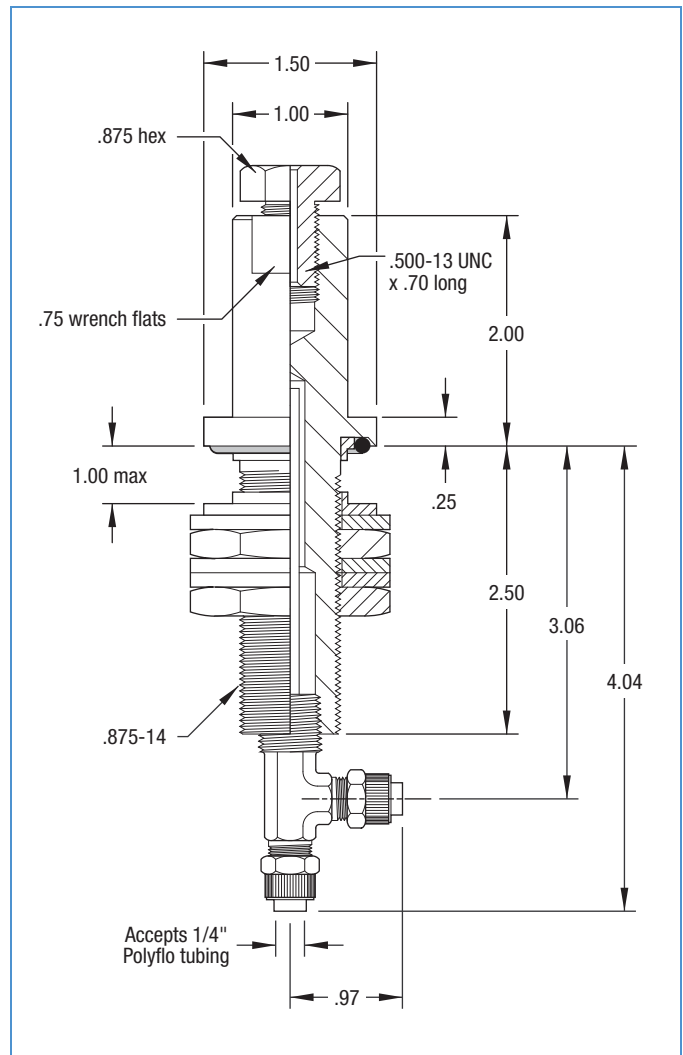
Specifications

Configuration	Watercooled conductor, ceramic insulated
Voltage	50V DC maximum
Current	1000 Amperes maximum
Material	
Baseplate mount	Brass
Conductor	OFE Copper
Vacuum Range	1×10^{-4} to 1×10^{-8} Torr
Temperature Range	200°C maximum, intermittent, 150°C maximum, sustained Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table
Connector	Air and vacuum connectors included

HIGH VACUUM SERIES

Description

The FHC-1000 is a high-current, low-voltage electrical baseplate feedthrough for the transmission of up to 1000 amps at 50 volts into a vacuum system. It is designed for standard one-inch diameter through-hole mounting. Units are constructed of oxygen-free copper and brass with Teflon insulators for strength and durability. One-piece construction eliminates any possibility of water leakage through welded parts. Waterline connectors accept 1/4" polypropylene tubing. Bakeable to 200°C.



DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1000 AMP	1	FHC-1000	648000



Features

- High power, high frequency applications
- Single tube conductor: 35kW @ 13.5 MHz
- Dual tube conductors: 10kW @ 450 KHz
- OFE copper conductor material
- Additional configurations available through MDC - see pages 320-321 for MDC Ceramic Seals contact information

Specifications

Configuration	Hollow tubes, ceramic insulated
Voltage	One tube: 10000V maximum Two tubes: 8000V maximum
Power	One tube: 35kW maximum Two tubes: 10kW maximum
Frequency	One tube: 13.5 MHz maximum Two tubes: 450 KHz maximum
Material	
Flanges	304ss
Conductor	OFE copper
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: 300°C maximum HV: 200°C maximum, intermittent, 150°C maximum, sustained Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table

ULTRAHIGH & HIGH VACUUM SERIES

Description

MDC RF-Power feedthroughs are state of the art ceramic to metal seal components. They are constructed entirely of non-magnetic materials, *i.e.* copper and stainless steel, which enhance their performance in RF induction fields. These feedthroughs are used primarily in high power and high frequency induction load applications. One of the most common applications being induction coil vacuum heaters. Depending on the application, heater designs can take on numerous configurations. Even though some feedthroughs are sold and detailed as single components, they should be used in pairs; one lead brings power and coolant in to the system and the other takes them out.

Figure 1
35kW @ 13.5 MHz

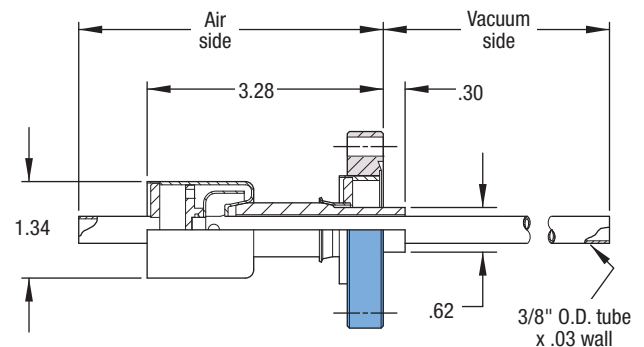
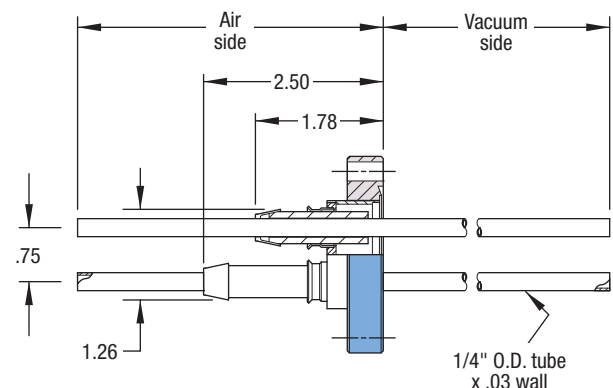


Figure 2
10kW @ 450 KHz



Description *(continued)*

The use of an open or closed loop cooling system is an essential requirement when using these components. The characteristic “skin effect” of RF at these power and frequency levels makes cooling of ceramic to metal seal interfaces imperative. The absence of cooling will generate sufficient heat to damage ceramic to metal seals. Note that practical coolant flow rates should be determined by the customer for each application, based on the heat dissipating capacity of the coolant in use.

Del-Seal™ CF



FLANGE SIZE	RATING	FLANGE O.D.	FIGURE	AIR SIDE	VACUUM SIDE	WT LB	REFERENCE	PART NUMBER
ONE CONDUCTOR								
2-3/4	35 kW	2.73	1	4.23	4.52	1	RF-35KW	620001
TWO CONDUCTOR								
2-3/4	10 kW	2.73	2	4.25	4.14	1	RF-10KW	620000

Kwik-Flange™ KF



FLANGE SIZE	RATING	FLANGE O.D.	ISO REF.	FIGURE	AIR SIDE	VACUUM SIDE	WT LB	REFERENCE	PART NUMBER
ONE CONDUCTOR									
K200	35 kW	2.95	NW50	1	4.18	4.57	1	K200-35KW	620022
TWO CONDUCTOR									
K150	10 kW	2.16	NW40	2	4.29	4.10	1	K150-10KW	620020
K200	10 kW	2.95	NW50	2	4.19	4.20	1	K200-10KW	620021



Description

MDC Ceramic to Metal Adapters are recommended for high and ultrahigh vacuum system applications requiring high-voltage insulation. They feature high reliability, leak tightness at 1×10^{-10} atm. cc/sec helium, and maximum voltage ratings as noted in the tables below. "Break" style adapters are either 3/4" or 1-1/4" nominal diameter, and "Envelope" style adapters are 2-1/2" nominal diameter and above. They are made with ceramic insulator material having a minimum aluminum oxide content of 90%. Ceramic-to-Kovar® and Kovar®-to-stainless steel seals are made with vacuum tube grade silver bearing braze alloy. Del-Seal™ CF adapters are supplied with one rotatable and one non-rotatable flange for easy installation. UHV series are bakeable to 450°C maximum. HV series can be baked to 200°C intermittent and are usable to 150°C sustained temperature.

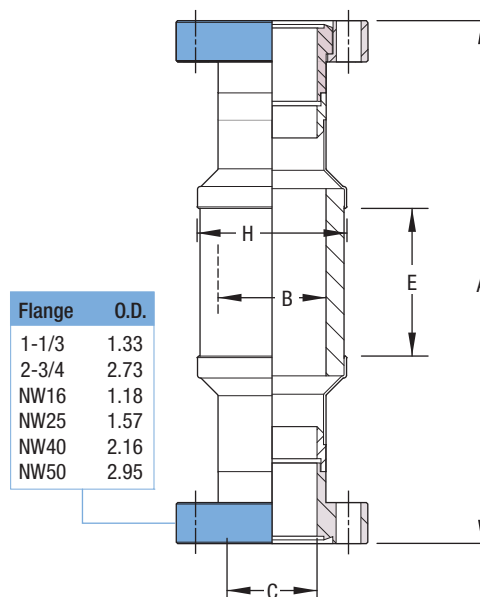
Specifications

Configuration	UHV: One rotatable, one nonrotatable Del-Seal™ CF flange
	HV: Identical ISO flanges each end
Voltage Rating	Breaks: 10kVDC and 15kVDC
	Envelopes: 8kVDC and 15kVDC
Material	
Flanges	304ss
Sleeves	Kovar
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr
	HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: 450°C maximum
	HV: 150°C maximum
	Gradient: 25°C per minute maximum
Weight and Dimensions	See table

ULTRAHIGH & HIGH VACUUM SERIES

Breaks

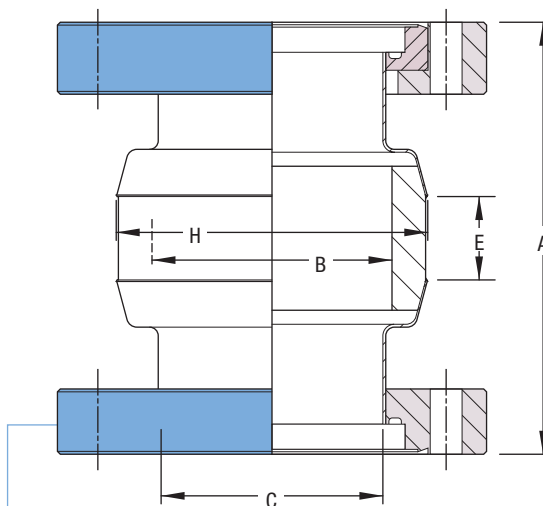
3/4" and 1-1/4"



Flange	O.D.
1-1/3	1.33
2-3/4	2.73
NW16	1.18
NW25	1.57
NW40	2.16
NW50	2.95

Envelopes

2-1/2" through 7-3/4"



Flange	O.D.
4-1/2	4.47
6	5.97
8	7.97
10	9.97
NW63	3.74
NW100	5.12
NW160	7.09

• LF Large-Flange™ sizes NW63 through NW160 are claw clamp style flanges

Del-Seal™ CF



FLANGE SIZE	VOLTAGE RATING	NOM A	B	C	NOM E	NOM H	WT LB	REFERENCE	PART NUMBER
BREAKS									
1-1/3	10kV	3.62	.75	.63	1.00	1.04	1	CB-075	464000
2-3/4	15kV	4.22	1.25	1.37	2.00	1.66	1	CB-125	464001
ENVELOPES									
4-1/2	8kV	4.50	2.50	2.31	.75	3.23	6	CE-250	465000
6	8kV	4.62	3.50	3.75	.75	4.25	8	CE-350	465001
8	15kV	5.50	6.00	6.00	1.50	6.92	16	CE-600	465002
10	15kV	5.75	7.75	7.75	1.50	8.80	21	CE-775	465003

ISO KF & ISO LF



FLANGE SIZE	ISO REF.	VOLTAGE RATING	NOM A	B	C	NOM E	NOM H	WT LB	REFERENCE	PART NUMBER
BREAKS										
K075	NW16	10kV RMS	3.62	.75	.63	1.00	1.04	1	K075-CB	464020
K100	NW25	10kV RMS	2.94	.75	.63	1.00	1.04	1	K100-CB	464021
K150	NW40	15kV RMS	4.22	1.25	1.37	2.00	1.66	1-1/2	K150-CB	464022
K200	NW50	15kV RMS	4.00	1.25	1.37	2.00	1.66	1-1/2	K200-CB	464023
ENVELOPES										
L250	NW63	8kV RMS	4.25	2.50	2.31	.75	3.23	6	L250-CE	465020
L400	NW100	8kV RMS	4.37	3.50	3.75	.75	4.25	14	L400-CE	465021
L600	NW160	15kV RMS	5.25	6.00	6.00	1.50	6.92	16	L600-CE	465022

LF Large-Flange™ sizes NW63 through NW160 are claw clamp style flanges



Features

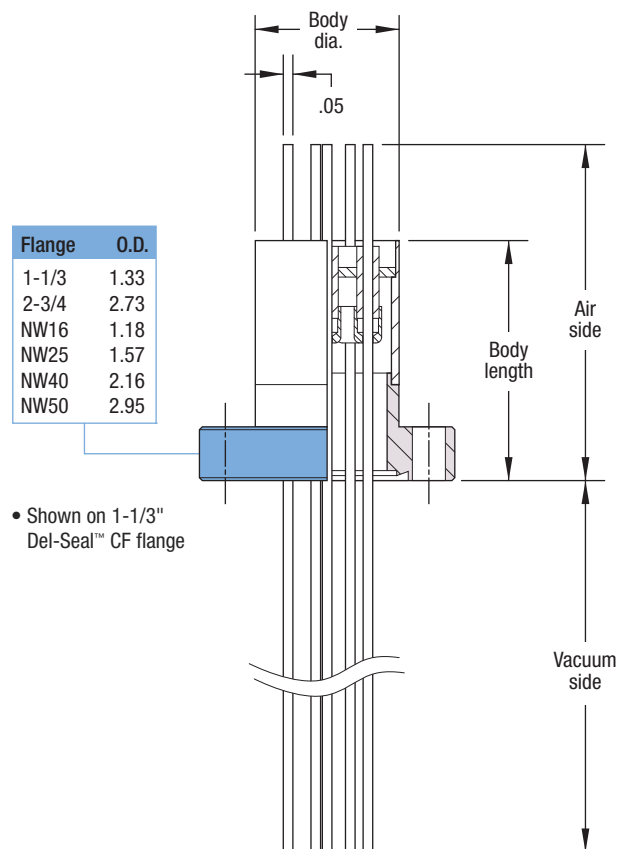
- Medium power applications
- Eight conductors
- Solid or tubular configuration
- Additional configurations available through MDC - see pages 320-321 for MDC Ceramic Seals contact information

Specifications

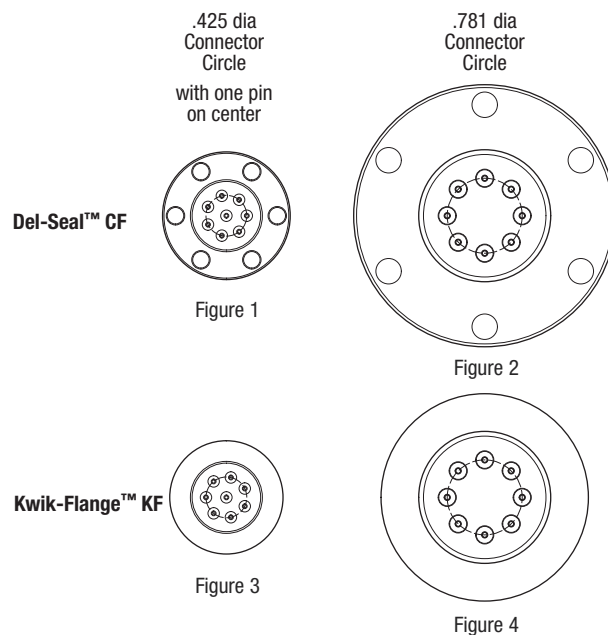
Application	Used in a variety of applications including sample heating and biasing.
Configuration	Solid conductor, ceramic insulated Tube conductor, ceramic insulated
Voltage	1000V DC maximum
Current	Solid conductor: 7 Amperes per pin maximum Tube conductor: Unspecified ¹
Material	
Flanges	304ss
Conductor	Solid: Kovar® Tube: 304ss
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: 450°C maximum HV: 150°C maximum Gradient: 25°C per minute maximum
Weight and Dimensions	See drawing and table
Connector	Purchased separately
Caution	Do not attempt to shorten conductor pins. Damage may occur to ceramic material. Use Short Pin Series or contact factory.

¹ Tubular feedthroughs accept .032 diameter wire.

ULTRAHIGH & HIGH VACUUM SERIES



End Views - Air Side



Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	FIG.	BODY DIMEN. LENGTH	BODY DIMEN. DIA.	AIR SIDE	VACUUM SIDE	WT LB	REFERENCE	PART NUMBER
STANDARD PIN									
1-1/3	1.062	1	1.25	.75	1.75	3.50	1/2	MMC-8P	643001
2-3/4	2.312	2	1.05	1.37	1.80	3.90	1/2	MC-8P	643000
SHORT PIN									
1-1/3	1.062	1	1.25	.75	1.75	2.00	1/2	MMC-8PS	643002
2-3/4	2.312	2	1.05	1.37	1.80	2.45	1/2	MC-8PS	643003
TUBULAR									
1-1/3	1.062	1	1.25	.75	1.75	3.50	2	MMC-8T	646000
2-3/4	2.312	2	1.05	1.37	1.80	3.90	2	MC-8T	646001

Do not attempt to shorten pins; see caution page 344

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	FIG.	BODY DIMEN. LENGTH	BODY DIMEN. DIA.	AIR SIDE	VACUUM SIDE	WT LB	REFERENCE	PART NUMBER
STANDARD PIN									
K075	NW16	3	1.25	.75	1.75	3.50	1/2	K075-8P	643020
K100	NW25	3	.75	.75	1.25	4.00	1/2	K100-8P	643021
K150	NW40	4	1.00	1.37	1.75	3.95	1/2	K150-8P	643022
K200	NW50	4	1.00	1.37	1.75	3.95	1/2	K200-8P	643023
SHORT PIN									
K075	NW16	3	1.25	.75	1.75	2.00	1/2	K075-8PS	643024
K100	NW25	3	.75	.75	1.25	2.50	1/2	K100-8PS	643025
K150	NW40	4	1.00	1.37	1.75	2.50	1/2	K150-8PS	643026
K200	NW50	4	1.00	1.37	1.75	2.50	1/2	K200-8PS	643027
TUBULAR									
K075	NW16	3	1.25	.75	1.75	3.50	1	K075-8T	646020
K100	NW25	3	.75	.75	1.25	4.00	1	K100-8T	646021
K150	NW40	4	1.00	1.37	1.75	3.95	1	K150-8T	646022
K200	NW50	4	1.00	1.37	1.75	3.95	1	K200-8T	646023

Do not attempt to shorten pins; see caution page 344

Connectors



DESCRIPTION	PIN DIA.	QTY PER PKG.	WT LBS	REFERENCE	PART NUMBER
PUSH-ON, WITH SET SCREW ¹	.050	10	1/2	POEC-050	991539

¹ Wrench included with Push-On connector



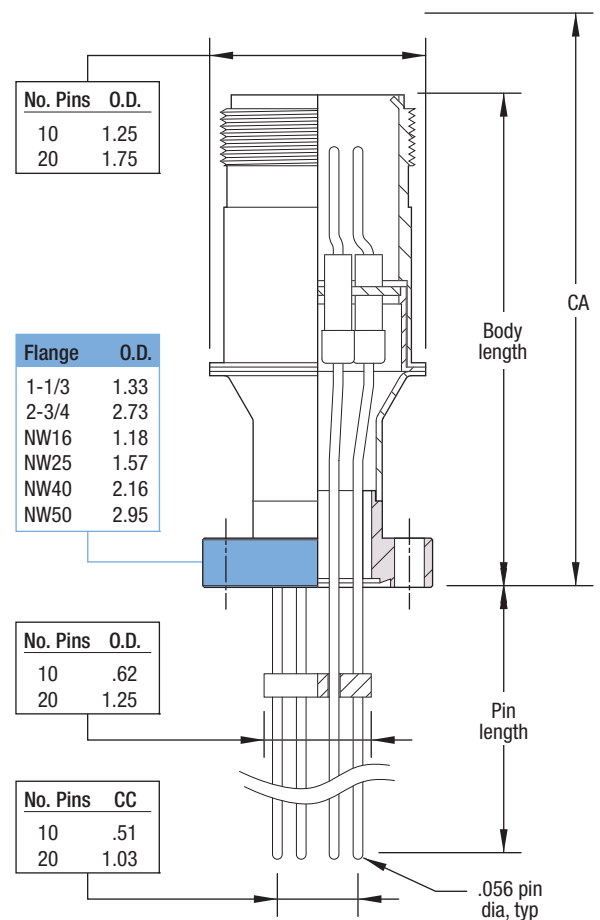
Features

- 10 or 20 pin configuration
- Short pin series available for special applications
- Additional configurations available through MDC - see pages 320-321 for MDC Ceramic Seals contact information

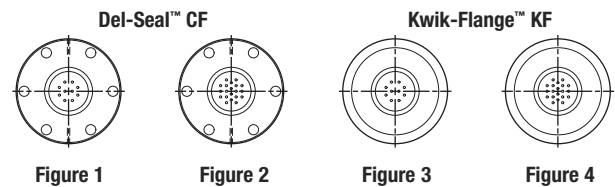
Specifications

Application	Used for the transmission of electrical signals or low power applications.
Configuration	Single ended multi-pin, Standard pin or Short pin
Voltage	700V DC maximum
Current	10 Amperes maximum
All pins loaded	10 pins: 50 Amperes maximum 20 pins: 75 Amperes maximum
Material	
Flanges	304ss
Conductor	Alumel
Vacuum Range	UHV: 1×10^{-4} to 1×10^{-13} Torr HV: 1×10^{-4} to 1×10^{-8} Torr
Temperature Range	UHV: 450°C maximum, without connector HV: 150°C maximum, without connector Connector: 65°C maximum Gradient: 25°C per minute maximum
Weight and Dimensions	See table
Connector	All feedthroughs supplied with air-side mating connector, MIL-C-5015 spec
Caution	Do not attempt to shorten conductor pins. Damage may occur to ceramic material. Use Short Pin Series or contact factory.

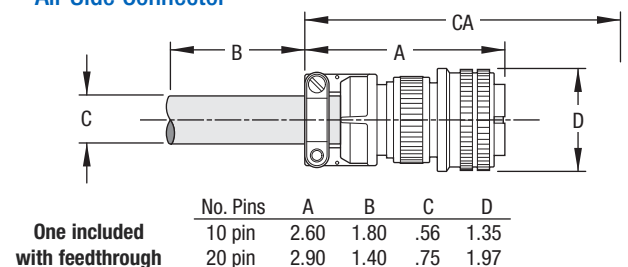
ULTRAHIGH & HIGH VACUUM SERIES



End Views - Air Side



Air Side Connector



Del-Seal™ CF



FLANGE SIZE	NO. OF PINS	END VIEW FIGURE	BODY LENGTH	PIN LENGTH	CA	WT LB	REFERENCE	PART NUMBER	PRICE \$
STANDARD PIN									
1-1/3	10	1	2.70	2.70	4.53	1	IF10-133	647050	340
2-3/4	10	1	2.25	3.14	4.08	1-1/2	IF10-275	647051	350
2-3/4	20	2	2.58	3.45	4.83	1-1/2	IF20-275	647052	435
SHORT PIN									
1-1/3	10	1	2.70	2.00	4.53	1	IF10-133-S	647053	340
2-3/4	10	1	2.25	2.45	4.08	1-1/2	IF10-275-S	647054	350
2-3/4	20	2	2.58	2.45	4.83	1-1/2	IF20-275-S	647055	435

Do not attempt to shorten pins; see caution page 346

Kwik-Flange™ KF



FLANGE SIZE	NO. OF PINS	END VIEW FIGURE	BODY LENGTH	PIN LENGTH	CA	WT LB	REFERENCE	PART NUMBER	PRICE \$
STANDARD PIN									
K075	10	3	2.70	2.70	4.53	1	K075-IF10	647056	340
K100	10	3	2.20	3.19	4.03	1	K100-IF10	647057	340
K150	10	3	2.20	3.19	4.03	1	K150-IF10	647058	345
K200	10	3	2.20	3.19	4.03	1	K200-IF10	647059	345
K150	20	4	2.53	3.50	4.78	1	K150-IF20	647060	425
K200	20	4	2.53	3.50	4.78	1	K200-IF20	647061	435
SHORT PIN									
K075	10	3	2.70	2.00	4.53	1	K075-IF10-S	647062	340
K100	10	3	2.20	2.50	4.03	1	K100-IF10-S	647063	340
K150	10	3	2.20	2.50	4.03	1	K150-IF10-S	647064	345
K200	10	3	2.20	2.50	4.03	1	K200-IF10-S	647065	345
K150	20	4	2.53	2.50	4.78	1	K150-IF20-S	647066	425
K200	20	4	2.53	2.50	4.78	1	K200-IF20-S	647067	435

Do not attempt to shorten pins; see caution page 346

Connectors



DESCRIPTION	PIN DIA.	QTY PER PKG.	WT LBS	REFERENCE	PART NUMBER	PRICE \$
CRIMP CONNECTOR	.056	5	1/4	TC-CRIMP	991538	60
CERAMIC SPACER, 10 PIN	.056	1	1/4	CS10-2	680620	11
CERAMIC SPACER, 20 PIN	.056	1	1/4	CS20-2	680621	11
CERAMIC BEAD	.056, TIGHT FIT	85 ¹	1/4	CB-2	680601	33
CERAMIC BEAD	.056, LOOSE FIT	73 ¹	1/4	CB-3	680602	33

¹ Equivalent to one linear foot



Complete air-to-vacuum instrumentation connectivity

Features

- Ultrahigh Vacuum compatible
- Type-D Subminiature air-side connector
- PEEK in-vacuum connector
- Kapton® coated UHV ribbon cable
- Gold plated pins
- Del-Seal™ CF flange, Conflat® compatible design

Description

Feedthroughs and Air-side connector

Type-D subminiature connectors offer UHV feedthroughs with nine, fifteen or twenty-five pins hermetically sealed and electrically insulated using glass ceramic bonding. Feedthroughs are offered on Del-Seal™ CF Conflat® compatible metal seal flanges as well as ISO-NW elastomer seal Kwik-Flanges™. One air-side Type-D connector and snap on cover is included with each feedthrough. See page 349.

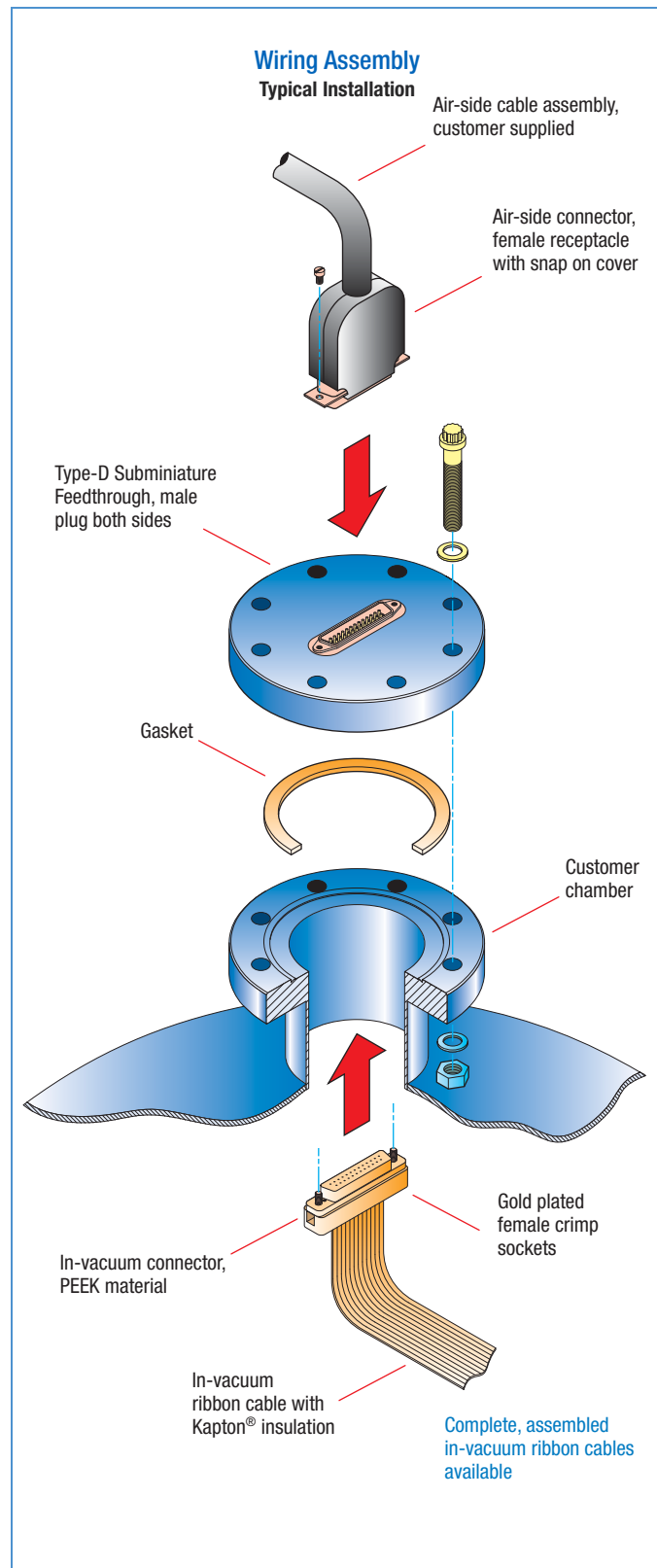
In-vacuum connector and insulated wire

For vacuum side connections a Kapton® insulated in-vacuum ribbon cable and PEEK material Type-D connectors meet the rigorous demands of UHV environments. In-vacuum cables and connectors are not included in the feedthrough assembly price and must be purchased separately. See the following pages for in-vacuum cables and connectors beginning on page 350.

Type-D hardware

Additional hardware may be purchased separately for expansion or replacement of system components. Refer to page 351.

ULTRAHIGH & HIGH VACUUM SERIES



ULTRAHIGH & HIGH VACUUM SERIES

Features

- UHV and HV compatible materials
- UHV temperature rated to 250°C
- MIL-C-24308 pin arrangement
- Gold plated pins
- Air side connector with snap on housing included
- Conflat® and ISO compatible designs

Hermetic Type-D subminiature feedthroughs are high density multi-pin instrumentation feedthroughs constructed with pin arrangements designed to meet MIL-C-24308 specifications. Nine, fifteen or twenty-five gold plated pins are hermetically sealed and electrically insulated in a stainless steel shell using the latest in glass ceramic bonding techniques. Each feedthrough assembly is supplied with an atmosphere side connector which requires customer wiring. Connector details are found on page 351, and additional units may be purchased as stand-alone items. UHV in-vacuum mating connectors and ribbon cable assemblies are available, but must be purchased separately. In-vacuum ribbon cable assemblies are on the next page.

Specifications

Voltage ¹	300VDC maximum
Current	5 Amperes maximum at 20°C
Material	
Shell	Stainless steel
Pins	Ni-Fe alloy, gold plated
Insulation / Seal	Glass ceramic
Vacuum Range UHV / HV	1x10 ⁻¹⁰ Torr / 1x10 ⁻⁸ Torr
Temperature Range ²	
Feedthrough	250°C
Del-Seal™ CF flange	450°C
Kwik-Flange™ ISO KF flange, continuous / intermittent	150°C / 200°C
Air side connector	60°C
Vacuum side connector	250°C
Thermal Gradient	25°C / minute maximum
Weight	See table
Dimensions	See table and drawing

¹ Electrical ratings are maximum test values. Feedthroughs are intended for instrumentation applications carrying low level signal voltages and currents.

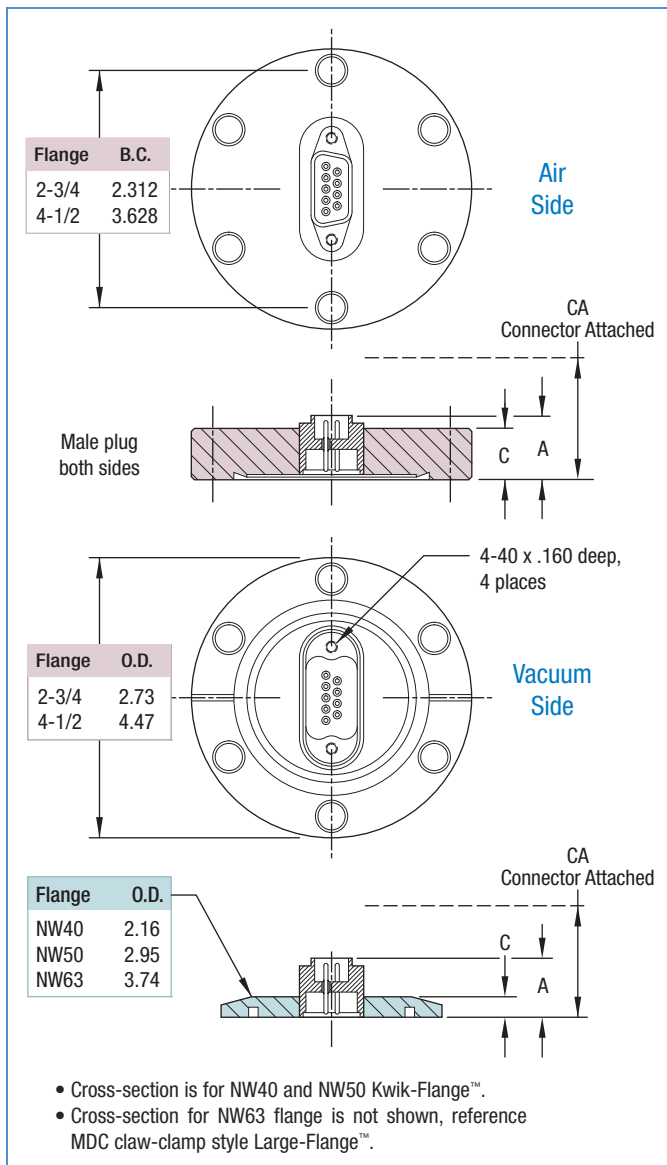
² Overall assembly ratings must be adjusted to that of the lowest rated component.

NO. PINS	FLG	A	C	CA	WT LB	REFERENCE	PART NUMBER
9	2-3/4	.63	.50	2.56	1	D9-275	633000
15	4-1/2	.78	.68	2.71	3	D15-450	633001
25	4-1/2	.78	.68	2.71	3	D25-450	633002

NO. PINS	FLG	A	C	CA	WT LB	REFERENCE	PART NUMBER
9	NW40	.58	.20	2.51	1	D9-K150	633003
15	NW50	.58	.20	2.51	3	D15-K200	633004
25	NW63	.58	.47	2.51	3	D25-L250	633005



Type-D subminiature feedthroughs: 9-Pin on 2-3/4" Del-Seal™ CF flange, 15-Pin on ISO NW50 Kwik-Flange™, and 25-Pin on 4-1/2" Del-Seal™ CF flange. Air-side connector with snap on housing included, not shown above.





KAP-R25-19S In-Vacuum Ribbon Cable with crimp sockets installed



KAP-R25-19SC In-Vacuum Ribbon Cable with PEEK connector installed

In-vacuum ribbon cable assemblies are designed to complement the Type-D hermetic feedthrough product line. They are offered in two standard configurations pictured above. In-vacuum ribbon cable assemblies are constructed with UHV compatible materials including PEEK (polyether-etherketone) thermoplastic connectors and Kapton® wire insulation. Individual conductors are electrically insulated by wrapping them with a Kapton® insulating film. Insulated conductors are then bundled into ribbon cable form by weaving the conductors with PEEK monofilament. These connectors are fitted with gold plated female crimp contacts which mate with male pins on MDC Type-D feedthroughs. Cable assemblies are available standard with termination on one end and no termination on opposite end. Custom termination of second end is available at an additional charge. PEEK connectors are secured to the UHV side of a Type-D feedthrough using the two 4-40 vented cap screws provided. Individual in-vacuum insulated stranded and coaxial wires are found on page 352.

ULTRAHIGH VACUUM

Features

- UHV compatible materials
- 250°C bakeout temperature
- Kapton® insulated wires
- PEEK ribbon weave and connector material
- Available with 9, 15 and 25 conductors
- Use with MDC Type-D Subminiature Feedthroughs

Specifications

Construction

Ribbon cable Kapton® insulation, PEEK weave

In-vacuum connector PEEK

Crimp sockets Gold plated

Connectors Compatible with industry standard

Type-D subminiature connectors or

MDC in-vacuum UHV connectors

Conductor 7 / .005" Stranded silver plated copper

Temperature Range 250°C Maximum

Vacuum Range 3.75×10^{-11} Torr

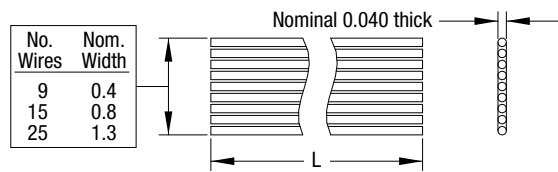
Electrical Rating 4kV DC, 1kV rms, 1Amp maximum

Number of Wires 9, 15 and 25

Kapton® is a Registered Trademark of DuPont Dow Elastomers

NO. WIRES	LENGTH INCHES	WT LB	REFERENCE	PART NUMBER
CRIMP SOCKETS ONLY				
9	19	1	KAP-R9-19S	680520
9	39	1	KAP-R9-39S	680521
15	19	1	KAP-R15-19S	680522
15	39	1	KAP-R15-39S	680523
25	19	1	KAP-R25-19S	680524
25	39	1	KAP-R25-39S	680525
SOCKETS AND CONNECTOR				
9	19	1	KAP-R9-19SC	680530
9	39	1	KAP-R9-39SC	680531
15	19	1	KAP-R15-19SC	680532
15	39	1	KAP-R15-39SC	680533
25	19	1	KAP-R25-19SC	680534
25	39	1	KAP-R25-39SC	680535

In-vacuum ribbon



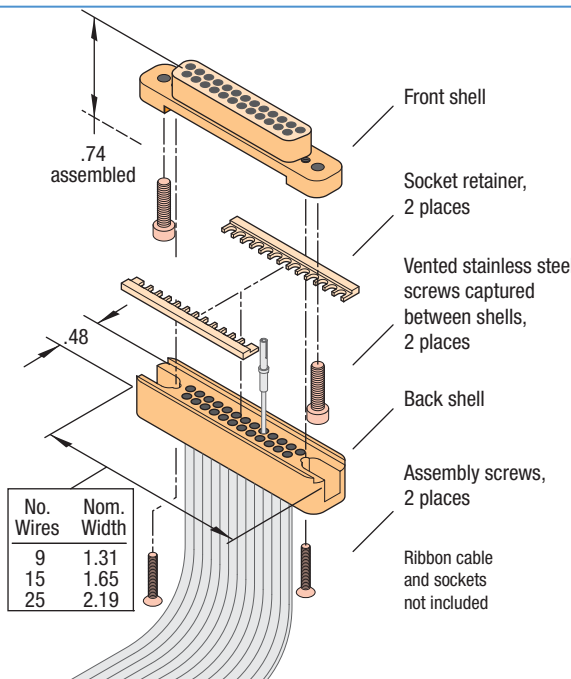
Available with 9, 15 or 25 wires in standard lengths of 19, 39 and 98 inches. Locate part number for ordering from the reference number.

Example: KAP-R25-39

25 wires — 39 inches

REFERENCE	PART NUMBER
KAP-R9-19	680560
KAP-R9-39	680566
KAP-R9-98	680561
KAP-R15-19	680562
KAP-R15-39	680567
KAP-R15-98	680563
KAP-R25-19	680564
KAP-R25-39	680568
KAP-R25-98	680565

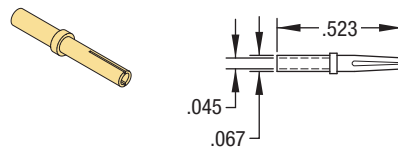
In-vacuum connector



REFERENCE	PART NUMBER
D9-PCC	680540
D15-PCC	680541
D25-PCC	680542

MDC in-vacuum connectors are ideally suited for UHV Type-D instrumentation connection applications. They consist of a four part PEEK housing which captures gold plated crimp sockets. These connectors include two 4-40 x 3/8" socket head screws used to secure the connector to the Type-D feedthrough flange assembly. In-vacuum ribbon and sockets must be purchased separately.

In-vacuum sockets

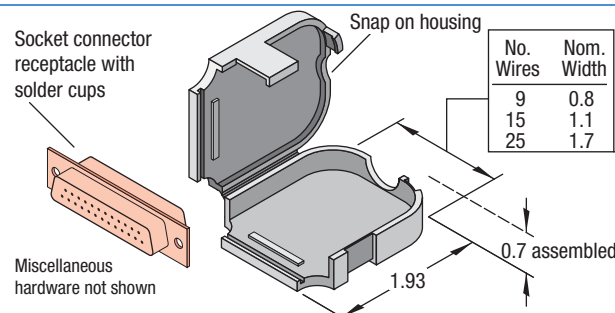


Use the following tools for crimp socket installation:
Crimp Tool - Mil-Spec Ref M22520/2-01
Contact Positioner - Mil-Spec Ref M22520/2-08

REFERENCE	PART NUMBER
DGCS-10	680509

Gold plated crimp sockets are sold in packages of 10. They provide a simple push-on connection to 0.040" diameter male pins. Sockets are mechanically crimped to ribbon cable conductors using military specification crimping and positioning tools.

Air-side connector



REFERENCE	PART NUMBER
D9-C	680511
D15-C	680512
D25-C	680513

MDC air-side Type-D connectors include solder cup female receptacle, snap on plastic housing and all fastening and strain relief hardware. Cables must be supplied and wired by the user.



ULTRAHIGH VACUUM SERIES

Features

- High strength Kapton® Type F film insulation
- Silver plated copper conductor
- Single strand unshielded configurations
- Single strand or coaxial configurations
- Bakeable to 260°C

Description

MDC In-Vacuum Insulated Wire is designed for high and ultrahigh vacuum use to 260°C. All conductors and shields are silver plated copper wire. Insulation is Kapton® Type F film which is applied and heat treated to effectively minimize trapped volumes of gas and maintain mechanical strength. KAP1 through KAP4 supplied in 10m (30-foot) rolls, KAP5 supplied in 5m (15-foot) rolls.

Note that all specifications and dimensions for the In-Vacuum Insulated Wire are metric.

Specifications

Mechanical

Initial Tear	13.4 kg/mm
Tensile Strength	0.97 Pa x 10 ⁻⁷
Elongation	75%

Electrical

Dielectric Constant	2.9
Dielectric Strength	80kV/mm
Dissipation Factor	.001

Thermal / Chemical

Moisture Absorption	0.4% @ 50% RH
Radiation Resistance	107 Rads

Material

Conductor	Silver plated copper
Insulator	Kapton® Type F film

Vacuum Range	1x10 ⁻¹¹ Torr
--------------	--------------------------

Temperature Range	260°C maximum Gradient: 25°C per minute maximum
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Weight	See table
--------	-----------

Dimensions	See drawing - All units metric
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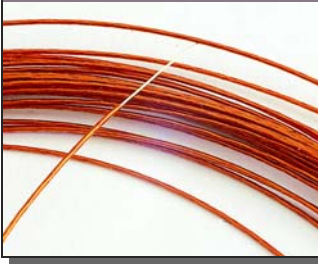
Wire Strippers



Wire strippers include precise wire diameter settings on an easy to read dial. Adjustable stops ensure repeatable stripping lengths. Two sizes cover the full range of In-Vacuum Insulated Wire offered in this catalog.

DESCRIPTION	REFERENCE	PART NUMBER
.12 to .40mm WIRE STRIPPER	KAP-S1	680569
.25 to .80mm WIRE STRIPPER	KAP-S2	680570

Single Strand



- Conductor Cross-Section .049 sq mm

REFERENCE

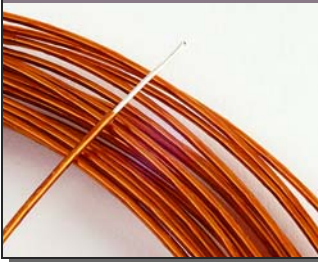
KAP1

PART NUMBER

680500

AWG	30
Resistance	375.8Ω/Km
Voltage	600V RMS 2kV DC
Current	1.5 Amps
Quantity per roll	30-ft (10m)

Single Strand



- Conductor Cross-Section .283 sq mm

REFERENCE

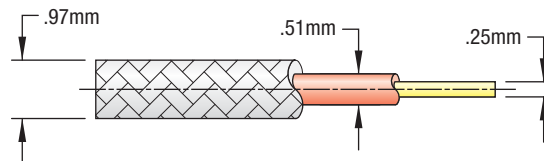
KAP2

PART NUMBER

680501

AWG	22
Resistance	64.0Ω/Km
Voltage	600V RMS 2kV DC
Current	5.5 Amps
Quantity per roll	30-ft (10m)

Coaxial, Single Strand



- Conductor Cross-Section .049 sq mm

REFERENCE

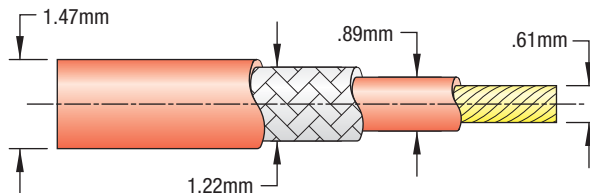
KAP3

PART NUMBER

680502

AWG	30
Resistance	375.8Ω/Km
Voltage	600V RMS 2kV DC
Current	1.5 Amps
Nom. Capacitance	180 pf/m
Quantity per roll	30-ft (10m)

Coaxial, Seven Strand



- Seven strands, each .20mm dia
- Conductor Cross-Section .220 sq mm

REFERENCE

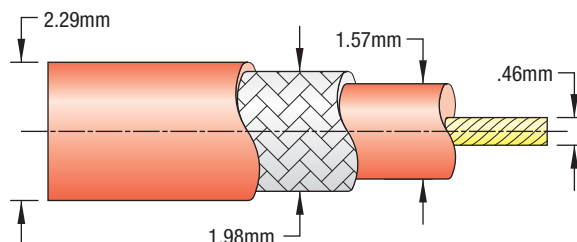
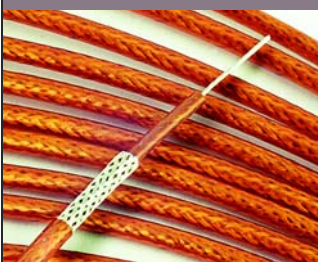
KAP4

PART NUMBER

680503

AWG	24
Resistance	87.2Ω/Km
Voltage	600V RMS 2kV DC
Current	4.5 Amps
Nom. Capacitance	300 pf/m
Quantity per roll	30-ft (10m)

Coaxial, Seven Strand



- Seven strands, each .15mm dia
- Conductor Cross-Section .120 sq mm

REFERENCE

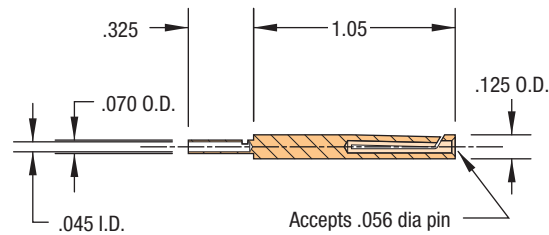
KAP5

PART NUMBER

680505

AWG	26
Impedance	50Ω
Resistance	155.0Ω/Km
Voltage	600V RMS 2kV DC
Current	2.5 Amps
Nom. Capacitance	95 pf/m
Quantity per roll	15-ft (5m)

Crimp Type



REFERENCE

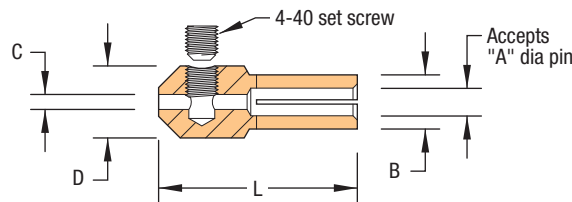
TC-CRIMP

PART
NUMBER

991538

Crimp connectors accept a .056" diameter pin. They are constructed of Nickel-200 material and are capable of withstanding a maximum temperature of 200°C in vacuum and 150°C in air. They are offered in packages of 5.

Push On



Reference	A	B	C	D	L	Amps	Qty
POEC-050	.050	.145	.052	.25	.69	15	10
POEC-060	.060	.187	.052	.25	.69	15	10
POEC-094	.094	.187	.052	.25	.69	25	10
POEC-250	.250	.450	.096	.50	1.00	30	2

REFERENCE

POEC-050
POEC-060
POEC-094
POEC-250

PART
NUMBER

991539

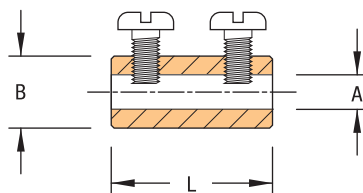
680361

991539-01

680360

Push On connectors are constructed of Beryllium-Copper material and gold-plated. Capable of maximum temperatures of 200°C in vacuum and 150°C in air. Each connector includes one stainless steel set screw. One wrench included per kit.

Inline Electrical



Reference	A	B	L	Amps	Qty
ILEC-059	.059	.187	.500	15	10
ILEC-120	.120	.250	.560	25	10
ILEC-260	.260	.500	1.00	35	10

REFERENCE

ILEC-059
ILEC-120
ILEC-260

PART
NUMBER

680370

680371

991540

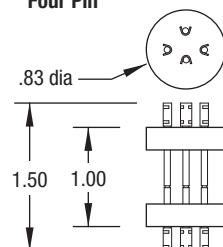
Constructed of Beryllium-Copper material and gold-plated. Capable of maximum temperatures of 400°C in vacuum and 150°C in air. Packages of 10 connectors include two 6-32 stainless steel screws for each connector.

Multipin



EAG-4

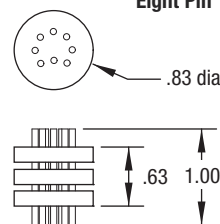
Four Pin



- 5 Amp rating
- Solder connection

EAG-8

Eight Pin



- 10 Amp rating
- Crimp connection

REFERENCE

EAG-4
EAG-8

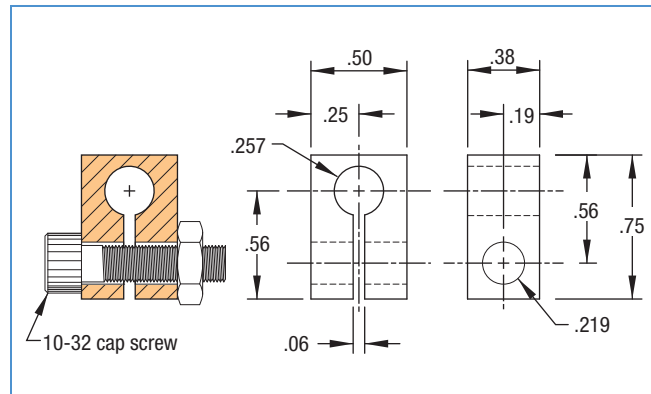
PART
NUMBER

680350

680351

EAG connectors are for in-vacuum use with instrumentation feedthroughs. Includes Pyrex® 7740 body with gold-plated pins. All materials are UHV compatible for use at 10⁻¹¹ Torr and bakeable to 250°C. Quantity of 1.

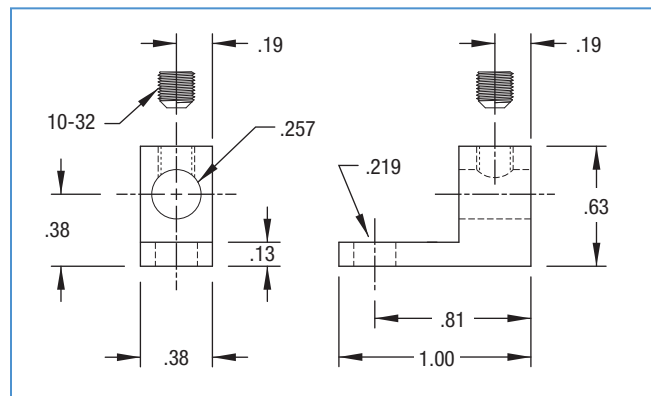
Inline Clamp



REFERENCE	PART NUMBER
ILPC	991536

Inline Power Clamps are made of OFE Copper material. Each clamp includes one 10-32 x 7/8" long stainless steel HD cap screw and nut. Sold individually.

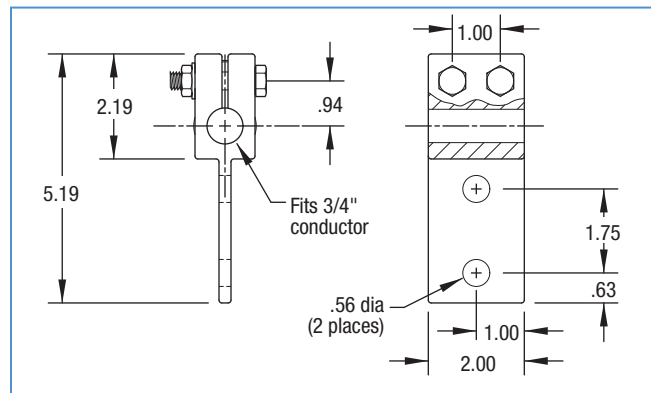
Angle Clamp



REFERENCE	PART NUMBER
RAPC	991537

Right Angle Power Clamps are made of OFE Copper material. Each clamp includes one 10-32 stainless steel socket head screw. Sold individually.

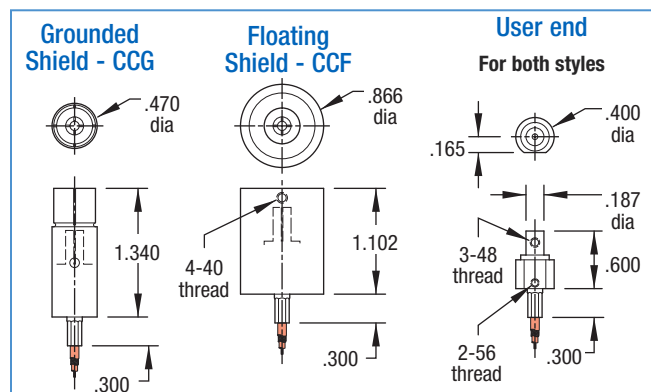
Connector



REFERENCE	PART NUMBER
HCC-750	640070

Connectors for high current power feedthroughs are made of silver plated OFE copper material. Each clamp includes two .375-16 stainless steel hex head bolts and nuts. Fits 3/4" conductor rod. See page 335 for additional information. Sold individually.

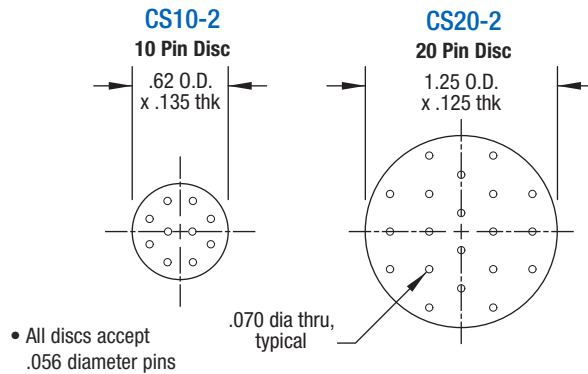
BNC Coaxial Cable



REFERENCE	PART NUMBER
CCG-094-19	640080
CCG-094-39	640081
CCF-094-19	640082
CCF-094-39	640083

BeCu contacts inside 304ss shell. Accepts .094 pins. Prewired with KAP5 coaxial wire. User end can be grounded using 2-56 thread; contact accepts up to 50 mil wire. Reference choice of 19" or 39" nominal length.

Ceramic Spacers

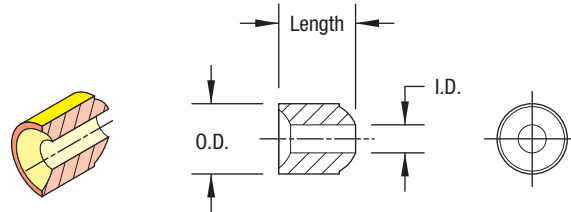


REFERENCE	PART NUMBER
CS10-2	680620
CS20-2	680621

MDC Ceramic Spacers are fabricated using high purity alumina, 95% Al₂O₃. They are used for spacing bare wires in air or vacuum systems from 10- or 20-pin instrumentation feedthroughs. The spacers can be baked to 450°C.

Price is per individual spacer.

Ceramic Beads



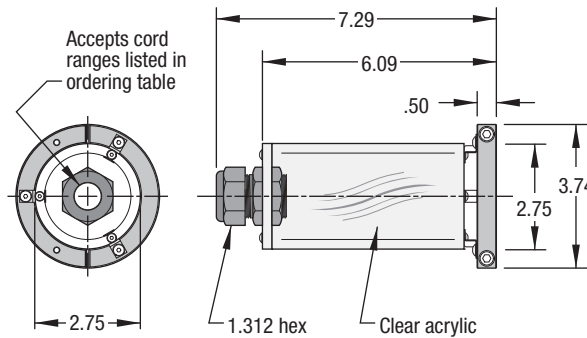
MDC Ceramic Beads are fabricated using high purity alumina, 95% Al₂O₃. They are ideal for insulating bare wires in air or vacuum systems. The short cylindrical tubes, with one end concave and the other convex, are stacked to provide continuous insulation. The beads can be baked to 450°C.

Price is per linear foot of beads.

DESCRIPTION	ACCEPTS WIRE DIA.	BEADS PER FOOT	BEAD LENGTH	BEAD O.D.	BEAD I.D.	WT LB
1-FOOT LENGTH	.045	125	.110	.100	.053	1
1-FOOT LENGTH	.050	85	.170	.156	.068	1
1-FOOT LENGTH	.064	73	.185	.183	.087	1
1-FOOT LENGTH	.102	56	.260	.239	.107	1
1-FOOT LENGTH	.128	53	.260	.240	.144	1
1-FOOT LENGTH	.128	38	.400	.366	.146	1

REFERENCE	PART NUMBER
CB-1	680600
CB-2	680601
CB-3	680602
CB-4	680603
CB-5	680604
CB-6	680605

High Voltage Shields



HVE Series Electrical Shields comply with most electrical safety codes. The shields fit over the outside diameter of 2-3/4" Del-Seal™ CF style flanges and are secured by tightening two bolts in the shield's split clamp-ring. A small air gap is provided between the acrylic shield and split clamp-ring to dissipate heat. Shields can be installed on existing equipment without breaking vacuum. Sold individually.

FLANGE SIZE	FLANGE O.D.	CORD RANGE	WT LB
2-3/4	2.73	0.15 - 0.32	2
2-3/4	2.73	0.23 - 0.47	2
2-3/4	2.73	0.35 - 0.63	2
2-3/4	2.73	0.51 - 0.71	2

REFERENCE	PART NUMBER
HVE-1	640050
HVE-2	640051
HVE-3	640052
HVE-4	640053



Fluid feedthroughs for water and liquid nitrogen service

Features

- UHV compatible
- Del-Seal™ CF mounts
- Kwik-Flange™ ISO KF mounts
- 1" Baseplate bolt mount
- Water service
- Liquid nitrogen service
- Swagelok® and VCR® fittings

MDC fluid feedthroughs are designed for the transmission of gasses or coolants into high and ultrahigh vacuum environments. They are constructed from 300 series stainless steel and available with single or dual tube configurations. All feedthrough versions are fitted with 1/4 inch tubes and terminated with industry standard tube fittings including Swagelok® and VCR® brand tube fittings.

VCR® Tube fittings are designed for rapid make-up in tube, pipe and welded systems. They are zero clearance fittings, ideal for installation in limited space. Sealing is accomplished with the compression of a removable copper metal gasket. This type of fitting is ideally suited for gas admission into UHV systems.

Swagelok® compression fittings are an economical alternative to the VCR® fitting. They do not require gaskets and seal by swaging the stainless steel tube to which they are mated.

The MDC fluid feedthrough product line is divided into two main categories, general service and cryogenic service. General service fluid feedthroughs are .035 inch single wall tube construction and designed for the transmission of water as a cooling medium. Watercooled fluid feedthroughs are an economical and reliable method of introducing water into a vacuum system. They are available with either style of tube fitting as described above. Cryogenic service fluid feedthroughs are designed for transmission of liquid nitrogen as the cooling medium. Because of the extreme thermal gradients encountered with liquid nitrogen, these feedthroughs are constructed with dual and coaxial tube geometries. The coaxial cavity between these tubes is on the vacuum side of the feedthrough assembly

and provides a thermal barrier that reduces condensation and ice buildup on the atmosphere side of the assembly. Ice buildup at the mounting flange interface would be detrimental to flange mount seal integrity especially in the case of elastomer seal types.

Three vacuum mount styles are available for all versions of fluid feedthroughs including Del-Seal™ CF metal seal flanges, Kwik-Flange™ ISO KF elastomer gasket seal flanges and 1" bolt baseplate mounts with elastomer gasket seals.

Del-Seal™ CF metal seal flanges employ a Conflat® compatible knife-edge sealing mechanism that produces a cold-flow deformation of a metal copper gasket. They are ideally suited for use in ultrahigh vacuum environments to 1×10^{-13} Torr and 450°C bakeout.

Kwik-Flange™ ISO KF flanges are ideal for vacuum environments requiring frequent assembly and disassembly. Fastening and sealing is achieved by a hinged radial clamp, which provides compression of an elastomer gasket. Kwik-Flange™ mounts comply with all ISO specifications for vacuum mount hardware. This style of mount is suitable for high vacuum service to 1×10^{-8} Torr and 150°C bakeout.

The baseplate bolt mount is a self contained vacuum mount that includes everything necessary for installation and sealing. The only requirement is that the chamber or baseplate wall must have a 1 inch clearance bore with a flat and smooth 1-3/4 inch diameter spot face for elastomer sealing. For a more detailed discussion of these specific vacuum mounts consult page 161 in the Flanges & Fittings section.



Swagelok® compression tube fittings page 358



VCR® metal gasket tube fittings page 360



Features

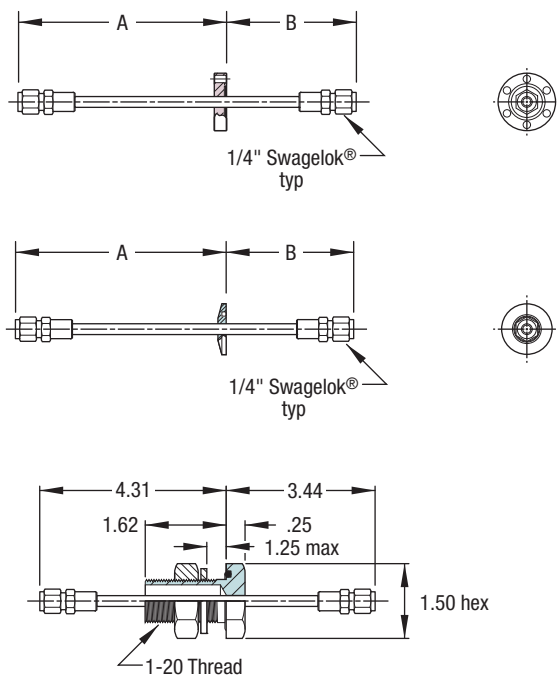
- Use with non-cryogenic fluids and gases
- Three mounting styles
- Custom configurations available
- Units with VCR® fittings on page 360
- Stainless steel construction

Specifications

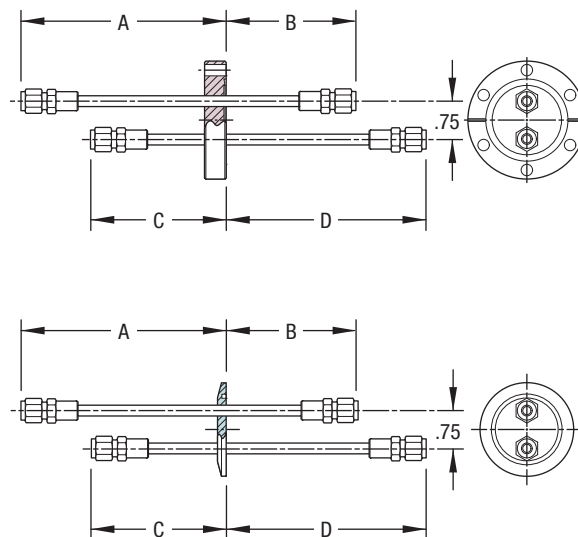
Application	Used for water or other non-cryogenic liquids.
Configuration	1/4" Swagelok® connectors, unshrouded
Material	
Flanges and tubes	304ss
Connectors	316ss
Vacuum Range	UHV: 1×10^{-13} Torr HV: 1×10^{-8} Torr
Temperature Range	UHV: 450°C maximum HV: 200°C maximum, intermittent, 150°C maximum, sustained
Weight and Dimensions	See table

ULTRAHIGH & HIGH VACUUM SERIES

Single tube



Dual tube



- Length dimensions taken from sealing surface of flange
- All tubes .250 O.D. x .035 wall

Fluid Feedthroughs

General Purpose with Swagelok®

Section 6.2

Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	NO. OF TUBES	A	B	C	D	WT LB	REFERENCE	PART NUMBER
1-1/3	1.062	1	4.75	3.00	-	-	3/4	LF-133	610000
2-3/4	2.312	1	4.75	3.00	-	-	3/4	LF-275	610001
2-3/4	2.312	2	4.75	3.00	3.12	4.63	1	LF-275-2	610002

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	NO. OF TUBES	A	B	C	D	WT LB	REFERENCE	PART NUMBER
K075	NW16	1	4.75	3.00	-	-	3/4	K075-LF	610020
K100	NW25	1	4.75	3.00	-	-	3/4	K100-LF	610021
K150	NW40	1	4.75	3.00	-	-	1	K150-LF	610022
K150	NW40	2	4.75	3.00	3.12	4.63	1	K150-LF-2	610024
K200	NW50	1	4.75	3.00	-	-	1	K200-LF	610023
K200	NW50	2	4.75	3.00	3.12	4.63	1	K200-LF-2	610025

Baseplate



BASEPLATE SIZE	NO. OF TUBES	WT LB	REFERENCE	PART NUMBER
1-INCH I.D.	1	SEE DRAWING FOR DIMENSIONS	LF-BP	610041



Features

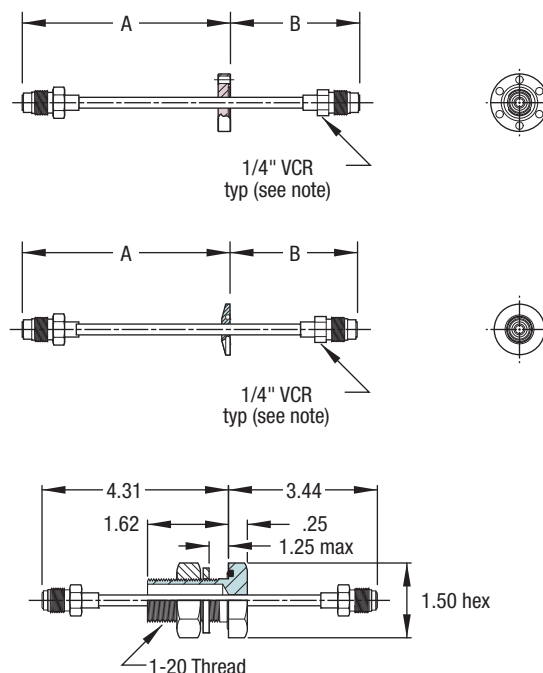
- Use with non-cryogenic fluids and gases
- Three mounting styles
- Custom configurations available
- Units with Swagelok® fittings on page 358
- Stainless steel construction

Specifications

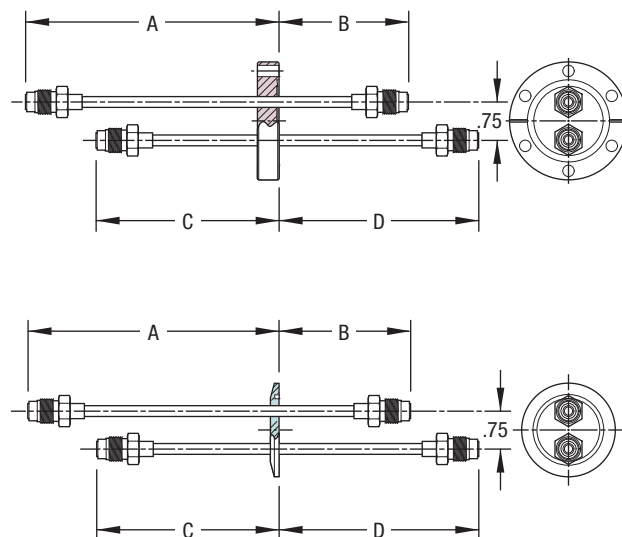
Application	Used for water or other non-cryogenic liquids.
Configuration	1/4" VCR® connectors, unshrouded
Material	
Flanges and tubes	304ss
Connectors	316ss
Vacuum Range	UHV: 1×10^{-13} Torr HV: 1×10^{-8} Torr
Temperature Range	UHV: 450°C maximum HV: 200°C maximum, intermittent, 150°C maximum, sustained
Weight and Dimensions	See table

ULTRAHIGH & HIGH VACUUM SERIES

Single tube



Dual tube



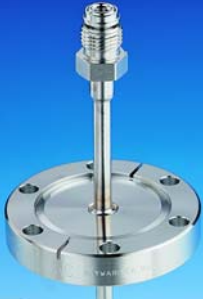
- Length dimensions taken from sealing surface of flange
- All tubes .250 O.D. x .035 wall
- Smallest sizes: 5/8" hex nuts modified to 1/2" flats, vacuum side only

Fluid Feedthroughs

General Purpose with VCR®

Section 6.2

Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	NO. OF TUBES	A	B	C	D	WT LB	REFERENCE	PART NUMBER
1-1/3	1.062	1	4.75	3.00	-	-	3/4	LF-133VCR	610003
2-3/4	2.312	1	4.75	3.00	-	-	3/4	LF-275VCR	610004
2-3/4	2.312	2	4.75	3.00	3.12	4.63	1	LF-275-2VCR	610005

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	NO. OF TUBES	A	B	C	D	WT LB	REFERENCE	PART NUMBER
K075	NW16	1	4.75	3.00	-	-	3/4	K075-LFVCR	610026
K100	NW25	1	4.75	3.00	-	-	3/4	K100-LFVCR	610027
K150	NW40	1	4.75	3.00	-	-	1	K150-LFVCR	610028
K150	NW40	2	4.75	3.00	3.12	4.63	1	K150-LF-2VCR	610029
K200	NW50	1	4.75	3.00	-	-	1	K200-LFVCR	610030
K200	NW50	2	4.75	3.00	3.12	4.63	1	K200-LF-2VCR	610031

Baseplate



BASEPLATE SIZE	NO. OF TUBES	WT LB	REFERENCE	PART NUMBER
1-INCH I.D.	1	SEE DRAWING FOR DIMENSIONS	LF-VCR-BP	610042



Features

- Use with cryogenic fluids
- Three mounting styles
- Custom configurations available
- Units with VCR® fittings on page 364
- Stainless steel construction

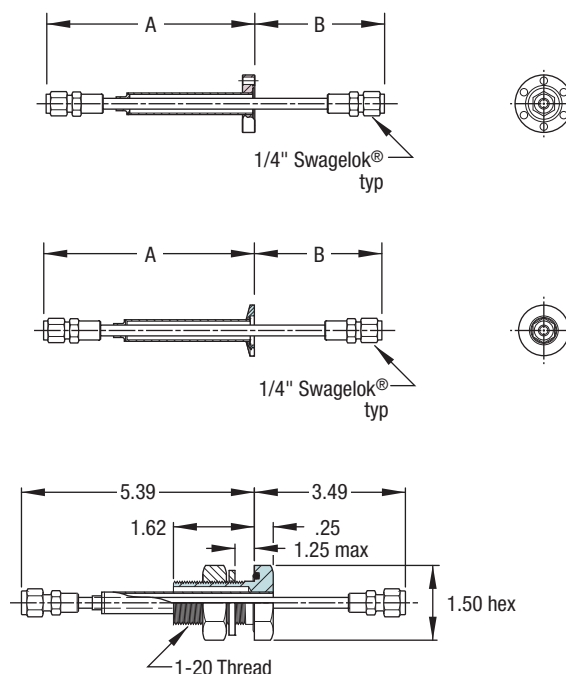
Specifications

Application	Liquid nitrogen or other cryogenic liquids
Configuration	1/4" Swagelok® connectors, shrouded
Material	
Flanges and tubes	304ss
Connectors	316ss
Vacuum Range	UHV: 1×10^{-13} Torr HV: 1×10^{-8} Torr
Temperature Range	UHV: -200°C to 450°C maximum HV: -20°C to 200°C maximum, intermittent ¹ 150°C maximum, sustained
Weight and Dimensions	See table

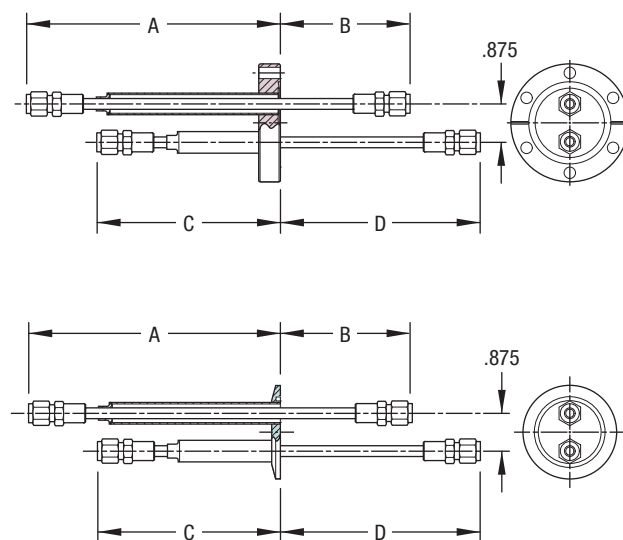
¹ With FKM / FPM fluoroelastomer seal; refer to Section 1.2 for temperature specifications for other elastomers.

ULTRAHIGH & HIGH VACUUM SERIES

Single tube

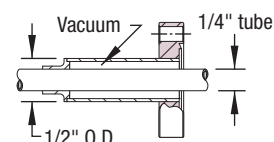


Dual tube



Shroud detail

- Length dimensions taken from sealing surface of flange
- All tubes .250 O.D. x .035 wall



Fluid Feedthroughs

Liquid Nitrogen with Swagelok®

Section 6.2

Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	NO. OF TUBES	A	B	C	D	WT LB	REFERENCE	PART NUMBER
1-1/3	1.062	1	5.88	3.00	-	-	3/4	LN-133	611000
2-3/4	2.312	1	5.88	3.00	-	-	3/4	LN-275	611001
2-3/4	2.312	2	5.88	3.00	4.25	4.63	1	LN-275-2	611002

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	NO. OF TUBES	A	B	C	D	WT LB	REFERENCE	PART NUMBER
K075	NW16	1	5.93	2.95	-	-	3/4	K075-LN	611020
K100	NW25	1	5.83	3.05	-	-	3/4	K100-LN	611021
K150	NW40	1	5.83	3.05	-	-	1	K150-LN	611022
K150	NW40	2	5.83	3.05	4.20	4.68	1	K150-LN-2	611024
K200	NW50	1	5.83	3.05	-	-	1	K200-LN	611023
K200	NW50	2	5.83	3.05	4.20	4.68	1	K200-LN-2	611025

Baseplate



BASEPLATE SIZE	NO. OF TUBES	WT LB	REFERENCE	PART NUMBER
1-INCH I.D.	1	SEE DRAWING FOR DIMENSIONS	LN-BP	611041



Features

- Use with cryogenic fluids
- Three mounting styles
- Custom configurations available
- Units with Swagelok® fittings on page 362
- Stainless steel construction

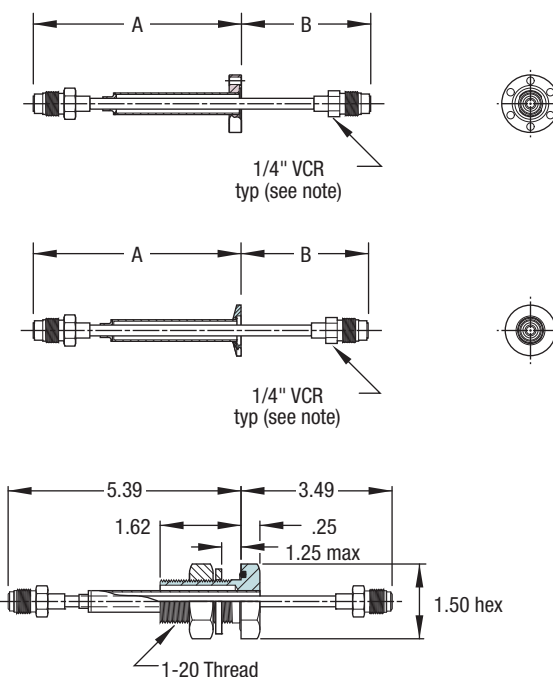
Specifications

Application	Liquid nitrogen or other cryogenic liquids
Configuration	1/4" VCR® connectors, unshrouded
Material	
Flanges and tubes	304ss
Connectors	316ss
Vacuum Range	UHV: 1×10^{-13} Torr HV: 1×10^{-8} Torr
Temperature Range	UHV: -200°C to 450°C maximum HV: -20°C to 200°C maximum, intermittent ¹ 150°C maximum, sustained
Weight and Dimensions	See table

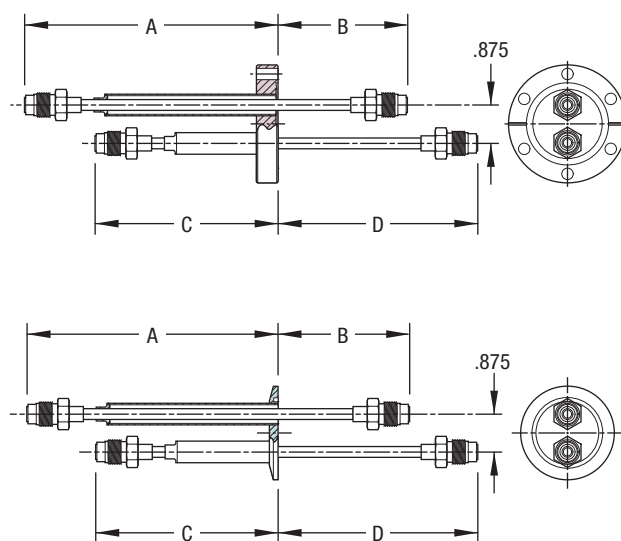
¹ With FKM / FPM fluoroelastomer seal; refer to Section 1.2 for temperature specifications for other elastomers.

ULTRAHIGH & HIGH VACUUM SERIES

Single tube

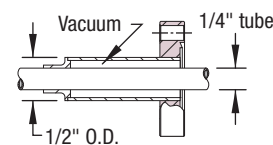


Dual tube



Shroud detail

- Length dimensions taken from sealing surface of flange
- All tubes .250 O.D. x .035 wall
- Smallest sizes: 5/8" hex nuts modified to 1/2" flats, vacuum side only



Fluid Feedthroughs

Liquid Nitrogen with VCR®

Section 6.2

Del-Seal™ CF



FLANGE SIZE	BOLT CIRCLE	NO. OF TUBES	A	B	C	D	WT LB	REFERENCE	PART NUMBER
1-1/3	1.062	1	5.88	3.00	-	-	3/4	LN-133VCR	611003
2-3/4	2.312	1	5.88	3.00	-	-	3/4	LN-275VCR	611004
2-3/4	2.312	2	5.88	3.00	4.25	4.63	1	LN-275-2VCR	611005

Kwik-Flange™ KF



FLANGE SIZE	ISO REF.	NO. OF TUBES	A	B	C	D	WT LB	REFERENCE	PART NUMBER
K075	NW16	1	5.93	2.95	-	-	3/4	K075-LNVCR	611026
K100	NW25	1	5.83	3.05	-	-	3/4	K100-LNVCR	611027
K150	NW40	1	5.83	3.05	-	-	1	K150-LNVCR	611028
K150	NW40	2	5.83	3.05	4.20	4.68	1	K150-LN-2VCR	611029
K200	NW50	1	5.83	3.05	-	-	1	K200-LNVCR	611030
K200	NW50	2	5.83	3.05	4.20	4.68	1	K200-LN-2VCR	611031

Baseplate



BASEPLATE SIZE	NO. OF TUBES	WT LB	REFERENCE	PART NUMBER
1-INCH I.D.	1	SEE DRAWING FOR DIMENSIONS	LN-VCR-BP	611042

7

Motion & Manipulation



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Triple axis micrometer driven XYZ stage page 426

- Vacuum environments
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- Product line
- Port mount flanges
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Vacuum Environments

Vacuum environments are an essential element in the analysis, development and fabrication of some of the world's most basic and sophisticated products. From complex experiments in particle physics and delicate x-ray tomography of the human body to the mass production of decorative coatings on automobile grills and exacting anti-reflective coatings on precision optical elements, vacuum environments are crucial. These and many other processes and products would be impossible to reproduce in an atmospheric environment. Near perfect vacuum environments can be attained in laboratory and production vacuum systems by careful selection of the vacuum components used in its design, construction and operation, keeping in mind that the system's ultimate vacuum level will be limited by its weakest component.

Motion Technology

Precise motion and manipulation of samples in an atmospheric environment can be a challenging endeavor. The complexity of the task is greatly increased if the samples are isolated from atmosphere inside a vacuum chamber while trying to effect precise manipulation on them through the chamber wall, without compromising vacuum integrity. This section represents MDC's ongoing efforts in the development and production of practical and dependable air to vacuum sample motion and manipulation solutions for the scientific and industrial vacuum community. It provides scientists, vacuum technologists and engineers with the most comprehensive line of high and ultrahigh vacuum motion and manipulation instruments available from one source. This section is divided into three basic sections

including motion, manipulation and motorization. MDC's motion and manipulation products are precision vacuum instruments manufactured to exacting tolerances in a production facility by skilled craftsmen, machinists and technicians using advanced robotic machining technology. All vacuum components produced by MDC are constructed of high grade vacuum compatible materials required for today's most demanding ultrahigh vacuum applications. At the heart of MDC motion and manipulation instrument design is the reliability and performance of edge welded stainless steel bellows. The use of edge welded stainless steel bellows has become a vacuum industry standard and an essential component in the construction of quality vacuum equipment. With the exception of a small number of direct drive products, all MDC motion and manipulation actuator seals are fitted with edge welded stainless steel bellows.

MDC rotary motion instruments allow the transmission of rotation through a chamber wall via a unique bellows sealed wobble shaft mechanism. Drive shaft bearing supports on both the air and vacuum sides of the drive shaft provide smooth rotary motion. Bearings on all MDC motion and manipulation instruments are coated with a Diconite® UHV compatible dry lubricant impinging on to the metal bearing surfaces. Linear motion is transmitted through a chamber wall using precision fine pitch lead screws coupled to bellows sealed, bearing supported shafts. MDC rotary and linear motion instruments are ideal for continuous or intermittent rotary and linear motion within a vacuum system. Sample motion is measured along laser etched scales on an actuator housing. MDC precision micrometers are offered on select

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to discolor when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.



Rotary, linear and multi-motion products page 376



Load-lock systems page 430

instruments. These micrometers employ a unique plus-minus scale which divides the overall travel of a device into positive or negative travel as measured from a central starting position. Products are offered in standard manual, pneumatic and motorized configurations.

Product Line

The motion section details basic rotary, linear and multi-motion devices. Rotary products are offered in standard, high temperature, pneumatic, miniature, precision, magnetic and direct drive configurations. Linear products offer most of the configurations listed in the rotary section with the addition of push-pull, rack and pinion and tunnel access drives. Multi-motion products offer both rotary and linear motion within the same instrument in standard, precision and direct drives. Also available in the multi-motion products are various wobble stick configurations.

The manipulation section details XYZ stages, load-lock systems, port aligners and in-vacuum accessories. Stages are available in various configurations including V-Plane® modular building block stages. Single and multiple axes stages are also available in compact, standard and heavy duty models. Stages are used for two and three dimensional sample manipulation inside UHV vacuum systems. Load-lock systems are available with circular or rectangular entry ports and come equipped with magnetically coupled sample transporters. Load-lock systems are sample staging chambers used to introduce samples into larger vacuum systems without breaking the larger system's vacuum. Port aligners are adjustable port flange interfaces designed to correct mate-up between components with

alignment imperfections. In-vacuum accessories are available for most motion and manipulation products found in this catalog. Cab-Fast® sample holders provide a quick, simple and flexible solution to most sample transfer applications. Mini-Scaffold™ mounting systems take advantage of existing vacuum ports for the permanent or temporary installation of in-vacuum support structures. Rotary and linear in-vacuum accessories are components designed to expand the capabilities of motion products presented in this catalog.

The motorization section includes AC, DC analog, DC stepper motors and the necessary controls required to optimize their operation. Motor specifications for all product motorization options are detailed in this section. Motor specifications are listed as support information for the products specifying their use. In-vacuum stepper motors for both high and ultrahigh vacuum applications are also offered.

Port Mount Flanges

Motion and manipulation product mount styles include two industry standard flange formats. Kwik-Flange™ ISO KF flanges are ideal for 1×10^{-8} Torr high vacuum systems requiring frequent assembly and disassembly. Fastening and sealing is achieved by a single hinged radial clamp, which provides compression of an elastomer gasket. Kwik-Flange™ flanges comply with all ISO specifications for vacuum hardware. Select products are offered with Del-Base™ 1" baseplate, elastomer seal mounts which are also suitable for high vacuum service.

Ultrahigh vacuum products are supplied with Del-Seal™ CF Conflat® compatible metal seal flanges. A knife-edge sealing mechanism

produces a seal through cold-flow deformation of a metal copper gasket. Del-Seal™ CF flanges are suitable for 1×10^{-13} Torr UHV environments where high temperature bakeouts are a must. For a complete line of vacuum connection hardware refer to Section 1.

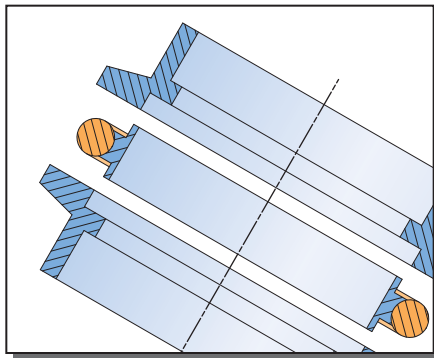
Custom Products

MDC's technical sales engineers can assist you with the modification of standard motion and manipulation products, as required by your special application; or we can produce components to specifications on your manual or electronic AutoCAD® DWG and DXF drawings. Developing and producing solutions to your vacuum needs is our business; we know that today's custom inquiries may become tomorrow's standard products. From the simplest of airtight seals to sophisticated motion and manipulation instruments, MDC provides a complete solution for vacuum science and industry.

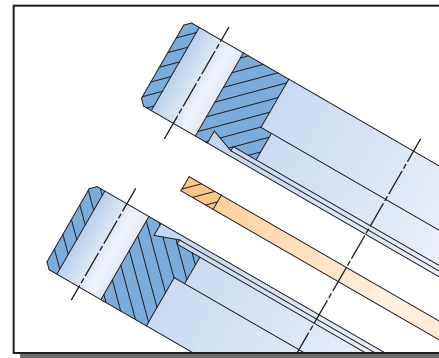


Motorization and controls

page 456



Kwik-Flange™ ISO KF elastomer seal flange system



Del-Seal™ CF metal seal flange system



MDC Precision micrometers measure along unique plus-minus laser etched scales.

Abbe Error

Linear off-axis error introduced through amplification of tilt and wobble with a long moment arm. This type of error occurs when the point under measurement is at a relatively long distance from the axis of motion.

Accuracy

The maximum expected difference between the actual and a desired position for a given input. Highly dependent on method of actual position measurement.

Accuracy, Absolute

The output of a system versus the commanded or ideal input.

Accuracy, On-Axis

The uncertainty of position after all sources of linear error are eliminated. Linear errors include: cosine error, leadscrew pitch error, abbe error and thermal expansion effects.

Backlash

The maximum magnitude of an input that produces no measurable output upon reversing direction. Typically the result of poor meshing between drivetrain components as with lead screw threads.

Display Resolution

The smallest motion detectable by a motion device's precision rule, micrometer or motor controls.

Eccentricity

Sometimes called concentricity, eccentricity in a rotary device is the deviation of the center of rotation from its mean position as the device turns.

Error

The difference between an obtained performance parameter and the ideal or desired result. Errors fall into two primary categories, on-axis and off-axis errors.

Friction

Friction is defined as the resistance to motion between surfaces in contact. Friction can be constant or it can vary with speed. Elements contributing to overall friction may be in the form of drag, sliding friction, system wear or lubricant viscosity.

Friction, Static

The friction that must be overcome to impart motion to a body at rest. Since static friction is higher than sliding friction, the force which must be applied to impart motion is greater than the force required to keep the body in motion. As a result, when a force is initially applied, the body will begin to move with a jump in some unpredictable and unrepeatable manner, producing non-linear, non-repeatable motion.

Gear Ratio, Drive Train

A motion instrument's drive train gear ratio is the relationship between received input motion and the delivered output motion. Ratios are expressed in the numerical notation $a:b$, where "a" represents the received motion or device input in revolutions or some other unit, and "b" represents the delivered or resulting output motion in revolutions for rotary devices or 1" of travel in linear motion instruments.

Hysteresis

The difference in the absolute position of an object for a given commanded input when approached from opposite directions. It is due to elastic forces accumulated in various drivetrain components, leadscrew wind-up, for instance. Often confused with backlash.

Load Capacity, Stage

The maximum centered load that can be placed directly on an XYZ motion stage and is typically limited by the load capacity of the bearings.

Load Capacity, Lateral or Moment

Also called side or bending load capacity, it is the maximum load that can be applied perpendicular to a shaft's axis of motion.

Load Capacity, Axial

The maximum centered and balanced compressive or tensile load that can be applied to a stage's or shaft's longitudinal or parallel axis of motion.

Minimum Incremental Motion

The smallest motion a device is capable of delivering reliably, not the smallest display resolution increment.

Play

Uncontrolled movement due to looseness of mechanical parts. Usually increases with the components age. Play is a contributor to backlash.

Position Stability

The ability to maintain a constant position over time. Variation from stable position is called drift. Contributors to drift include worn parts, migration of lubricant, and thermal variation.

Precision

Also known as repeatability, it is the range of deviations in output position that will occur for 95% of the motion excursions from the same error-free input. Accuracy and precision are not the same.

Repeatability

The ability of a motion instrument to reliably achieve a commanded position over many attempts regardless of the direction from which the position is approached.

Runout

The linear, not angular, portion of off-axis error. It is the deviation between ideal straight line motion and actual measured motion in a translation stage. Runout has two orthogonal components, straightness, a measure of in-plane deviation, and flatness, the out-of-plane deviation.

Sensitivity

The minimum input required to produce output motion or the ratio between output motion and input drive. Applicable particularly to manually actuated motion devices.

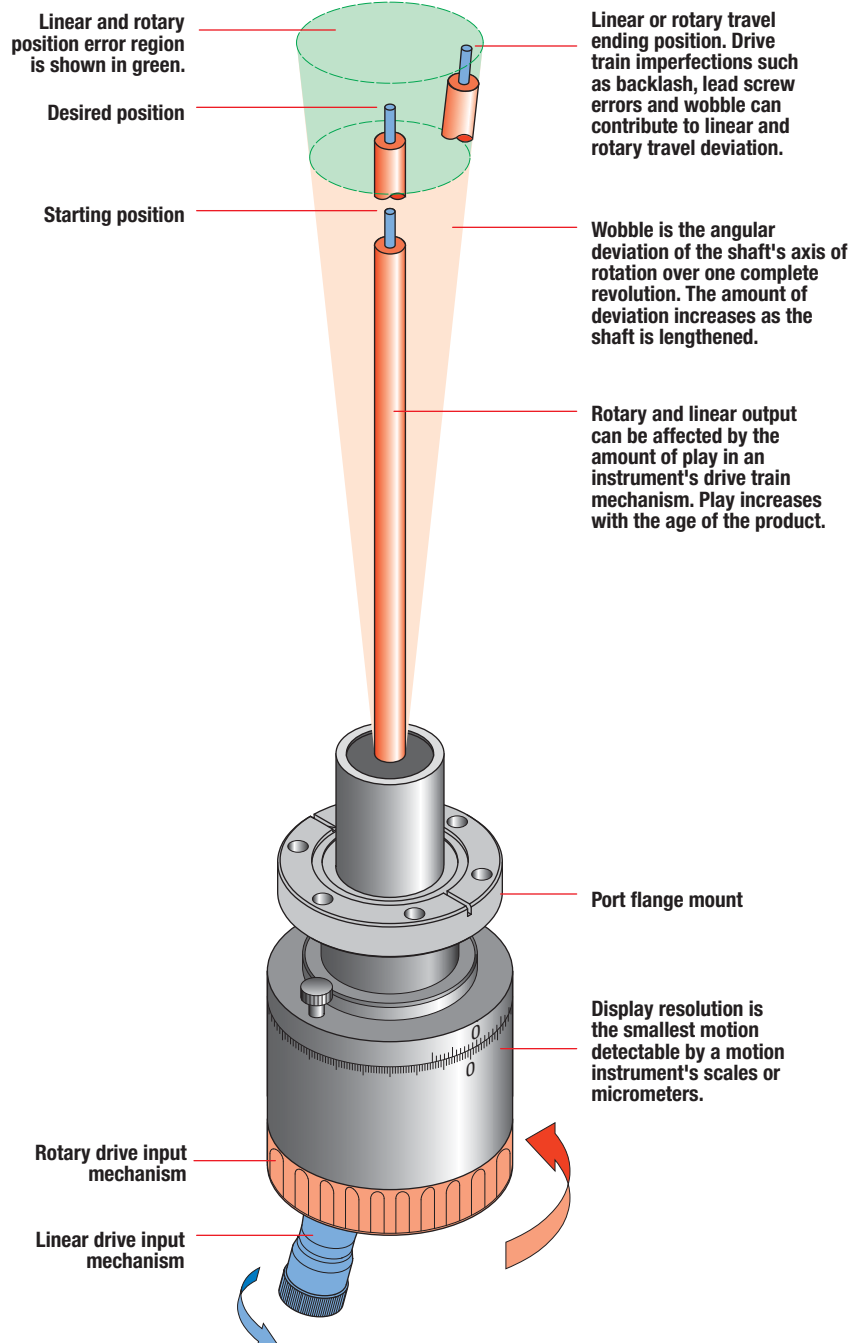
Tilt

The angular portion of off-axis error. It is the deviation between ideal straight line motion and actual measured motion in a translation stage. Tilt and wobble have three orthogonal components commonly referred to as roll, pitch, and yaw.

Wobble

Wobble is the angular deviation of the axis of rotation over one complete revolution.

Common Motion Deviations



This illustration is provided for reference only. Linear and rotary deviations have been exaggerated for illustration purposes.



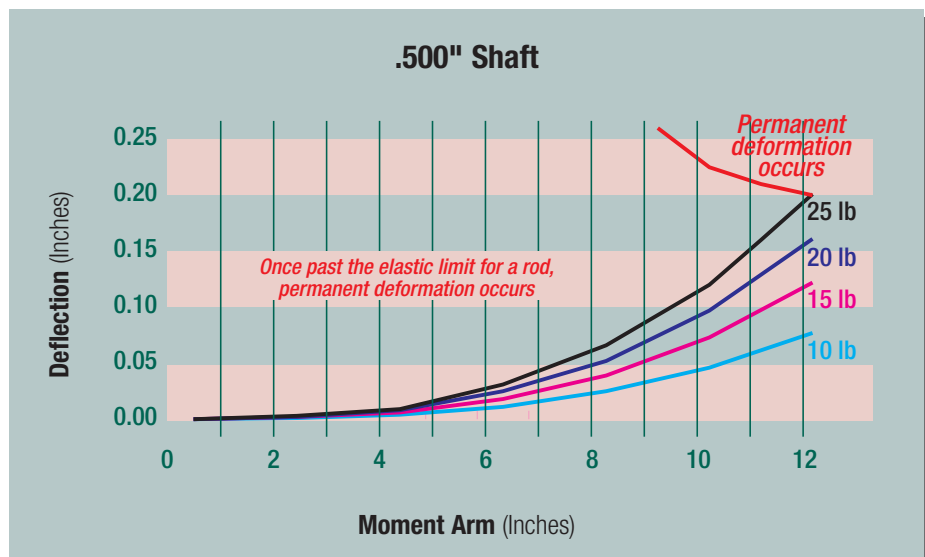
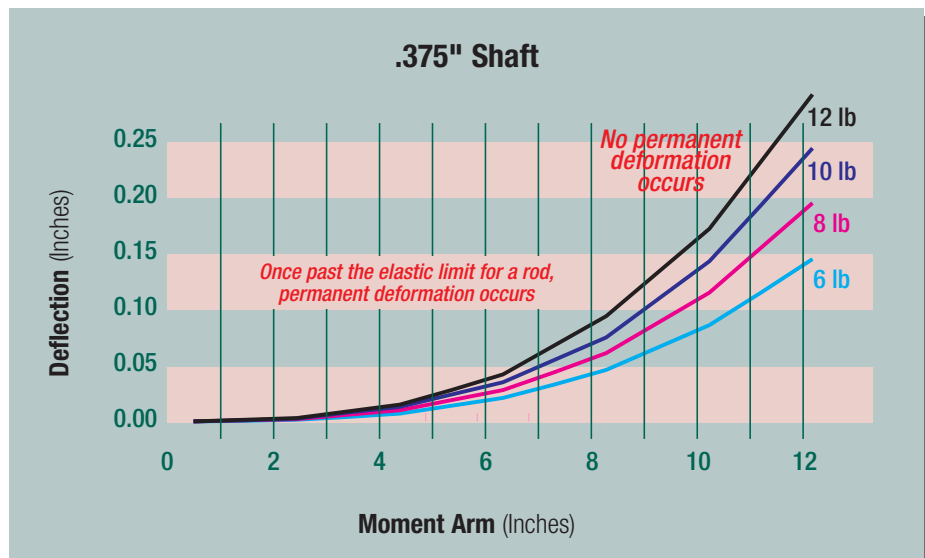
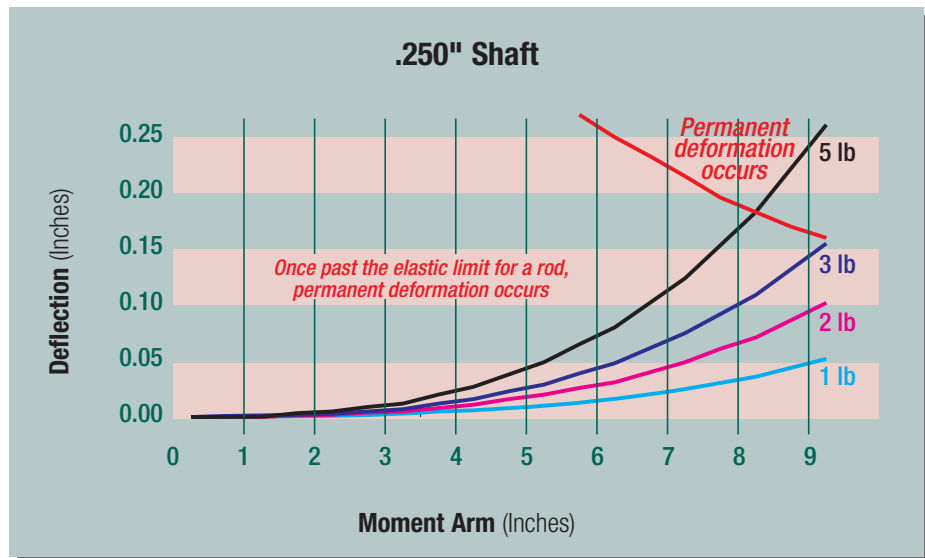
Shaft Deflection Graphs

These graphs represent the deflection caused by a lateral or moment load applied to solid cylindrical cross section rods.

For test purposes, 0.250" diameter rods in lengths of one to nine inches and 0.375" and 0.500" diameter rods in lengths of two to twelve inches were tested. Rods were mounted horizontally with one end fixed and supported while opposite ends were left free and unsupported. Rod end deflection measurements were made after applying each sample load to each unsupported rod length. Loads for the 0.250" diameter rods ranged from one to five pounds and five to twenty-five pounds for the 0.375" and 0.500" diameter rods. Rod material is 304 stainless steel, as used in the shaft construction of all MDC motion and manipulation instruments.

These graphs are for reference only and do not represent actual motion instrument shaft deflection. They are provided as visual aids for understanding the effects of lateral loading of any stainless steel rod.

Since shaft deflection may have a significant effect on the positioning of samples, careful consideration must be given to shaft loading and whether the shaft needs to be supported. MDC recommends that all shafts in excess of twelve inches must have additional linear or radial support.





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page 408

- Motion in vacuum
- Rotary motion
- Linear motion
- Multi-motion

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to dis-color when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.

Motion In Vacuum

MDC Precision motion products are vacuum compatible precision instruments ideal for demanding in-vacuum sample handling applications. The motion feedthrough product line presented in this section is divided into three basic categories including rotary, linear and multi-motion instruments. Each product category is comprised of one or more of the following drive configurations: standard, high-temperature, pneumatic, miniature, precision, magnetic and direct drive.

Motorization is available for most motion instruments featured throughout this catalog. High, medium and low torque, DC stepper motors as well as conventional AC motor options are available. Please note that motor controls are not included with motorization options and must be purchased separately. Detailed motor specifications as well as control electronics are offered in the motorization section beginning on page 455.

MDC Precision motion instruments detailed herein are available for either high or ultrahigh vacuum service. High vacuum products are mounted on ISO standard KF flanges. Better known in the industry as the MDC Kwik-Flange™, these versatile flanges provide quick-make and quick-break installation, making them ideal for vacuum systems requiring frequent assembly and disassembly. Sealing is achieved by compressing a FKM / FPM fluoroelastomer elastomer between two mating flanges fastened with a single, hinged aluminum clamp.

Ultrahigh vacuum devices are fitted with industry standard, Conflat® compatible, Del-Seal™ CF metal seal flanges. MDC Del-Seal™ CF flanges are designed with a standard knife-edge sealing geometry which produces a seal through cold-flow deformation of a copper gasket. Del-Seal™ CF flanges are typically used in UHV environments where high temperature bakeouts are a must. Bakeout temperatures greater than those specified may be achieved by disassembling and removing temperature sensitive components. Please reference feedthrough instruction manuals or contact MDC's technical staff for higher temperature ratings and detailed instructions on instrument disassembly and low temperature component removal. For maximum vacuum integrity, reliability and extended service life all motion device actuator seals incorporate edge welded stainless steel bellows.

Rotary Motion

Standard rotary motion feedthroughs are a practical and economical solution for rotary motion in most vacuum applications. Rotary motion position is measured along a 360° laser etched scale graduated in 5° increments. Welded stainless steel bellows with a unique off-axis wobble design, combined with rotary shaft bearing supports, provide rotary motion of unsurpassed reliability and performance. In contrast to standard rotary motion products, the high temperature standard rotary motion devices are constructed entirely of 304 stainless steel to endure the rigors of high temperature vacuum service.

Pneumatic drive rotary products are designed for in-vacuum shutters and other light-duty two-position motion applications. Pneumatic drive rotation is adjustable from 30° to 90°.

Miniature rotary motion feedthroughs are specifically designed for in-vacuum light-duty service where torques will not exceed 20 oz-in. Their small footprint makes them ideal for applications with severe space limitations.

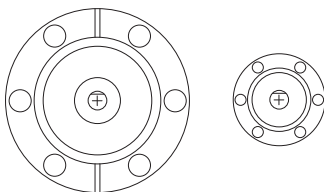
Precision rotary motion instruments are a step higher than standard rotary motion products. They offer greater precision with very low backlash and a display resolution of 0.1°.

Magnetically coupled rotary motion feedthroughs provide basic rotation and UHV compatibility without the use of bellows. This product is intended for light-duty service not exceeding 20 oz-in of torque. Direct drive rotary motion products provide basic rotation with HV compatibility. Vacuum integrity is maintained by a single preloaded FKM / FPM fluoroelastomer elastomer shaft seal. Fitted with dual rotary bearing shaft supports, this device can be manually or mechanically operated at intermittent speeds of up to 300 rpm. They are mounted on MDC Del-Base™ 1" baseplate mounts.

Differentially pumped direct drive rotary motion feedthroughs provide 100 lb-in maximum rotational torque and 500 rpm maximum rotation. The rotary shaft is supported by two radial bearings located inboard of dual FKM / FPM fluoroelastomer elastomer shaft seals. The region between the seals can be differentially pumped through a 1/8" female pipe thread port provided to attain UHV compatibility to 10⁻⁹ Torr.

Linear Motion

Standard linear motion feedthroughs are the perfect solution for most linear displacement vacuum applications. Linear position is measured along both radial and linear scales laser etched on actuator barrel and housing. Radial and linear scales are graduated in 0.001" and 0.025" increments respectively. One revolution of the barrel translates into 0.025" of linear travel. The housing's linear scale also includes graduation in 1mm increments for added convenience. Edge welded stainless steel bellows, a 40 pitch lead screw design and the use of linear bearing shaft support provide devices with excellent durability and performance. Unlike the standard motion products the high temperature linear motion feedthroughs are constructed entirely of 304 stainless steel to endure the rigors of high temperature vacuum service.



1-3/4" and 1-1/3" Del-Seal™
Shaft to flange orientation

Compact high temperature linear motion feedthroughs have a small footprint and are constructed with high temperature vacuum grade materials. Linear position is measured along a laser etched stainless steel barrel graduated in 20 equally spaced increments. A full revolution of the barrel translates into 1.25mm of linear travel. Formed stainless steel bellows, a 1.25mm fine pitch lead screw design and the use of radial bearings provide this product with excellent durability and performance. All drive mechanism components are located on the atmosphere side of the reentrant formed bellows.

Miniature linear motion feedthroughs are specifically designed for light-duty service. Full revolution of the barrel translates into 0.025" of linear travel.

Push-pull linear motion feedthroughs are the most basic of the manual motion devices offered in this catalog. They provide quick action linear motion via a stainless steel hand-held actuator shaft. They are typically operated by observing instrument motion through a vacuum viewport. For quick and easy positioning the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025". The actuator can be locked in position by tightening an integral lock knob located on the actuator housing.

Rack and pinion linear motion feedthroughs are very similar to push-pull devices, but provide finer control of linear motion. The 90° rack and pinion drive mechanism provides a quick-action drive with greater control than push-pull devices. For quick and easy positioning the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025". A 1-1/4 turn on the handle generates 1 inch of linear travel. The actuator can be locked in position by tightening an integral lock knob located on the actuator housing.

Pneumatic linear motion feedthroughs provide two-position fast action linear motion. Typical motion applications would include on-off, open-close and in-out motions similar to those of in-vacuum shutters. Linear travel can be shortened or lengthened via an integral stroke adjustment knob. For quick and easy positioning the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025"

Heavy duty manual, pneumatic and push pull linear motion feedthroughs allow linear

displacement of heavier samples and components. With the exception of the precision micrometer fitted unit, these devices do not provide position indication. Position of samples or components being moved must be verified visually. Unlike conventional motion feedthroughs, heavy duty models employ reentrant welded bellows construction.

Multi-Motion

Multi-motion feedthroughs are instruments with more than one degree of freedom. This product category includes combinations of linear, rotary and wobble motion.

Rotary-linear standard devices offer 360° of rotation and one inch of linear travel via two separate drive knob actuators. Both rotary and linear positions are measured along a laser etched actuator barrel and housing. The 360° rotary scale is graduated in 5° increments. The linear scale has both a linear and rotary scale component, the linear portion is graduated in 0.050" increments while the rotary portion is graduated in 0.001" increments. Full revolution of the linear scale produces 0.025" of travel.

Precision rotary-linear motion instruments are a step higher than the standard rotary-linear products. They offer greater precision with very low backlash, a rotary display resolution of 0.1°, and 0.500" of micrometer precision linear travel with 0.001" resolution.

Wobble stick multi-motion devices with linear, angular wobble, rotary and articulated pincer configurations are available in this product category. The most elaborate device provides 360° sample rotation, 4.50" of push-pull linear travel, 22° of angular tilt or wobble and a mechanical pincer jaw with 0.880" diameter sample capacity.



Rotary motion instruments

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Linear motion instruments

page 386



Multi-motion instruments

page 403



BRM-133

ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion
- Manual or Motorized actuator
- Rotary position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

MDC standard rotary motion feedthroughs are a popular and economical solution for in-vacuum sample or device rotation. They are constructed of the highest grade vacuum compatible materials. Position is measured along a 360° laser etched black-anodized barrel graduated in 5° increments. Welded stainless steel bellows, a unique off-axis wobble design and the use of rotary shaft bearing supports provide devices of unsurpassed reliability and performance. Feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ elastomer seal port mounts. Automation can be achieved with one of four motorization options and controls. Motor controls must be purchased separately. Motor control options, specifications and ordering information begin on page 464.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range UHV / HV	1x10 ⁻¹¹ Torr / 1x10 ⁻⁸ Torr
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Temperature Range ¹ UHV / HV	-20°C to 100°C
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Speed	20 rpm
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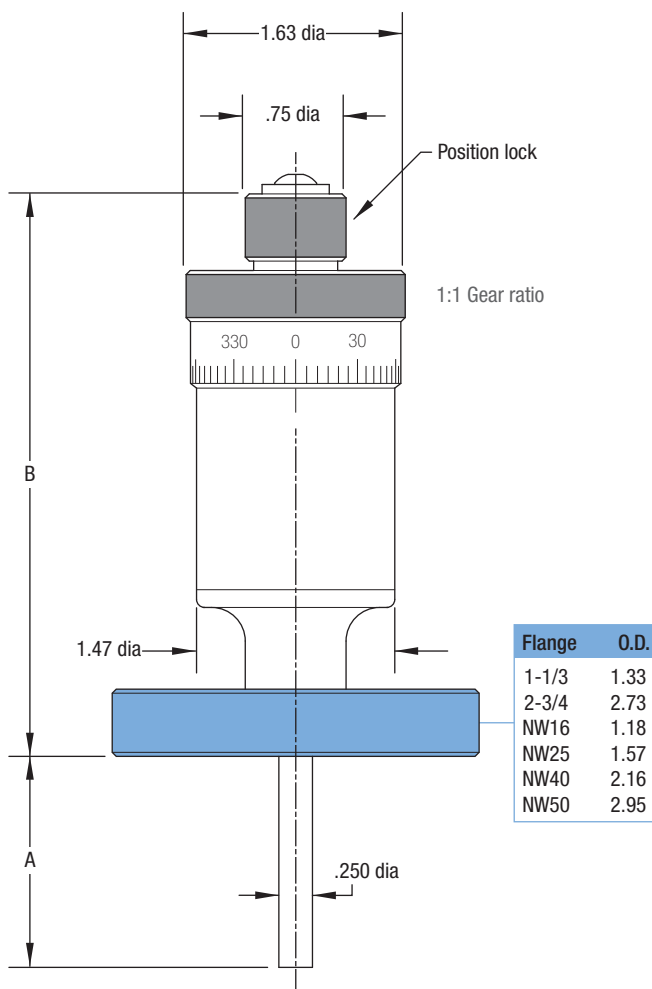
Torque	50 oz-in maximum
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Axial load	6 lb maximum
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Lateral load	10 lb maximum
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Weight & Dimensions	See table
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¹ UHV units are bakeable to 230°C with actuator removed and 30°C maximum when motorized



- Shown with 2-3/4" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 100°C

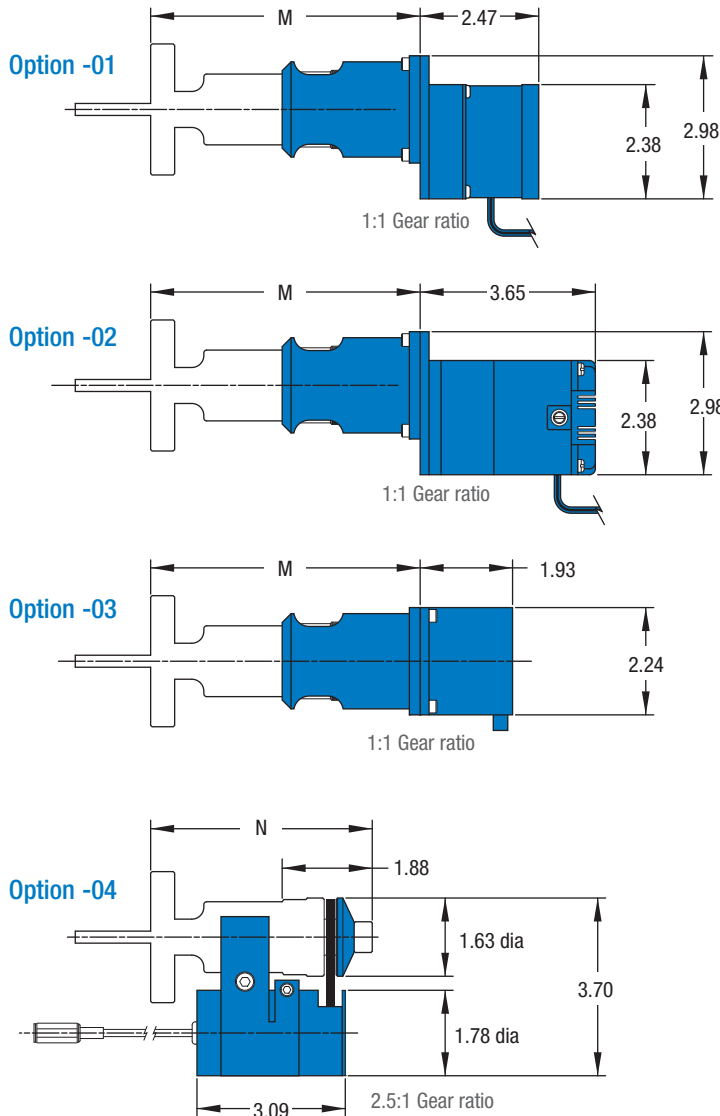
FLANGE SIZE	FLANGE O.D.	A	B	M	N	WT LB	REFERENCE	PART NUMBER
1-1/3	1.33	1.57	4.30	5.63	4.64	1	BRM-133	670000
2-3/4	2.73	1.57	4.30	5.63	4.64	2	BRM-275	670002

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

FLANGE SIZE	FLANGE O.D.	A	B	M	N	WT LB	REFERENCE	PART NUMBER
NW16	1.18	1.45	4.42	5.75	4.86	1	K075-BRM	670020
NW40	2.16	1.62	4.25	5.58	4.69	2	K150-BRM	670022

Motorization Options



OPTION -01
INLINE 115V AC MOTOR



OPTION -02
INLINE 90V DC MOTOR



OPTION -03
INLINE STEPPER MOTOR



OPTION -04
SIDE MOUNT 12V DC MOTOR



MOTORIZATION ²	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
INLINE AC	A	3	-01
INLINE DC	B	6	-02
INLINE STEPPER	D	2	-03
SIDE-MOUNT DC	C	2	-04

² When ordering motorized options, add the option number and price to the desired UHV or HV component part number listed above. For example: 670002-03. For total unit weight, add option weight to component weight. Motor specifications begin on page 458.



ULTRAHIGH VACUUM SERIES

Features

- Continuous rotary motion
- Manual actuator
- Rotary position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts
- Guide tube included on extended models

Description

MDC Precision high temperature rotary motion feedthroughs are the perfect solution for UHV sample rotation. They are constructed of 304ss to endure the rigors of high temperature vacuum service. Rotation can be measured along a 360° laser etched barrel graduated in 5° increments. Welded stainless steel bellows, a unique off-axis wobble design and the use of rotary shaft bearing supports provide a product of unsurpassed reliability and performance. Extended length models are constructed with bearing fitted shaft support guide tubes for maximum rigidity. Feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

Material

Flange / Actuator body 304ss

Shaft seal AM 350 welded bellows

Vacuum Range 1x10⁻¹¹ Torr

Temperature Range -20°C to 230°C

Torque 50 oz-in maximum

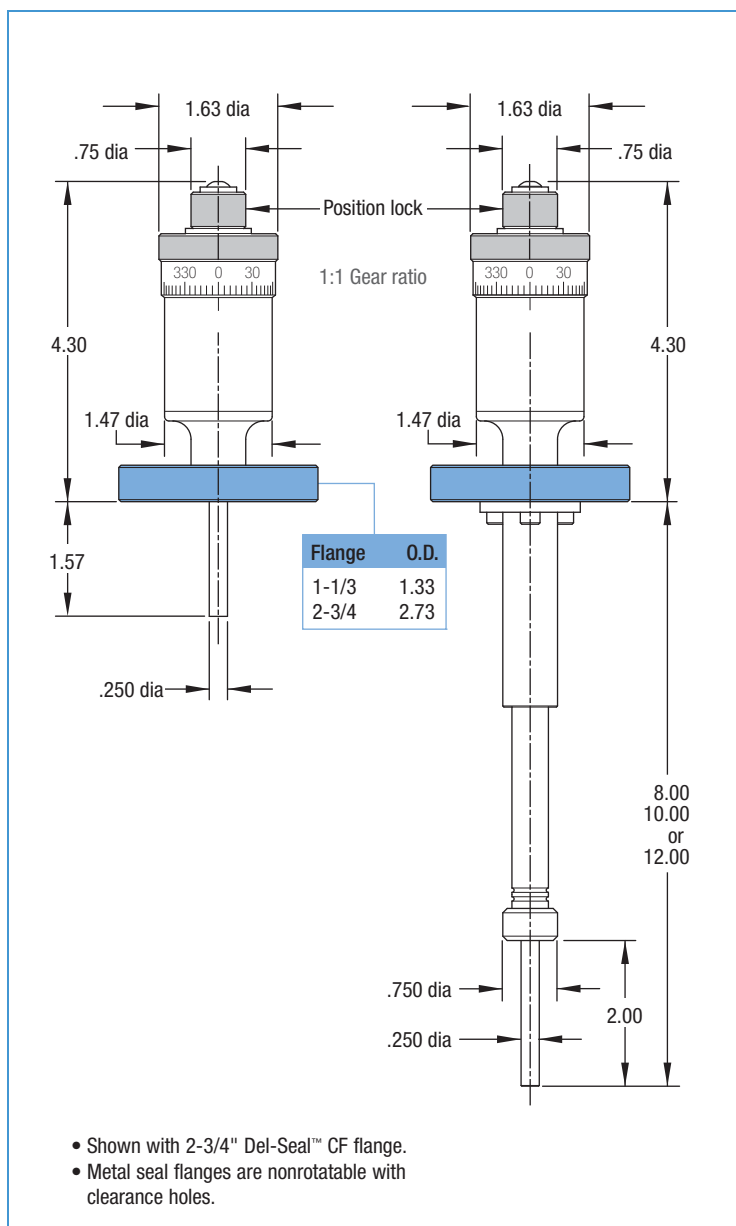
Axial load 6 lb maximum

Lateral load 10 lb maximum

Weight & Dimensions See table

SHAFT LENGTH	FLANGE	WT LB	REFERENCE	PART NUMBER
STANDARD				
1.57	1-1/3	1	HTBRM-133	670004
1.57	2-3/4	2	HTBRM-275	670005

EXTENDED				
8.00	2-3/4	8	HTBRM-275-8	670006
10.00	2-3/4	9	HTBRM-275-10	670007
12.00	2-3/4	10	HTBRM-275-12	670008





ULTRAHIGH & HIGH VACUUM SERIES

Features

- Adjustable 90° rotary motion
- Pneumatic actuator
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts
- Solenoid air pressure to 100 PSIG maximum

Description

MDC pneumatic rotary feedthroughs are designed for in-vacuum shutters and other light-duty two-position rotary motion applications. Feedthrough rotation has two adjustable stops. One adjusts the start position from 0° to 30°, and the other adjusts the finish position from 60° to 90°. One air control solenoid valve (120VAC 50/60Hz) is also included. Feedthroughs are available on Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ elastomer seal port mounts.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum AM
Shaft seal / Piston seal	350 welded bellows / FKM / FPM

Vacuum Range UHV / HV 1×10^{-11} Torr / 1×10^{-8} Torr

Temperature Range¹ UHV / HV -20°C to 100°C

Torque 50 oz-in maximum

Weight & Dimensions See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3 UHV	2	ABRM-133	670050
2-3/4 UHV	3	ABRM-275	670051

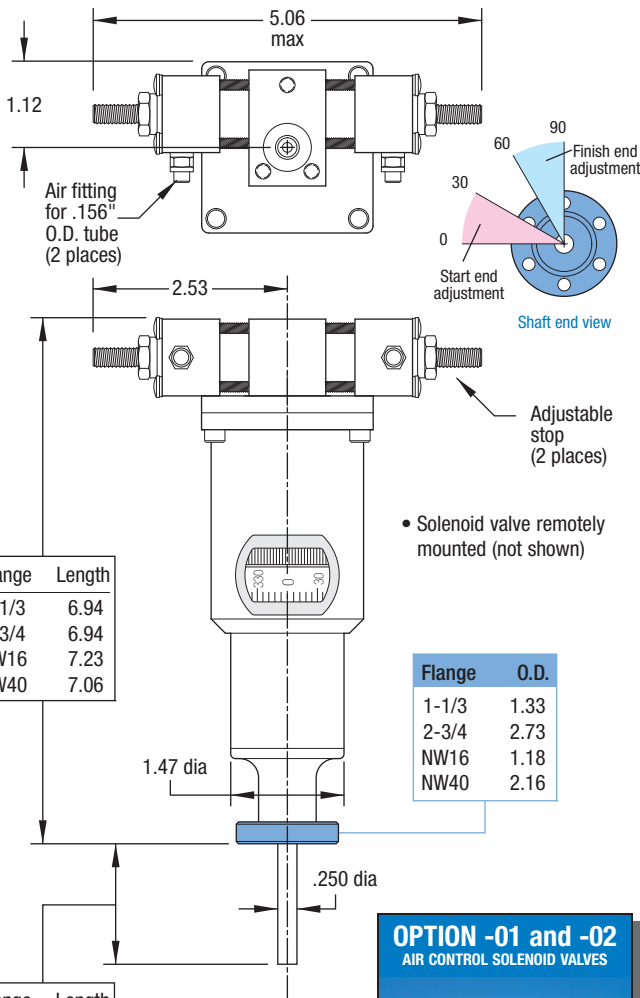
DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW16 HV	2	K075-ABRM	670052
NW40 HV	3	K150-ABRM	670053

DESCRIPTION ²	OPTION NUMBER
24V DC AIR CONTROL SOLENOID VALVE	-01
240V AC AIR CONTROL SOLENOID VALVE	-02

¹ UHV units are bakeable to 230°C with actuator removed.

² When ordering solenoid options, add the option number and price to the desired UHV or HV part number listed above. For example: 670050-02.

ABRM-133



• Solenoid valve remotely mounted (not shown)

- Shown with 1-1/3" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.





ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion
- Manual or Motorized actuator
- Rotary position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

MDC miniature rotary feedthroughs are specifically designed for in-vacuum light-duty applications where torques will not exceed 20 oz-in. Feedthroughs are available in both manual or low voltage DC motor configurations. Motors can be fitted with optional magnetic encoder. Motor controls must be purchased separately. Reference page 464 for motor control options.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range	1x10 ⁻¹¹ Torr
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Temperature Range¹ Manual	-20°C to 100°C
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Torque	25 oz-in maximum
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Axial load	2 lb maximum
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Lateral load	6 lb maximum
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Weight & Dimensions	See table
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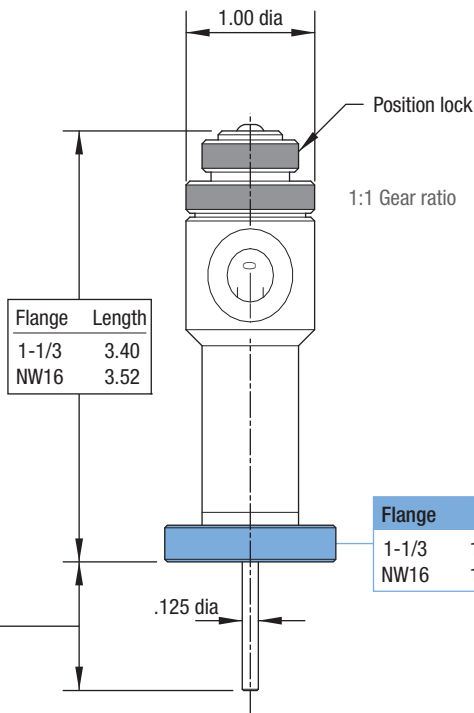
DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3 UHV	2	MBR-133	671500

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW16 HV	2	K075-MBR	671501

MOTORIZATION ²	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
MOTOR	C	1	-01
MOTOR & ENCODER	C	1	-02

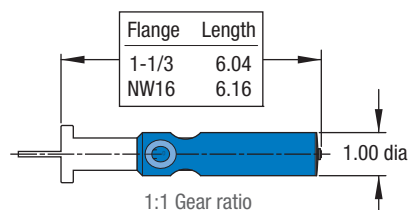
¹ UHV units are bakeable to 230°C with actuator removed and 30°C maximum when motorized.

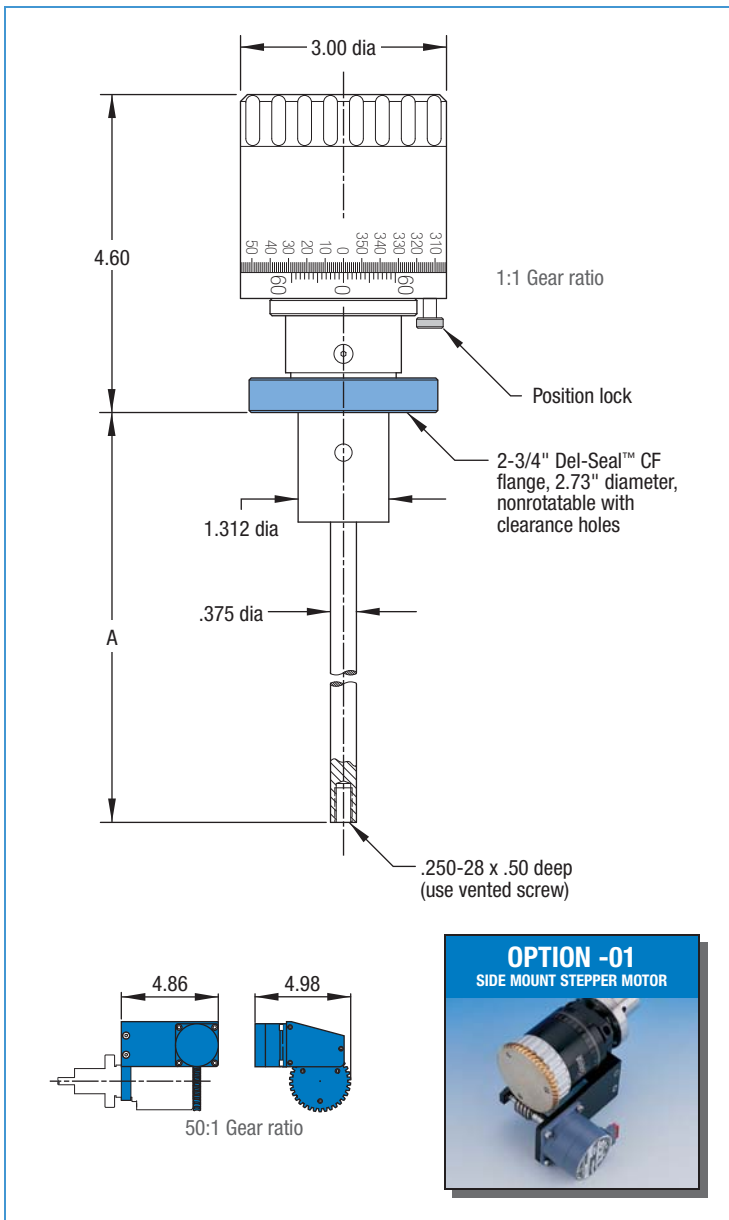
² When ordering motorized options, add the option number and price to the desired UHV or HV component part number listed above. For example: 671500-02 For total unit weight, add option weight to component weight. Refer to page 459 for motor specifications.



- Shown with 1-1/3" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

Flange	Length
1-1/3	1.00
NW16	.88





ULTRAHIGH VACUUM SERIES

Features

- Continuous rotary motion
- Manual or Motorized actuator
- Rotary position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts
- Low backlash design

Description

Precision rotary motion feedthroughs are low backlash instruments with a display resolution of 0.1°. Welded stainless steel bellows, a unique off-axis wobble design and the use of rotary shaft bearing supports provide long life and smooth operation. Feedthroughs are available on Conflat® compatible Del-Seal™ CF metal seal flanges. Motorization option is available. Motor controls must be purchased separately. Reference page 465.

Specifications

Material

Flange / Actuator knob	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range	1x10 ⁻¹¹ Torr
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Temperature Range	-20°C to 230°C
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Torque	7 lb-in maximum
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Axial load	5 lb maximum
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Lateral load	10 lb maximum
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Weight & Dimensions	See table
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A	FLANGE	WT LB	REFERENCE	PART NUMBER
10.00	2-3/4	7	PBRM1-10	670024
15.75	2-3/4	7	PBRM1-15	670027
23.62	2-3/4	8	PBRM1-23	670030
31.50	2-3/4	8	PBRM1-31	670033

MOTORIZATION ¹	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
STEPPER MOTOR	D	5	-01

¹ When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 670024-01. For total unit weight, add option weight to component weight. Refer to page 459 for motor specifications.



MRM-275

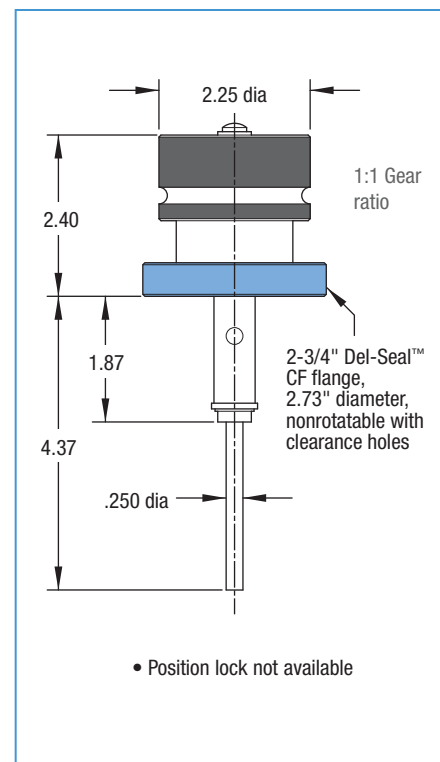
Ultrahigh Vacuum, Magnetic Drive

Features

- Continuous rotary motion
- Manual Actuator
- Bakeable to 100°C
- Del-Seal™ CF port mount
- Magnetically coupled

Specifications

Materials	UHV compatible
Vacuum Range	1x10 ⁻¹¹ Torr
Temperature Range	-20°C to 100°C
Speed	50 rpm maximum
Torque	20 oz-in maximum
Axial load	2.5 lb maximum
Lateral load	5 lb @ 4" extension maximum



• Position lock not available

Description

MDC Precision magnetically coupled rotary motion feedthroughs provide basic rotation and UHV compatibility without the use of bellows. This product is intended for manually operated light-duty service not exceeding 20 oz-in of torque. Conflat® compatible 2-3/4" diameter Del-Seal™ CF metal seal flanges are the standard mount.

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
MANUAL ACTUATION 2-3/4 DEL-SEAL UHV	2	MRM-275	671000



FRM-125

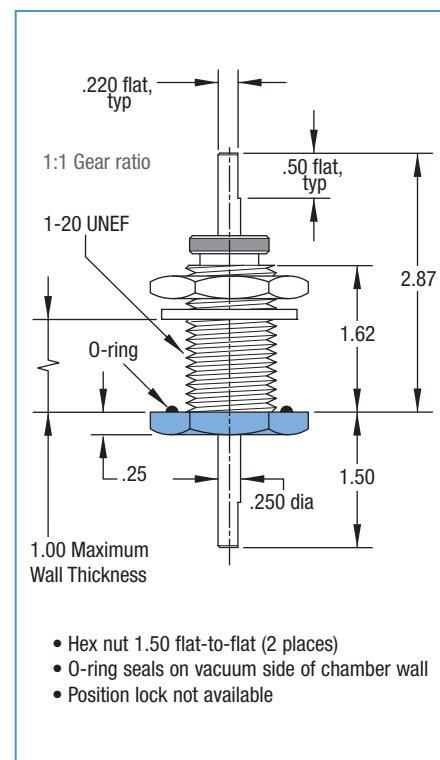
High Vacuum, Direct Drive

Features

- Continuous rotary motion
- Manual actuator
- FKM / FPM fluoroelastomer elastomer shaft seal
- Bakeable to 100°C
- 1" bolt hole installation

Specifications

Materials	HV compatible
Vacuum Range	1x10 ⁻⁸ Torr
Temperature Range	-20°C to 100°C
Speed	300 rpm maximum
Torque	100 oz-in maximum
Axial load	2.5 lb maximum
Lateral load (higher loads at reduced rpm)	5 lb

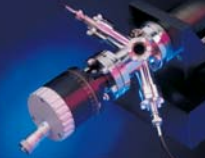


- Hex nut 1.50 flat-to-flat (2 places)
- O-ring seals on vacuum side of chamber wall
- Position lock not available

Description

MDC direct drive rotary motion feedthroughs provide basic rotation and HV compatibility. Vacuum integrity is maintained by a single pre-loaded FKM / FPM fluoroelastomer elastomer shaft seal. Fitted with dual rotary bearing shaft supports, this product can be manually or mechanically operated at intermittent speeds up to 300rpm. It is mount-ed on the traditional 1" baseplate mount.

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
MANUAL ACTUATION 1" BASEPLATE HV	2	FRM-125	652000



ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion
- Manual actuator
- UHV or HV compatible materials
- Differentially pumped, Dual FKM / FPM fluoroelastomer elastomer shaft seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

Differentially pumped direct drive rotary motion feedthroughs provide 100 lb-in maximum rotational torque and 500rpm maximum rotation. The rotary shaft is supported by two radial bearings located inboard of dual FKM / FPM fluoroelastomer elastomer shaft seals. The region between the seals can be differentially pumped through the 1/8" female pipe thread port provided and thus attain UHV compatibility to 10^{-9} Torr. Feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ port mounts.

Specifications

Material

Flange / Actuator body 304ss

Shaft seal FKM / FPM fluoroelastomer

Vacuum Range 1×10^{-9} Torr

Temperature Range¹ -20°C to 100°C

Speed 500 rpm maximum

Torque 100 lb-in maximum

Axial load 2.5 lb maximum

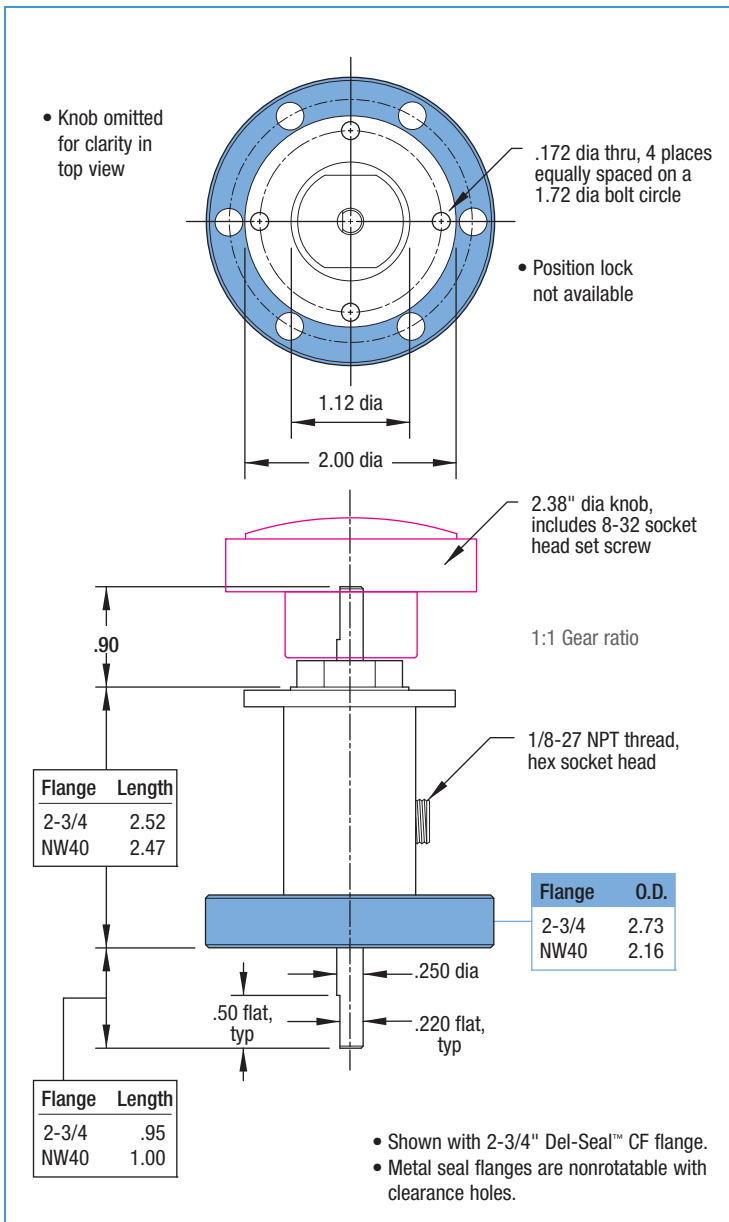
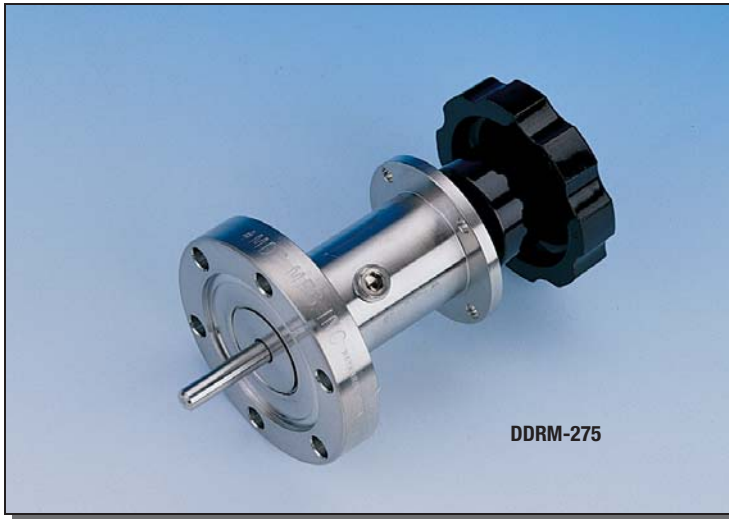
Lateral load (higher loads at reduced rpm) 5 lb

Weight & Dimensions See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4 UHV	2	DDRM-275	652100

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW40 HV	2	K150-DDRM	652101

¹ UHV units are bakeable to 150°C with actuator removed.





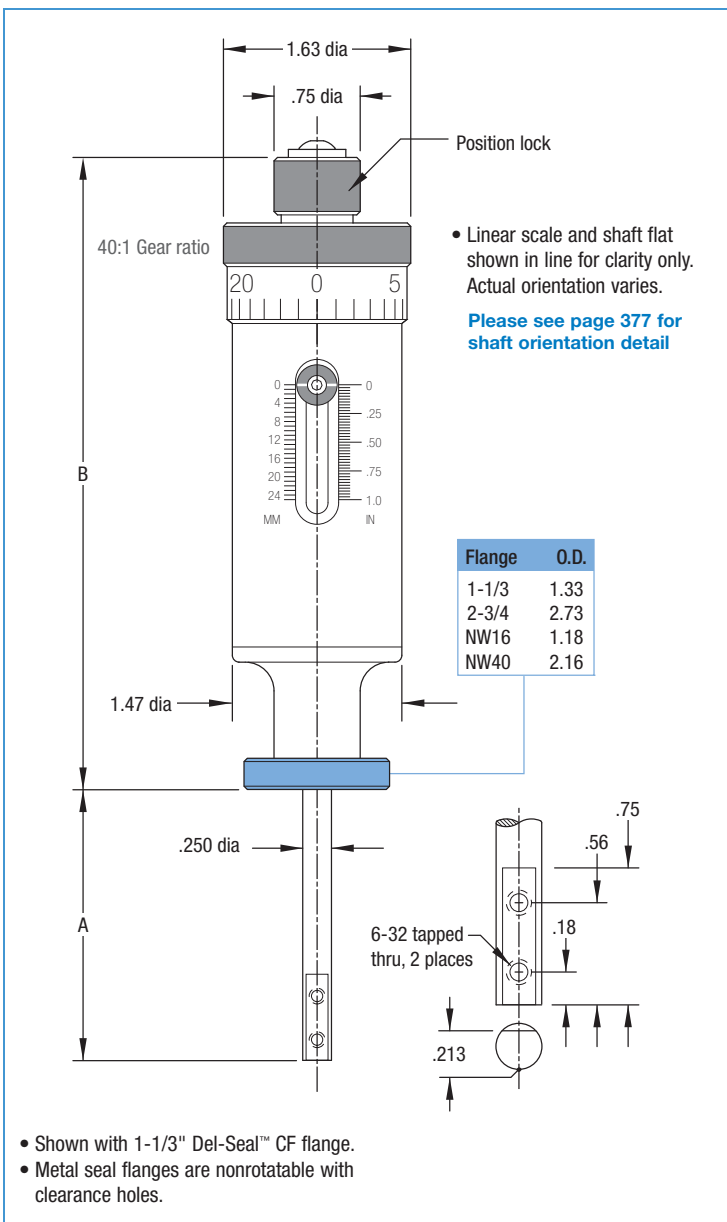
ULTRAHIGH & HIGH VACUUM SERIES

Features

- 1 to 6 inch linear travel
- Manual or Motorized actuator
- Linear position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

MDC standard linear motion feedthroughs are the perfect solution for linear displacement of in-vacuum samples or devices. They are constructed of the highest grade vacuum compatible materials. Linear position is measured along a laser etched black-anodized barrel graduated in 0.001" increments. A full revolution of the barrel translates into 0.025" of linear travel. A linear scale on the body is also provided and is marked in both inch and metric units. The inch scale is graduated in increments of 0.025" while the metric scale is graduated in 1mm increments. Welded stainless steel bellows, a 40 pitch lead screw design and the use of linear bearing shaft support provide devices with excellent durability and performance. They are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ port mounts. Automation can be attained with one of four motorization options and controls. Motor controls must be purchased separately. Motor control options, specifications and ordering information begin on page 464.



Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range UHV / HV	1x10 ⁻¹¹ Torr / 1x10 ⁻⁸ Torr
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Temperature Range ¹ UHV / HV	-20°C to 100°C
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Axial load	5 lb maximum
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Lateral load	5 lb @ 2" extension maximum
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Weight & Dimensions	See table
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¹ UHV units are bakeable to 230°C with actuator removed and 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 100°C

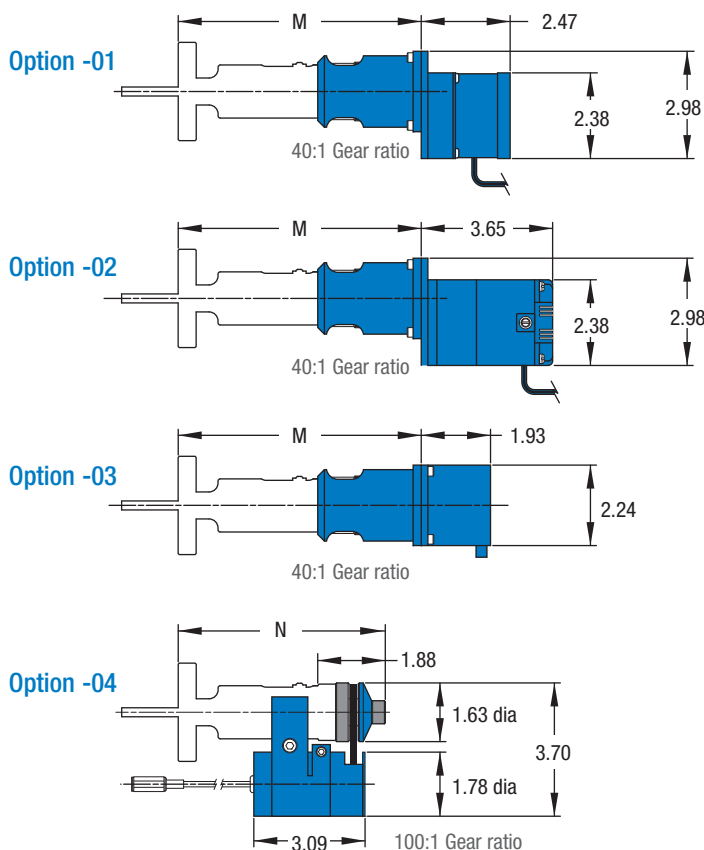
FLANGE SIZE	LINEAR TRAVEL	A MIN - MAX		B	M	N	WT LB	REFERENCE	PART NUMBER
1-1/3	1.00	3.55	4.55	5.50	6.76	5.76	1	BLM-133-1	660000
1-1/3	2.00	3.55	5.55	7.00	8.26	7.26	2	BLM-133-2	660004
1-1/3	4.00	3.55	7.55	10.08	11.76	10.76	3	BLM-133-4	660008
1-1/3	6.00	3.55	9.55	12.55	14.76	13.76	4	BLM-133-6	660012
2-3/4	1.00	3.55	4.55	5.50	6.76	5.76	2	BLM-275-1	660002
2-3/4	2.00	3.55	5.55	7.00	8.26	7.26	2	BLM-275-2	660006
2-3/4	4.00	3.55	7.55	10.08	11.76	10.76	3	BLM-275-4	660010
2-3/4	6.00	3.55	9.55	12.55	14.76	13.76	4	BLM-275-6	660014

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN - MAX		B	M	N	WT LB	REFERENCE	PART NUMBER
NW16	1.00	3.43	4.43	5.62	6.98	5.98	1	K075-BLM-1	660020
NW16	2.00	3.43	5.43	7.12	8.48	7.48	2	K075-BLM-2	660024
NW16	4.00	3.43	7.43	10.62	11.98	10.98	3	K075-BLM-4	660028
NW16	6.00	3.43	9.43	13.62	14.98	13.98	4	K075-BLM-6	660032
NW40	1.00	3.60	4.60	5.45	6.81	5.81	1	K150-BLM-1	660022
NW40	2.00	3.60	5.60	6.95	8.31	7.31	2	K150-BLM-2	660026
NW40	4.00	3.60	7.60	10.45	11.81	10.81	3	K150-BLM-4	660030
NW40	6.00	3.60	9.60	13.45	14.81	13.81	4	K150-BLM-6	660034

Motorization Options



OPTION -01
INLINE 115V AC MOTOR



OPTION -02
INLINE 90V DC MOTOR



OPTION -03
INLINE STEPPER MOTOR



OPTION -04
SIDE MOUNT 12V DC MOTOR



MOTORIZATION ²	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
INLINE AC	A	3	-01
INLINE DC	B	6	-02
INLINE STEPPER	D	2	-03
SIDE-MOUNT DC	C	2	-04

² When ordering motorized options, add the option number and price to the desired UHV or HV component part number listed above. For example: 660000-03. For total unit weight, add option weight to component weight. Motor specifications begin on page 458.



ULTRAHIGH VACUUM SERIES

Features

- 1 to 2 inch linear travel
- Manual actuator
- Linear position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts

Description

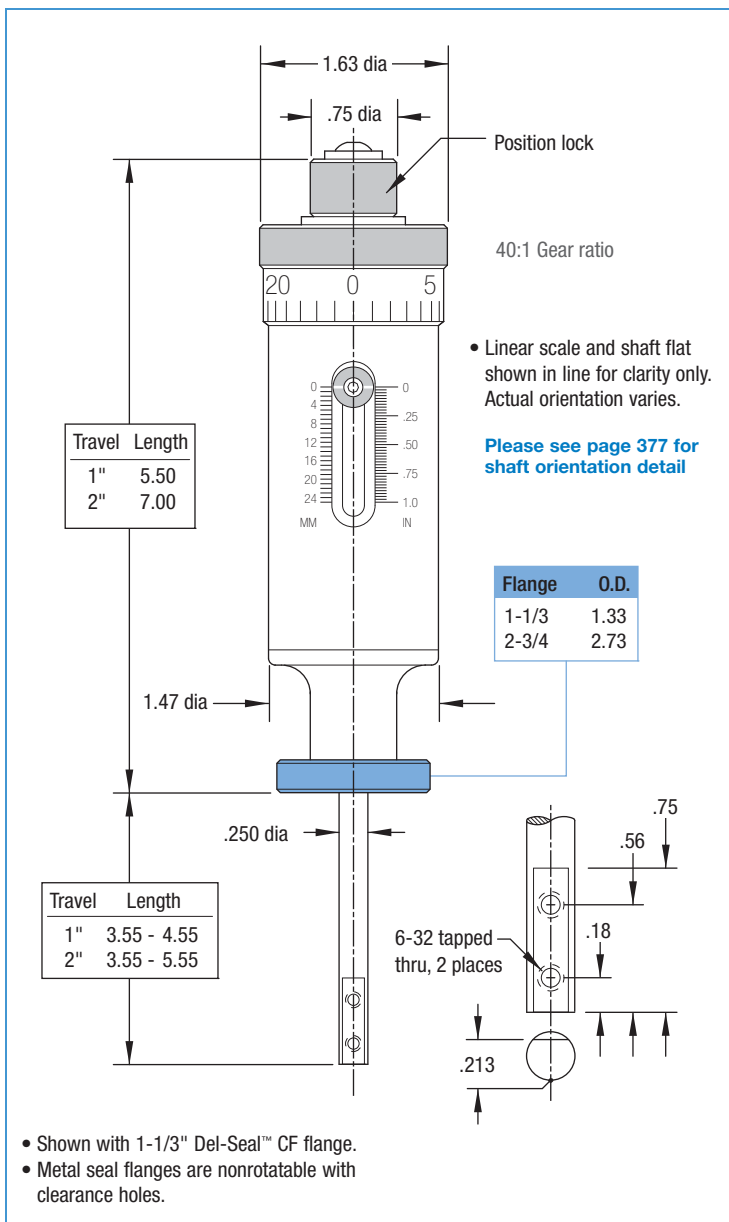
MDC Precision high temperature linear motion feedthroughs are the per-fect solution for linear displacement of in-vacuum samples or devices. They are constructed of 304ss to endure the rigors of high temperature vacuum service. Linear position is measured along a laser etched stainless steel barrel graduated in 0.001" increments. A full revolution of the barrel translates into 0.025" of linear travel. A linear scale on the body is also provided and is marked in both inch and metric units. The inch scale is graduat-ed in increments of 0.025" while the metric scale is graduated in 1mm increments. Welded stainless steel bellows, a 40 pitch lead screw design and the use of linear bearing shaft support provide devices with excellent durability and performance. They are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

Material

Flange / Actuator body	304ss
Shaft seal	AM 350 welded bellows
Vacuum Range	1x10 ⁻¹¹ Torr
Temperature Range	-20°C to 230°C
Axial load	5 lb maximum
Lateral load	5 lb @ 2" extension maximum
Weight & Dimensions	See table

LINEAR TRAVEL	FLANGE	WT LB	REFERENCE	PART NUMBER
1.00	1-1/3	1	HTBLM-133-1	660036
1.00	2-3/4	2	HTBLM-275-1	660037
2.00	1-1/3	2	HTBLM-133-2	660038
2.00	2-3/4	3	HTBLM-275-2	660039



ULTRAHIGH VACUUM SERIES

Features

- 2 inch linear travel
- Manual actuator
- UHV compatible materials
- Formed bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts

Description

Compact high temperature linear motion feedthroughs have the smallest atmosphere side envelope and are constructed with high temperature vacuum grade materials. Linear position is measured along a laser etched stainless steel barrel graduated in 20 equally spaced increments. A full revolution of the barrel translates into 1.25mm of linear travel. Air side linear clearance must be considered to accommodate the rising lead screw mechanism. Formed stainless steel bellows, a 1.25mm pitch lead screw design and the use of radial bearings provide this product with excellent durability and performance. All drive mechanism components are located on the atmosphere side of the formed bellows. Vacuum mounts include 1-1/3" or 2-3/4" diameter, industry standard, Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

Material

Flange / Actuator body	304ss
Shaft seal	Type 321 stainless steel formed bellows

Vacuum Range	1x10 ⁻¹¹ Torr
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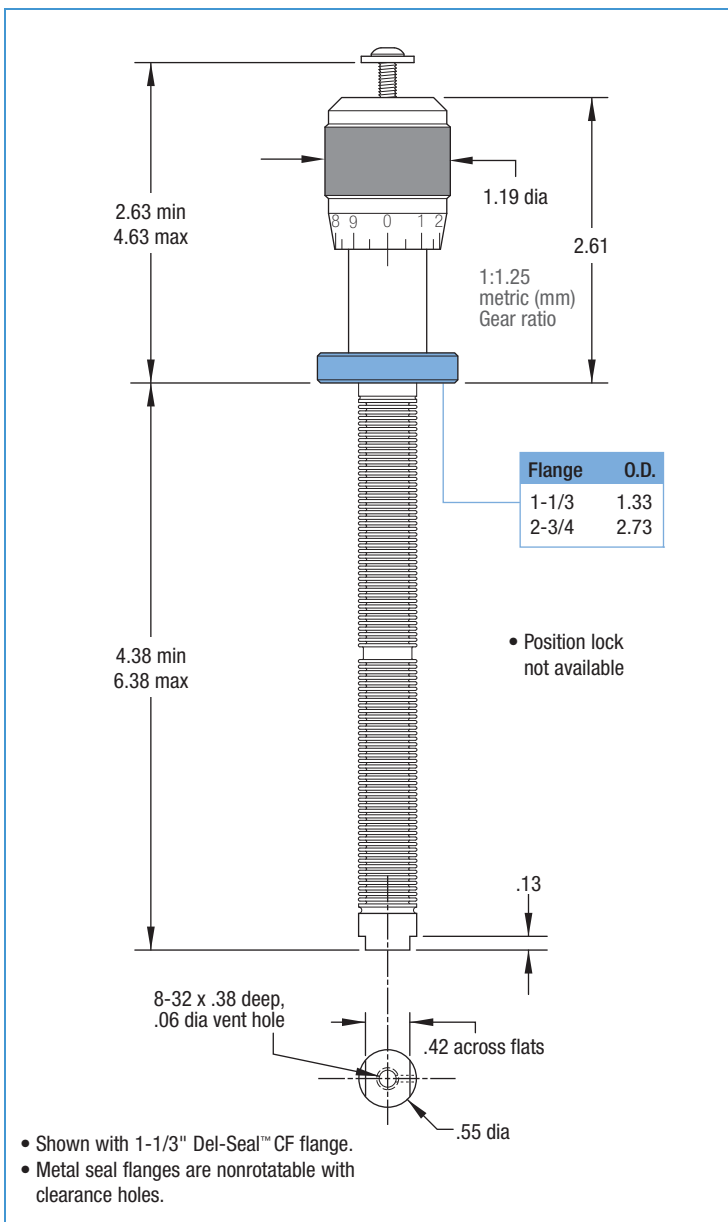
Temperature Range	-20°C to 230°C
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Axial load	10 lb maximum
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Lateral load	5 lb @ 2" extension maximum
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Weight & Dimensions	See table
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DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3 UHV	1	LMD-133-2	665514
2-3/4 UHV	3	LMD-275-2	665515





MBL-133-1

ULTRAHIGH & HIGH VACUUM SERIES

Features

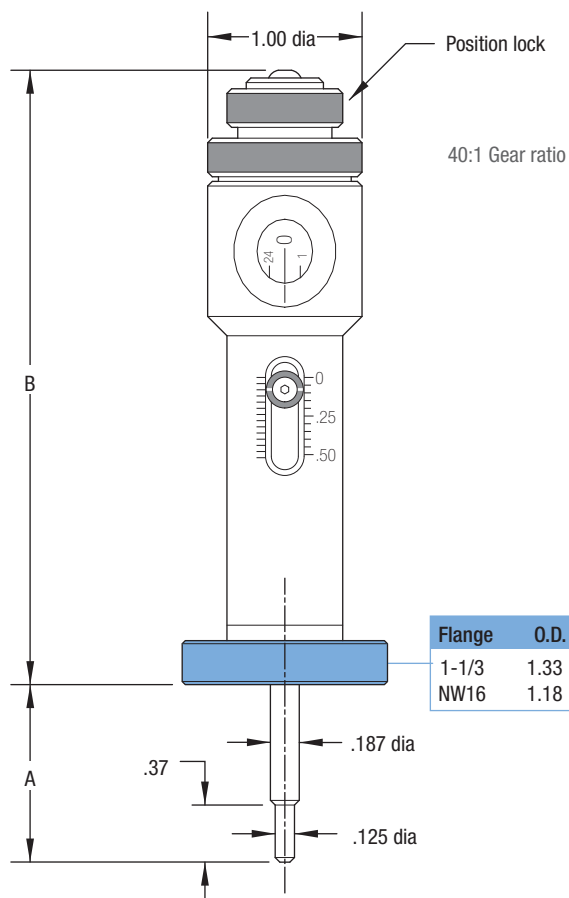
- 1/2 to 1 inch linear travel
- Manual or Motorized actuator
- Linear position lock
- UHV and HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

MDC Precision miniature linear feedthroughs are specifically designed for in-vacuum light-duty applications. Full revolution of the bar-rel translates into 0.025" of linear travel. These instruments are available in both manual or low voltage 12 VDC motor configurations. Motor options with an integral magnetic encoder are also available. See page 459 for complete motor specifications.

Motor controls are not included with the motor options and must be purchased separately. Motor controls and specifications are detailed on page 464.

MDC miniature linear feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ port mounts.



- Shown with 1-1/3" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

Specifications
Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range	1x10 ⁻¹¹ Torr
---------------------	--------------------------

Temperature Range¹ Manual	-20°C to 100°C
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Axial load	2.5 lb maximum
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Lateral load	6 lb maximum
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Weight & Dimensions	See table
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¹ UHV units are bakeable to 230°C with actuator removed and 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 100°C

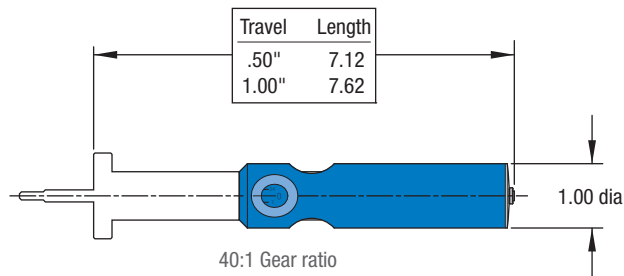
FLANGE SIZE	LINEAR TRAVEL	A MIN - MAX		B	WT LB	REFERENCE	PART NUMBER
1-1/3	0.50	1.00	1.50	4.50	2	MBL-133-0	660500
1-1/3	1.00	1.00	2.00	5.00	2	MBL-133-1	660501

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN - MAX		B	WT LB	REFERENCE	PART NUMBER
NW16	0.50	1.00	1.50	4.62	2	K075-MBL-0	660502
NW16	1.00	1.00	2.00	5.12	2	K075-MBL-1	660503

Motorization Options



OPTION -01 INLINE 12V DC MOTOR



OPTION -02 INLINE 12V DC MOTOR & ENCODER



MOTORIZATION ²	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
MOTOR	C	1	-01
MOTOR & ENCODER	C	1	-02

² When ordering motorized options, add the option number and price to the desired UHV or HV component part number listed above. For example: 660502-02. For total unit weight, add option weight to component weight. Refer to page 459 for motor specifications.



ULTRAHIGH & HIGH VACUUM SERIES

Features

- 1 to 6 inch linear travel
- Manual actuator
- Linear position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

MDC Precision push-pull linear motion feedthroughs are the most basic of the manual motion devices offered in this catalog. They provide quick action linear motion via a stainless steel hand-held actuator shaft. They are typically operated by observing the motion process through a vacuum viewport. For quick and easy positioning reference the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025". An attractive black anodized finish provides high contrast visibility of the laser etched graduated scale. The actuator can be locked in position by simply tightening the position lock located at the top end of the actuator body.

Push-pull linear motion feedthroughs are offered in travel lengths between 1" and 6". They are constructed of the highest grade vacuum compatible materials. Welded stainless steel bellows and the use of linear bearing shaft supports provide reliability and smooth operation. Push-pull feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ elastomer seal port mounts.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range UHV / HV	1x10 ⁻¹¹ Torr / 1x10 ⁻⁸ Torr
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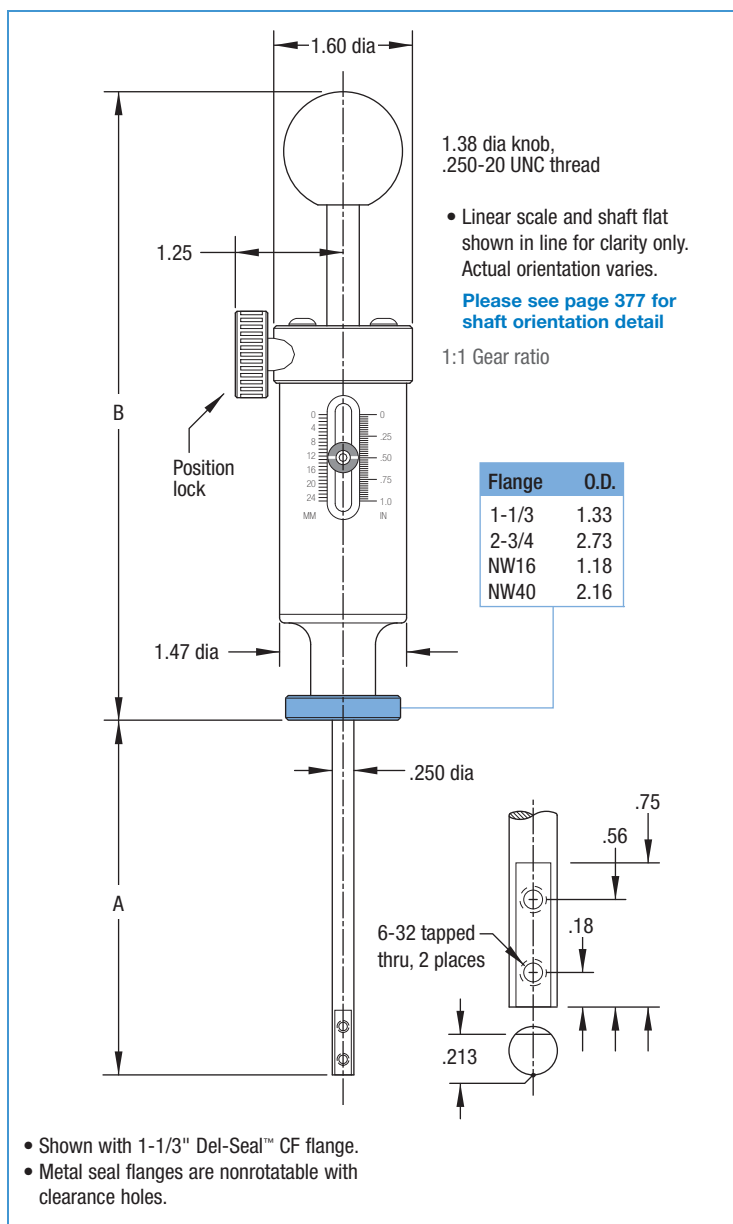
Temperature Range ¹ UHV / HV	-20°C to 100°C
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Axial load	10 lb maximum
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Lateral load	5 lb @ 2" extension maximum
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Weight & Dimensions	See table
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¹ UHV units are bakeable to 230°C with actuator removed.





ULTRAHIGH VACUUM SERIES

Del-Seal™ CF **100°C**

FLANGE SIZE	LINEAR TRAVEL	A MIN - MAX		B MIN - MAX		WT LB	REFERENCE	PART NUMBER
1-1/3	1.00	3.55	4.55	6.5	7.5	1	SBLM-133-1	663000
1-1/3	2.00	3.55	5.55	8.0	10.0	2	SBLM-133-2	663004
1-1/3	4.00	3.55	7.55	11.5	15.5	3	SBLM-133-4	663016
1-1/3	6.00	3.55	9.55	14.5	20.5	4	SBLM-133-6	663018
2-3/4	1.00	3.55	4.55	6.5	7.5	2	SBLM-275-1	663002
2-3/4	2.00	3.55	5.55	8.0	10.0	2	SBLM-275-2	663006
2-3/4	4.00	3.55	7.55	11.5	15.5	3	SBLM-275-4	663017
2-3/4	6.00	3.55	9.55	14.5	20.5	4	SBLM-275-6	663019

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF **100°C**

FLANGE SIZE	LINEAR TRAVEL	A MIN - MAX		B MIN - MAX		WT LB	REFERENCE	PART NUMBER
NW16	1.00	3.43	4.43	6.6	7.6	1	K075-SBLM-1	663008
NW16	2.00	3.43	5.43	8.1	10.1	2	K075-SBLM-2	663012
NW16	4.00	3.43	7.43	11.7	15.7	3	K075-SBLM-4	663020
NW16	6.00	3.43	9.43	14.6	20.6	4	K075-SBLM-6	663024
NW40	1.00	3.60	4.60	6.5	7.6	1	K150-SBLM-1	663010
NW40	2.00	3.60	5.60	8.0	10.0	2	K150-SBLM-2	663014
NW40	4.00	3.60	7.60	11.5	15.5	3	K150-SBLM-4	663022
NW40	6.00	3.60	9.60	14.5	20.5	4	K150-SBLM-6	663026



ULTRAHIGH & HIGH VACUUM SERIES

Features

- 2 to 6 inch linear travel
- Manual actuator
- Linear position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

MDC Precision rack and pinion linear motion feedthroughs are very similar to push-pull devices, but provide finer control of linear motion. The rack and pinion drive mechanism is still considered quick-action when compared to rotating actuator, linear motion devices. They too are operated by observing the motion process through a vacuum viewport. For quick and easy positioning reference the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025". A 1-1/4 turn on the handle generates 1 inch of linear travel. An attractive black anodized finish provides high contrast and visibility of the laser etched graduated scale. The actuator can be locked in position by simply tightening the position lock located at the top end of the actuator body.

Rack and pinion linear motion feedthroughs are offered in travel lengths between 2" and 6". They are constructed of high grade vacuum compatible materials. Welded stainless steel bellows and the use of linear bearing shaft supports provide reliability and smooth operation. Rack and pinion feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ elastomer seal port mounts.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range UHV / HV	1x10 ⁻¹¹ Torr / 1x10 ⁻⁸ Torr
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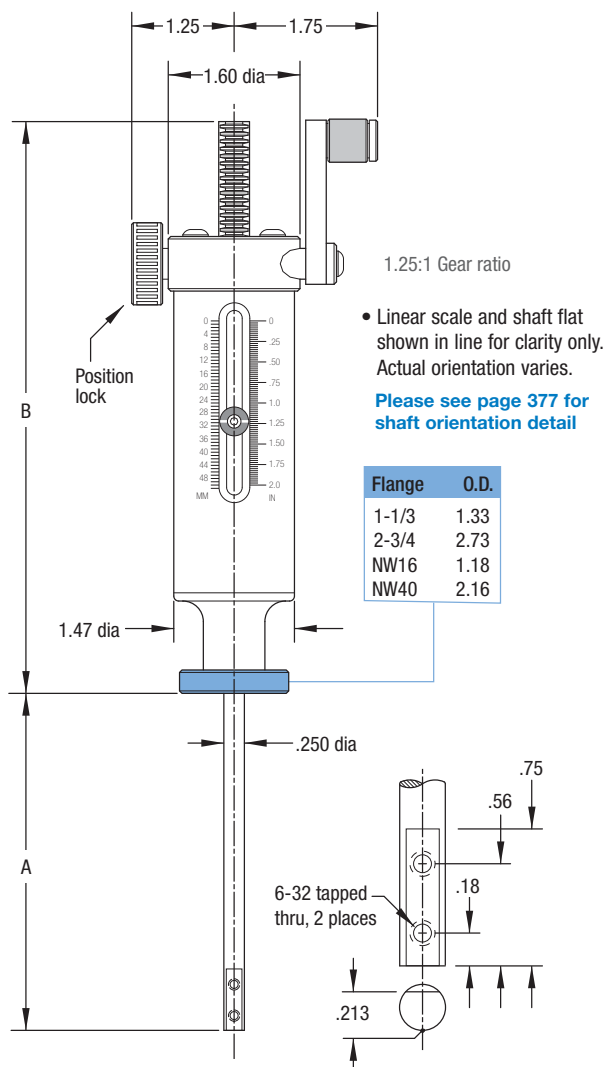
Temperature Range ¹ UHV / HV	-20°C to 100°C
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Axial load	10 lb maximum
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Lateral load	5 lb @ 2" extension maximum
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Weight & Dimensions	See table
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¹ UHV units are bakeable to 230°C with actuator removed.



- Shown with 1-1/3" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.

Linear Motion

Rack & Pinion



Section 7.1

ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN - MAX		B MIN - MAX		WT LB	REFERENCE	PART NUMBER
1-1/3	2.00	3.55	5.55	6.5	8.5	2	RPLM-133-2	666000
1-1/3	4.00	3.55	7.55	10.0	14.0	3	RPLM-133-4	666002
1-1/3	6.00	3.55	9.55	13.0	19.0	4	RPLM-133-6	666004
2-3/4	2.00	3.55	5.55	6.5	8.5	3	RPLM-275-2	666001
2-3/4	4.00	3.55	7.55	10.0	14.0	4	RPLM-275-4	666003
2-3/4	6.00	3.55	9.55	13.0	19.0	5	RPLM-275-6	666005

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN - MAX		B MIN - MAX		WT LB	REFERENCE	PART NUMBER
NW16	2.00	3.43	5.43	6.62	8.62	2	K075-RPLM-2	666006
NW16	4.00	3.43	7.43	10.12	14.12	3	K075-RPLM-4	666010
NW16	6.00	3.43	9.43	13.12	19.12	4	K075-RPLM-6	666014
NW40	2.00	3.60	5.60	6.45	8.45	2	K150-RPLM-2	666008
NW40	4.00	3.60	7.60	9.95	13.95	3	K150-RPLM-4	666012
NW40	6.00	3.60	9.60	12.95	18.95	4	K150-RPLM-6	666016



ABLM-275-2



Includes solenoid

ULTRAHIGH & HIGH VACUUM SERIES

Features

- 1 to 2 inch linear travel
- Pneumatic actuator
- Adjustable linear travel stop
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts
- Air control solenoid valve
- Solenoid air pressure to 100 PSIG maximum

Description

Pneumatic linear motion feedthroughs provide two-position fast action linear motion. Typical motion applications would include on-off, open-close and in-out motions similar to those of in-vacuum shutters. Linear travel can be shortened or lengthened by turning the adjustment knob located at the top end of the pneumatic actuator. Once adjusted the jam nut locks the knob in place. Linear travel adjustment is from 0" to 1" for one inch travel devices and from 1" to 2" for two inch travel devices. For quick and easy positioning the feedthrough body has been laser etched with linear travel graduation marks in increments of 0.025". A black anodized finish provides high contrast and visibility of the laser etched graduated scale. Pneumatic linear motion feedthroughs are offered in travel lengths of 1" and 2". They are constructed of high grade vacuum compatible materials. Welded stainless steel bellows and the use of linear bearing shaft supports provide reliability and smooth operation. Pneumatic feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ elastomer seal port mounts.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Piston seal	FKM / FPM fluoroelastomer O-ring

Vacuum Range UHV / HV	1x10 ⁻¹¹ Torr / 1x10 ⁻⁸ Torr
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Temperature Range ¹ UHV / HV	-20°C to 100°C
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Axial load	20 lb maximum
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Lateral load	5 lb @ 2" extension maximum
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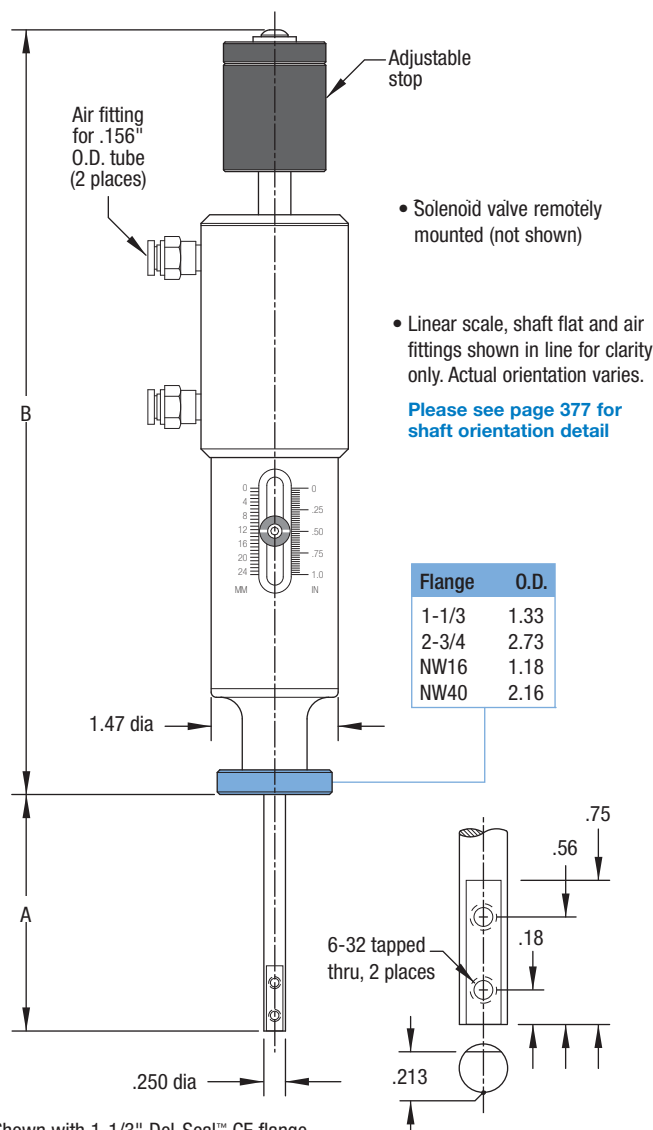
Actuator Pressure	60-80 psi
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Piston Surface Area	0.88 in ²
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Solenoid Valve	120 VAC 50/60 Hz
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Weight & Dimensions	See table
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¹ UHV units are bakeable to 230°C with actuator removed.



- Shown with 1-1/3" Del-Seal™ CF flange.
- Metal seal flanges are nonrotatable with clearance holes.



ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN - MAX		B MIN - MAX		WT LB	REFERENCE	PART NUMBER
1-1/3	1.00	3.55	4.55	8.5	9.5	2	ABLM-133-1	662000
1-1/3	2.00	3.55	5.55	11.0	13.0	3	ABLM-133-2	662004
2-3/4	1.00	3.55	4.55	8.5	9.5	3	ABLM-275-1	662002
2-3/4	2.00	3.55	5.55	11.0	13.0	3	ABLM-275-2	662006

HIGH VACUUM SERIES

Kwik-Flange™ ISO KF 100°C

FLANGE SIZE	LINEAR TRAVEL	A MIN - MAX		B MIN - MAX		WT LB	REFERENCE	PART NUMBER
NW16	1.00	3.43	4.43	8.6	9.6	2	K075-ABLM-1	662008
NW16	2.00	3.43	5.43	11.1	13.1	3	K075-ABLM-2	662012
NW40	1.00	3.60	4.60	8.5	9.5	2	K150-ABLM-1	662010
NW40	2.00	3.60	5.60	11.0	13.0	3	K150-ABLM-2	662014

Solenoid Options

OPTION -01 AND -02 AIR CONTROL SOLENOID VALVE



DESCRIPTION ¹

24V DC AIR CONTROL SOLENOID VALVE
240V AC AIR CONTROL SOLENOID VALVE

OPTION NUMBER

-01
-02

¹ When ordering solenoid options, add the option number to the end of the desired UHV or HV component part number listed above. For example: 662000-01. For total unit weight, add option weight to manual component weight.



ULTRAHIGH VACUUM SERIES

Features

- 2 to 6 inch linear travel
- Manual actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF port mounts

Description

Heavy duty linear motion feedthroughs allow linear displacement of larger in-vacuum samples and components. This feedthrough has basic, rotary manual actuation and does not provide position indication. Position must be determined by visual inspection of the in-vacuum sample or component. A heavy duty acme thread lead screw provides 1" of linear travel for every six revolutions of the actuator knob. Unlike conventional motion feedthroughs, heavy duty models have a reentrant welded bellows configuration.

All feedthroughs are constructed using high grade vacuum compatible materials. Feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range	1x10 ⁻¹¹ Torr
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Temperature Range¹	-20°C to 100°C
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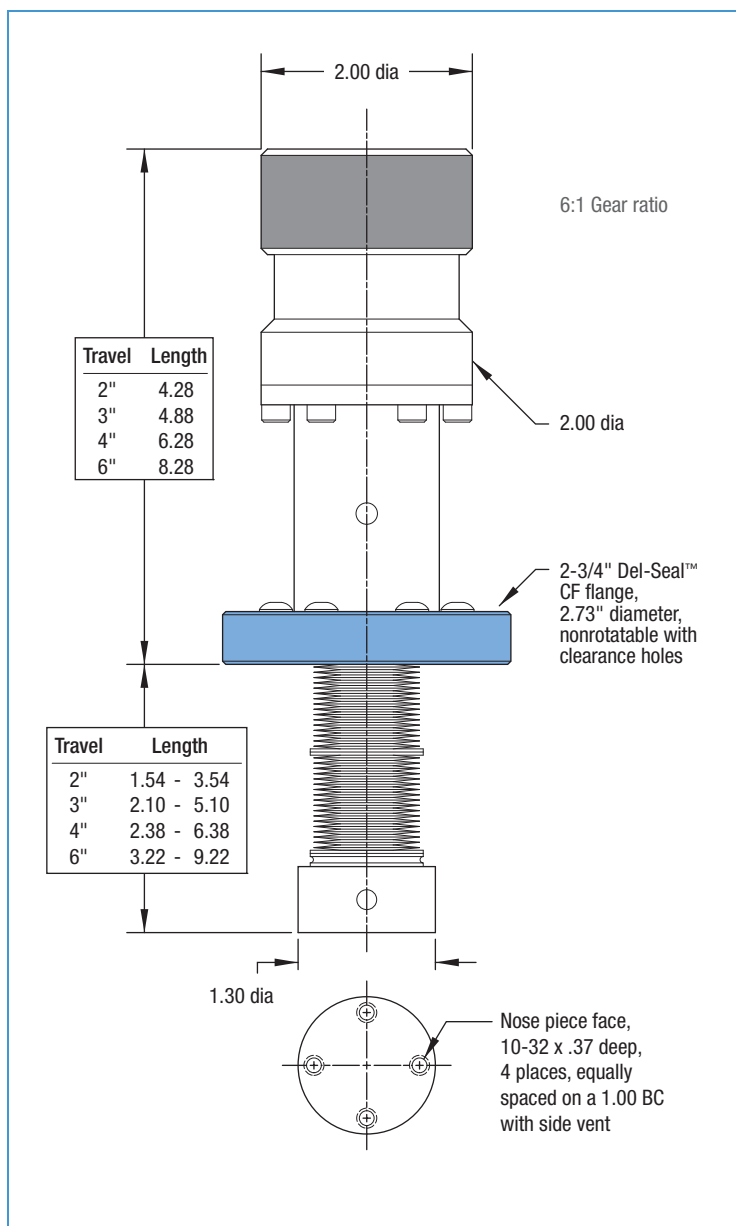
Axial load	20 lb maximum
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Lateral load	20 lb @ 4" extension maximum
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Weight & Dimensions	See table
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LINEAR TRAVEL		WT LB	REFERENCE	PART NUMBER
2.00	UHV	2	HLM-275-2	661018
3.00	UHV	2	HLM-275-3	661000
4.00	UHV	2	HLM-275-4	661016
6.00	UHV	3	HLM-275-6	661017

¹ UHV units are bakeable to 230°C with actuator removed.



ULTRAHIGH VACUUM SERIES

Features

- 1 to 3 inch linear travel
- Pneumatic actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF port mounts
- Solenoid air pressure to 100 PSIG maximum

Description

Heavy duty pneumatic linear motion feedthroughs provide two-position fast action linear motion for heavy sample loads. Typical motion applications would include open-close or in-out motions similar to those used for in-vacuum shutters. Sample linear position is not adjustable and is limited to the one, two or three inch strokes available.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows
Actuator Gaskets	FKM / FPM fluoroelastomer

Vacuum Range 1x10⁻¹¹ Torr

Temperature Range¹ -20°C to 100°C

Axial load 20 lb maximum

Lateral load 20 lb @ 3" extension maximum

Weight & Dimensions See table

LINEAR TRAVEL		WT LB	REFERENCE	PART NUMBER
1.00	UHV	2	ALM-275-1	661050
2.00	UHV	3	ALM-275-2	661051
3.00	UHV	3	ALM-275-3	661052

DESCRIPTION ²	OPTION NUMBER
24V DC AIR CONTROL SOLENOID VALVE	-01
240V AC AIR CONTROL SOLENOID VALVE	-02

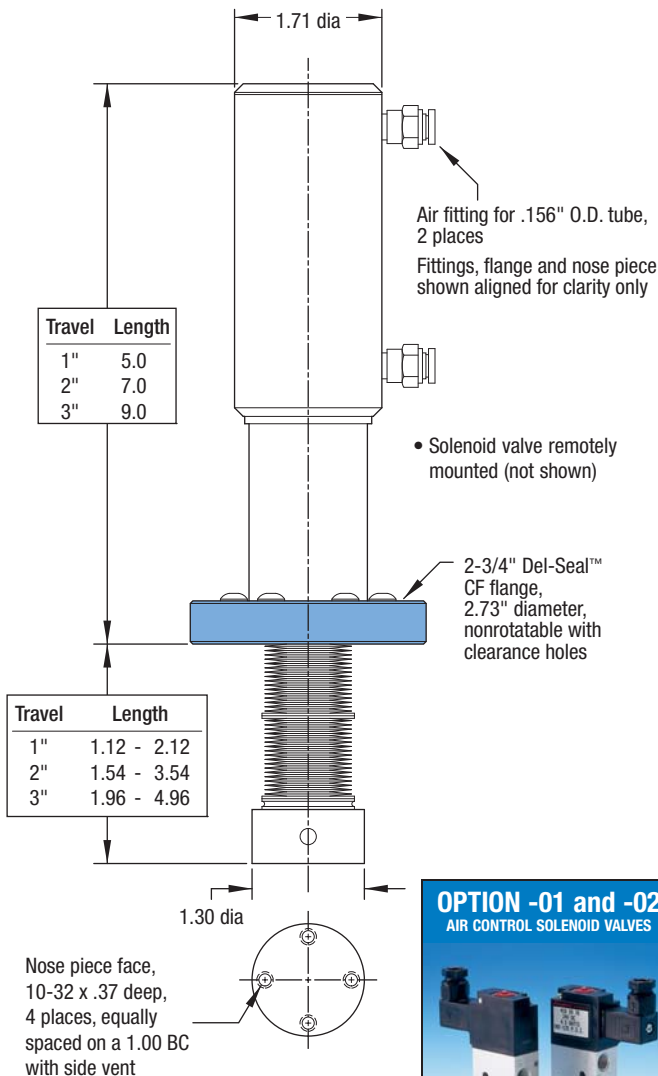
¹ UHV units are bakeable to 230°C with actuator removed.

² When ordering solenoid options, add the option number to the end of the desired UHV part number listed above. For example: 661050-02.

ALM-275-2



Includes solenoid



OPTION -01 and -02 AIR CONTROL SOLENOID VALVES





ULTRAHIGH VACUUM SERIES

Features

- 2 to 6 inch linear travel
- Manual actuator
- Linear position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF port mounts

Description

Heavy duty push-pull linear motion feedthroughs allow linear displacement of heavier samples and components than conventional designs. These devices do not provide position indication. Sample or component position must be verified visually through a viewport. Sample linear position can be fixed with an integral position lock knob mounted on the actuator housing. Unlike conventional motion feedthroughs, heavy duty models employ reentrant welded bellows construction allowing the use of sturdier and larger diameter shafts. Push-pull linear motion feedthroughs provide two-position fast action motion ideal for applications including open-close or in-out motions similar to those used for in-vacuum shutters. Standard models with two-, four- and six-inch maximum travel are offered on 2-3/4" Conflat® compatible Del-Seal™ CF metal seal flanges. Special configurations, such as the three-inch version displayed in the photograph, may be quoted upon request.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range	1x10 ⁻¹¹ Torr
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Temperature Range¹	-20°C to 100°C
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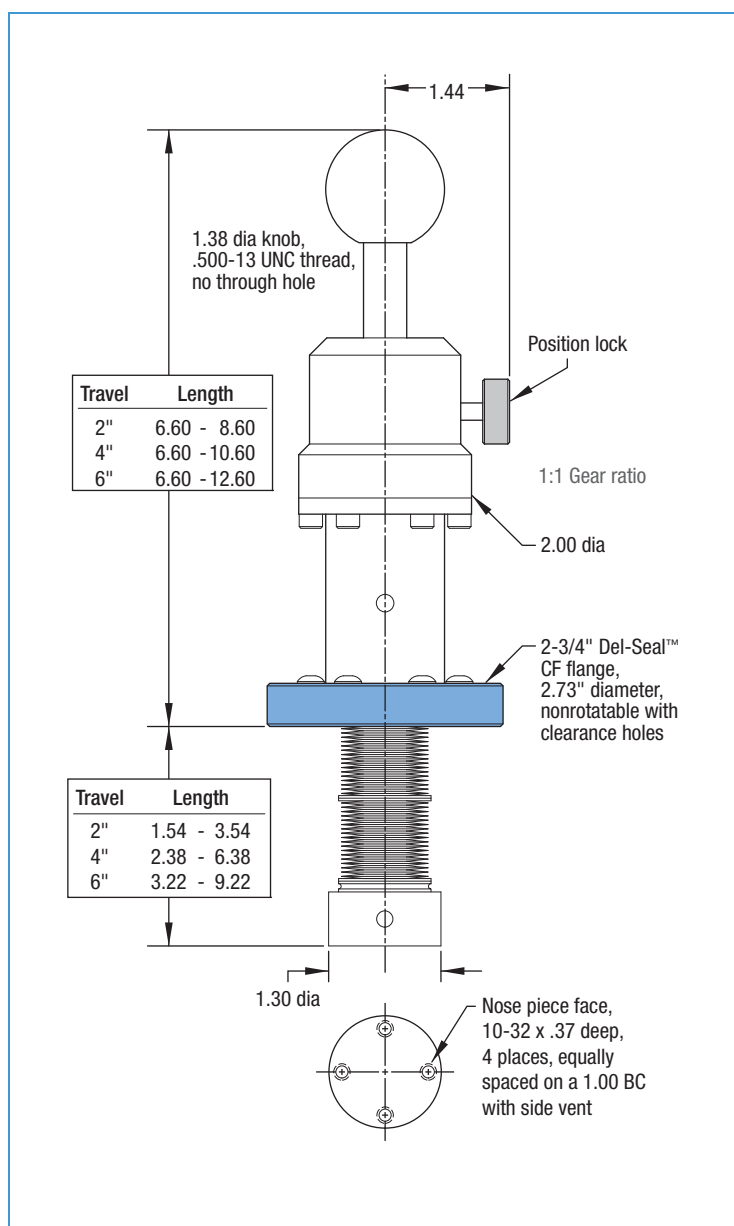
Axial load	20 lb maximum
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Lateral load	20 lb @ 4" extension maximum
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Weight & Dimensions	See table
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LINEAR TRAVEL		WT LB	REFERENCE	PART NUMBER
2.00	UHV	3	SLM-275-2	674001
4.00	UHV	4	SLM-275-4	674003
6.00	UHV	5	SLM-275-6	674005

¹ UHV units are bakeable to 230°C with actuator removed.



ULTRAHIGH VACUUM SERIES

Features

- 2 to 6 inch linear travel
- Manual actuator
- Linear position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF port mounts

Description

Heavy duty tunnel access, push-pull linear motion feedthroughs allow linear displacement of heavy samples and components. The push-pull shaft is hollow providing tunnel access for instrumentation leads such as those used for thermocouple temperature measurements and other low voltage electrical applications. The vacuum nose piece is shipped with a blank 1-1/3" Del-Seal™ CF mini flange which can be removed or modified to accept electrical feedthroughs as required. These devices do not provide position indication. Sample or component position must be verified visually through a viewport. Sample linear position can be fixed with an integral position lock knob mounted on the actuator housing. Unlike conventional motion feedthroughs, heavy duty models employ reentrant welded bellows construction allowing the use of sturdier and larger diameter shafts. Models with two-, four- and six-inch maximum travel are offered on 2-3/4" Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range	1x10 ⁻¹¹ Torr
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Temperature Range¹	-20°C to 100°C
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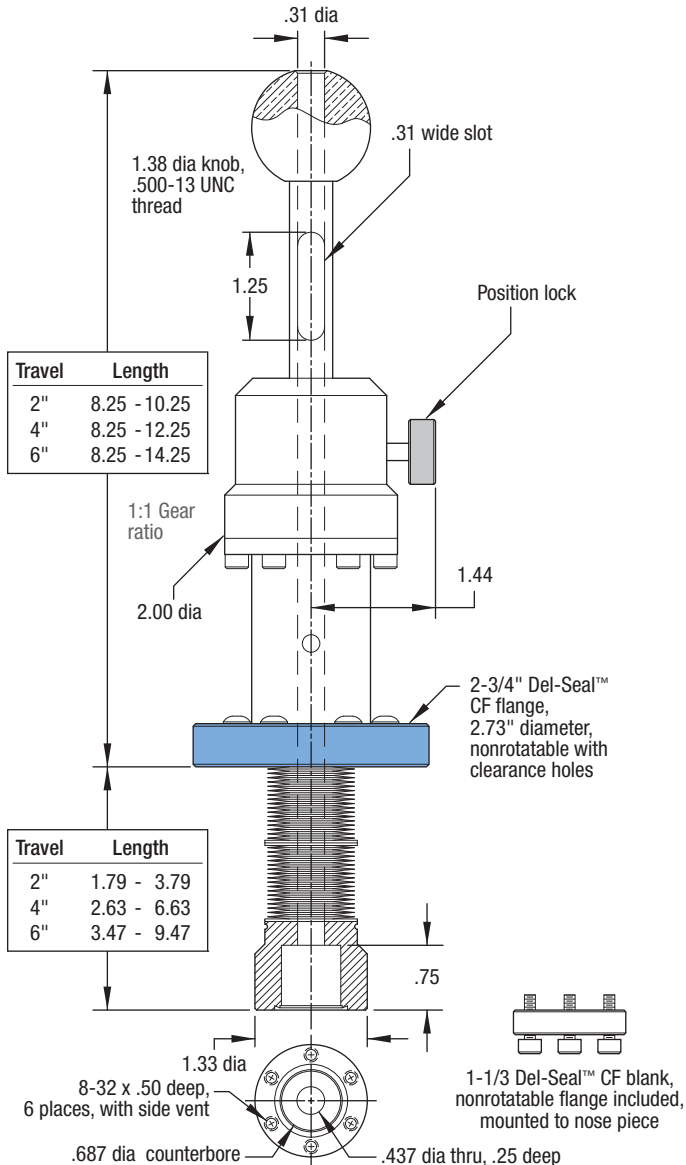
Axial load	20 lb maximum
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Lateral load	20 lb @ 4" extension maximum
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Weight & Dimensions	See table
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LINEAR TRAVEL		WT LB	REFERENCE	PART NUMBER
2.00	UHV	3	TLM-275-2	667000
4.00	UHV	4	TLM-275-4	667001
6.00	UHV	5	TLM-275-6	667002

¹ UHV units are bakeable to 230°C with actuator removed.





ULTRAHIGH VACUUM SERIES

Features

- 2 inch linear travel
- Manual, precision micrometer actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF port mount

Description

Heavy duty, micrometer driven linear motion feedthroughs allow linear displacement of heavier samples and components with the accuracy and precision of fine pitch thread micrometers. These devices provide position indication on both rotary and linear scales with display resolutions of 0.0001" on the rotary scale and 0.025" on the linear scale. A full revolution of the rotary scale translates into 0.025" of linear travel. Unlike conventional motion feedthroughs, heavy duty models employ reentrant welded bellows construction allowing the use of sturdier and larger diameter shafts. Models with two inch maximum travel are offered on 2-3/4" Conflat® compatible Del-Seal™ CF metal seal flanges.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range 1x10⁻¹¹ Torr

Temperature Range¹ -20°C to 100°C

Axial load 10 lb maximum

Lateral load 20 lb @ 4" extension maximum

Weight & Dimensions See table

LINEAR TRAVEL	WT LB	REFERENCE	PART NUMBER
2.00	UHV	3	LMM-275-2 668002

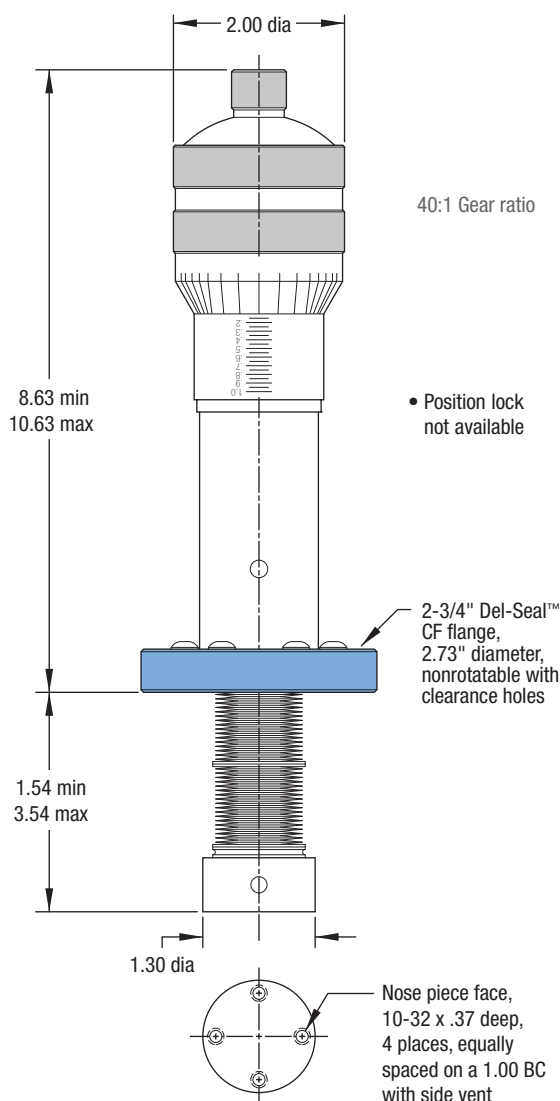
¹ UHV units are bakeable to 230°C with actuator removed.



Plus-Minus Scale



LMM-275-2





ULTRAHIGH & HIGH VACUUM SERIES

Features

- 360° rotary motion and 1 inch linear travel
- Manual actuator
- Rotary position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

Rotary-linear standard devices offer 360° of rotation and one inch of linear travel via two separate drive knob actuators. Both rotary and linear positions are measured along laser etched scales on actuator barrel and housing. The 360° rotary scale is graduated in 5° increments. The linear scale has both a linear and rotary scale components, the linear portion is graduated in 0.025" increments while the rotary portion is graduated in 0.001" increments. Full revolution of the linear scale produces 0.025" of linear travel. These instruments are offered on both Del-Seal™ CF metal seal flanges for ultrahigh vacuum service and Kwik-Flange™ ISO KF elastomer seal flanges for high vacuum service.

Specifications

Material

Flange / Actuator body	304ss / Anodized aluminum
Shaft seal	AM 350 welded bellows

Vacuum Range UHV / HV	1x10 ⁻¹¹ Torr / 1x10 ⁻⁸ Torr
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Temperature Range ¹ UHV / HV	-20°C to 100°C
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Torque	50 oz-in maximum
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Axial load	4 lb maximum
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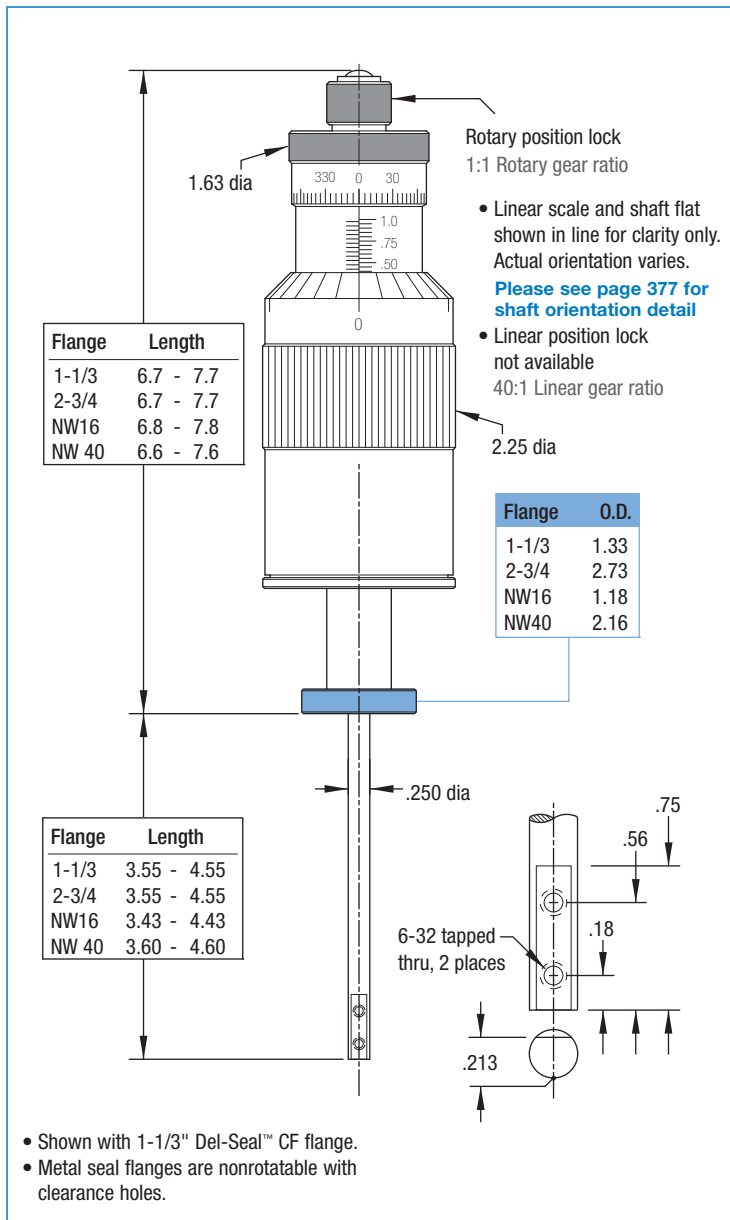
Lateral load	4 lb @ 2" extension maximum
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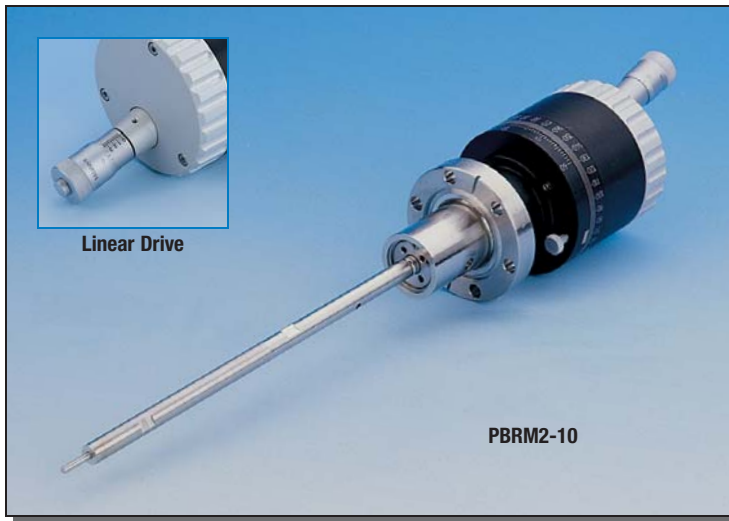
Weight & Dimensions	See table
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DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3 UHV	3	BRLM-133	672000
2-3/4 UHV	3	BRLM-275	672002

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW16 HV	3	K075-BRLM	672004
NW40 HV	3	K150-BRLM	672006

¹ UHV units are bakeable to 230°C with actuator removed.





ULTRAHIGH VACUUM

Features

- Continuous rotary motion and 1/2 inch linear travel
- Manual or Motorized actuator
- Rotary position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mount

Description

Precision rotary-linear motion feedthroughs are low backlash instruments with a rotary display resolution of 0.1° and a linear display resolution of 0.001". Full revolution of the linear drive translates into 0.025" of linear travel with a maximum overall linear travel of 0.500". Welded stainless steel bellows, a unique off-axis wobble design and the use of rotary shaft bearing supports provide long life and smooth operation. Feedthroughs are available on 2-3/4" diameter Conflat® compatible Del-Seal™ CF metal seal flanges. Motorization options are available for both linear and rotary drive components. If motorization is required on both drives, add each option number to the end of the base part number. Note that the entire linear drive mechanism (manual or motorized) will rotate when the rotary drive is actuated. This must be considered when allocating space for its installation. Motor controls are not included with the motorization options and must be purchased separately. Reference page 465 for motor controllers.

Specifications

Material

Flange / Actuator body	304ss / Aluminum
Shaft seal	AM 350 welded bellows
Position knob & internal washer	Brass

Vacuum Range	1x10 ⁻¹¹ Torr
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Temperature Range ¹	-20°C to 230°C
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Torque	7 lb-in maximum
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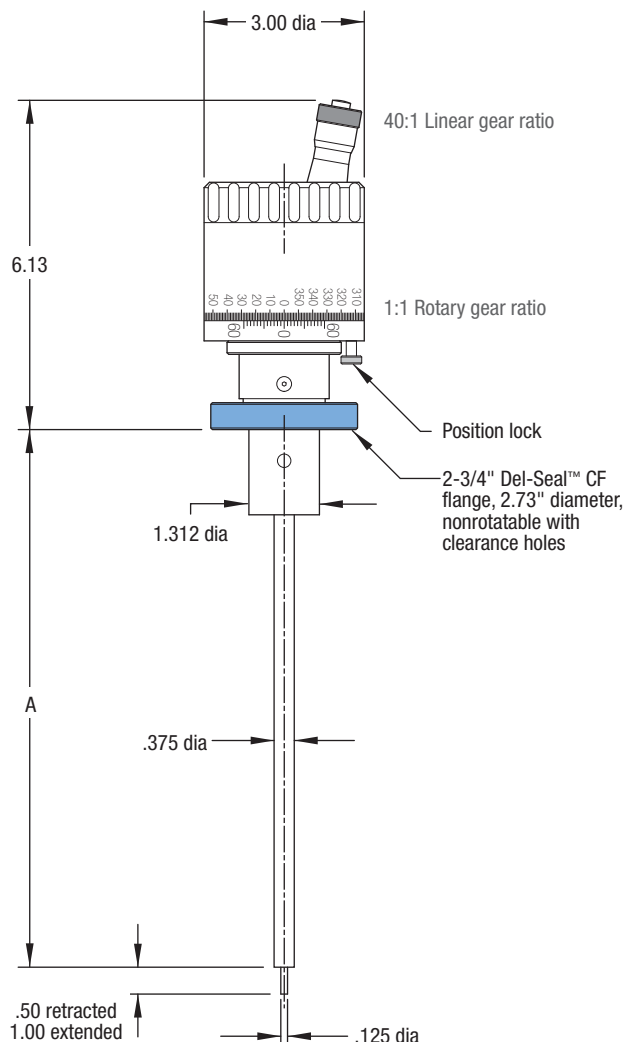
Axial load

Rotary	5 lb maximum
Linear	1 lb maximum

Lateral load	10 lb @ 2" extension maximum
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Weight & Dimensions	See table
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¹ UHV units are bakeable to 30°C maximum when motorized.



ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 230°C

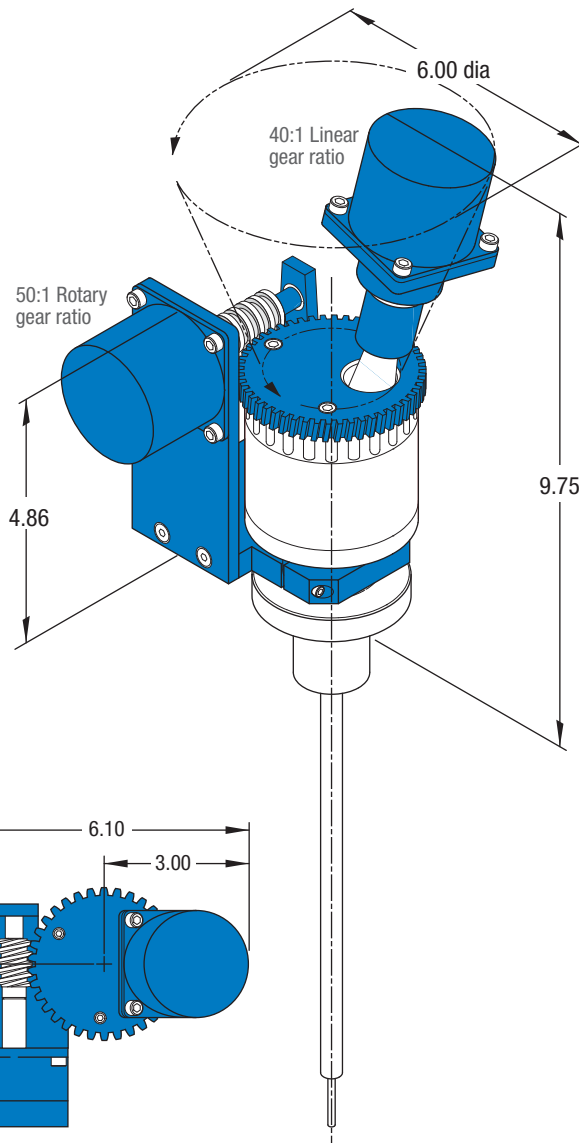
FLANGE SIZE	FLANGE O.D.	A	WT LB	REFERENCE	PART NUMBER
2-3/4	2.73	10.00	8	PBRM2-10	670025
2-3/4	2.73	15.75	8	PBRM2-15	670028
2-3/4	2.73	23.62	9	PBRM2-23	670031
2-3/4	2.73	31.50	9	PBRM2-31	670034

Motorization Options



MOTORIZATION ²	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
ROTARY AXIS	D	5	-01
LINEAR AXIS	D	2	-02

² When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 670025-01-02. For total unit weight, add option weight to component weight. Refer to page 460 for motor specifications.



Top view



ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion and 8 inch linear travel
- Manual actuator
- UHV or HV compatible materials
- Differentially pumped, Dual FKM / FPM fluoroelastomer elastomer shaft seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

Differentially pumped direct drive rotary-linear motion feedthroughs are a basic and economical solution for vacuum applications requiring both rotary and linear motion. Their simple construction provides 100 lb-in of manual rotational torque.

The rotary shaft is supported by two phosphor bronze bearings and uses dual FKM / FPM fluoroelastomer elastomer shaft seals. The region between the seals can be differentially pumped through the 1/8" female pipe thread port provided and thus attain UHV compatibility to 10^{-9} Torr. Feedthroughs are available on industry standard Conflat® compatible 2-3/4" diameter Del-Seal™ CF metal seal flanges or ISO KF NW40 Kwik-Flange™ port mounts.

Specifications

Material

Flange / Actuator body 304ss

Shaft seal FKM / FPM fluoroelastomer

Vacuum Range UHV / HV 1×10^{-9} Torr / 1×10^{-8} Torr

Temperature Range¹ UHV / HV -20°C to 100°C

Torque 100 lb-in maximum

Axial load (no lock to support weight) 10 lb maximum

Lateral load 5 lb @ 2" extension maximum

Weight & Dimensions See table

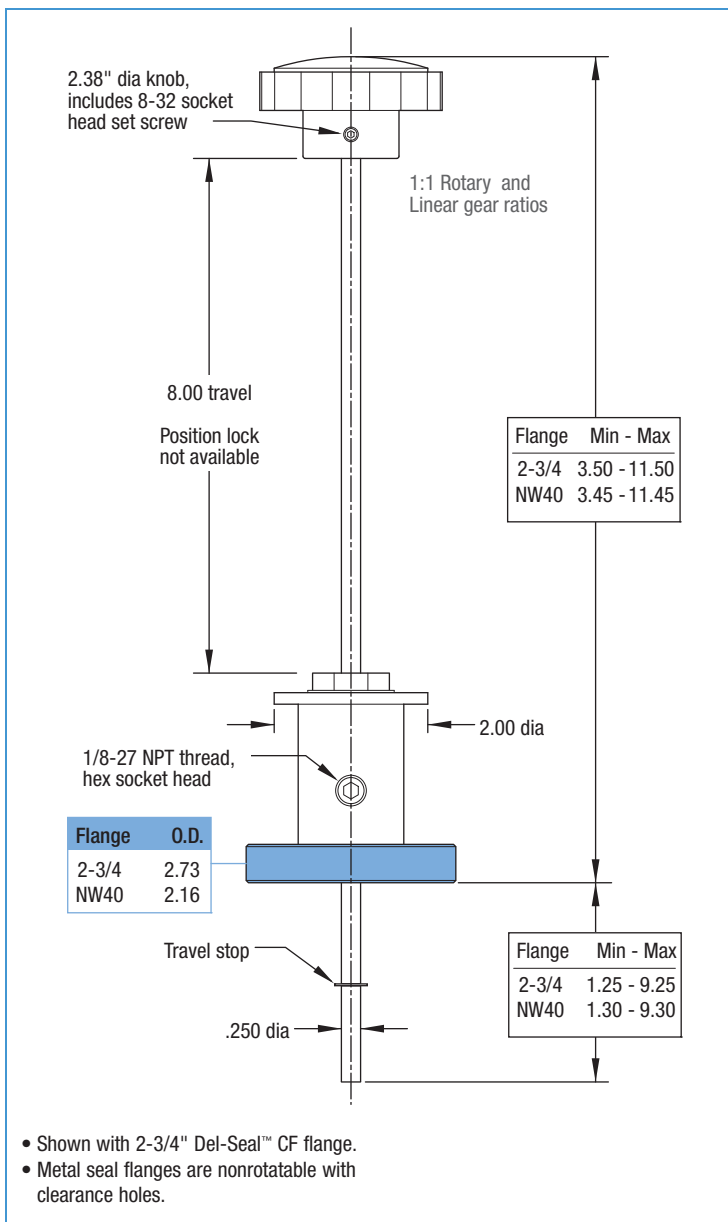
DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4 UHV	3	CRPP-1	672008

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW40 HV	2	K-CRPP-1	672009

¹ UHV units are bakeable to 150°C with actuator removed.



CRPP-1





ULTRAHIGH & HIGH VACUUM SERIES

Features

- 4-1/2 inch linear travel and 22° wobble motion
- Manual actuator
- Angular position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

Wobble stick linear-angular motion feedthroughs are basic and manual sample motion devices. They provide quick action linear travel and angular wobble motion via a stainless steel hand-held actuator shaft with a ball and socket joint design. They are typically operated by observing sample motion through a vacuum viewport. The actuators angular position can be locked in place by tightening the lock collar located on the port mount flange. Wobble stick linear-angular motion feedthroughs are offered with 4-1/2 inch linear travel and a maximum 22° of angular wobble with unrestricted mating flange and port diameter. Reentrant, welded stainless steel bellows are standard on these products. Feedthroughs are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or ISO KF Kwik-Flange™ port mounts.

Specifications

Material

Flange / Actuator body 304ss

Shaft seal AM 350 welded bellows

Vacuum Range UHV / HV 1x10⁻¹¹ Torr / 1x10⁻⁸ Torr

Temperature Range¹ UHV / HV -20°C to 100°C

Axial load (no lock to support weight) 20 lb maximum

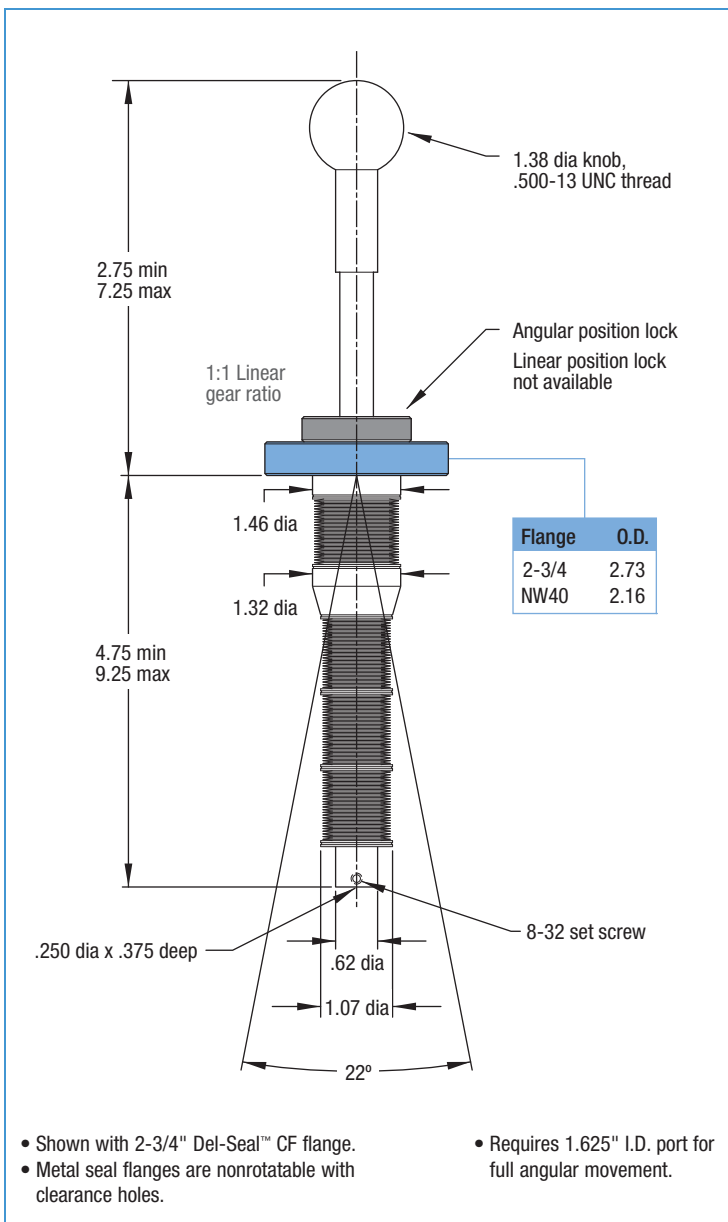
Lateral load 20 lb @ 4" extension maximum

Weight & Dimensions See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4 UHV	3	SU-275	696000

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW40 HV	2	K150-SU	696001

¹ UHV units are bakeable to 230°C with actuator removed.





ULTRAHIGH & HIGH VACUUM SERIES

Features

- 4-1/2 inch linear travel and 22° wobble, with pincer-grip
- Manual actuator
- Angular position lock
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

Wobble sticks with pincer action are identical to the wobble-linear products, except for the addition of an integral and articulated sample holding pincer mechanism. The pincer is activated via two shaft mounted finger grips allowing the pincer jaws to grip 0.880" maximum sample diameters. These feedthroughs provide quick action linear-angular motion via a manually activated shaft with ball and socket joint design. They are typically operated by observing sample motion through a vacuum viewport. Angular position can be locked with an integral lock collar located on the port mount flange. They are available on industry standard Conflat® compatible Del-Seal™ CF metal seal flanges or Kwik-Flange™ port mounts.

Specifications

Material

Flange / Actuator body 304ss

Shaft seal AM 350 welded bellows

Vacuum Range UHV / HV 1×10^{-11} Torr / 1×10^{-8} Torr

Temperature Range¹ UHV / HV -20°C to 100°C

Axial load 2 lb maximum

Lateral load 2 lb maximum

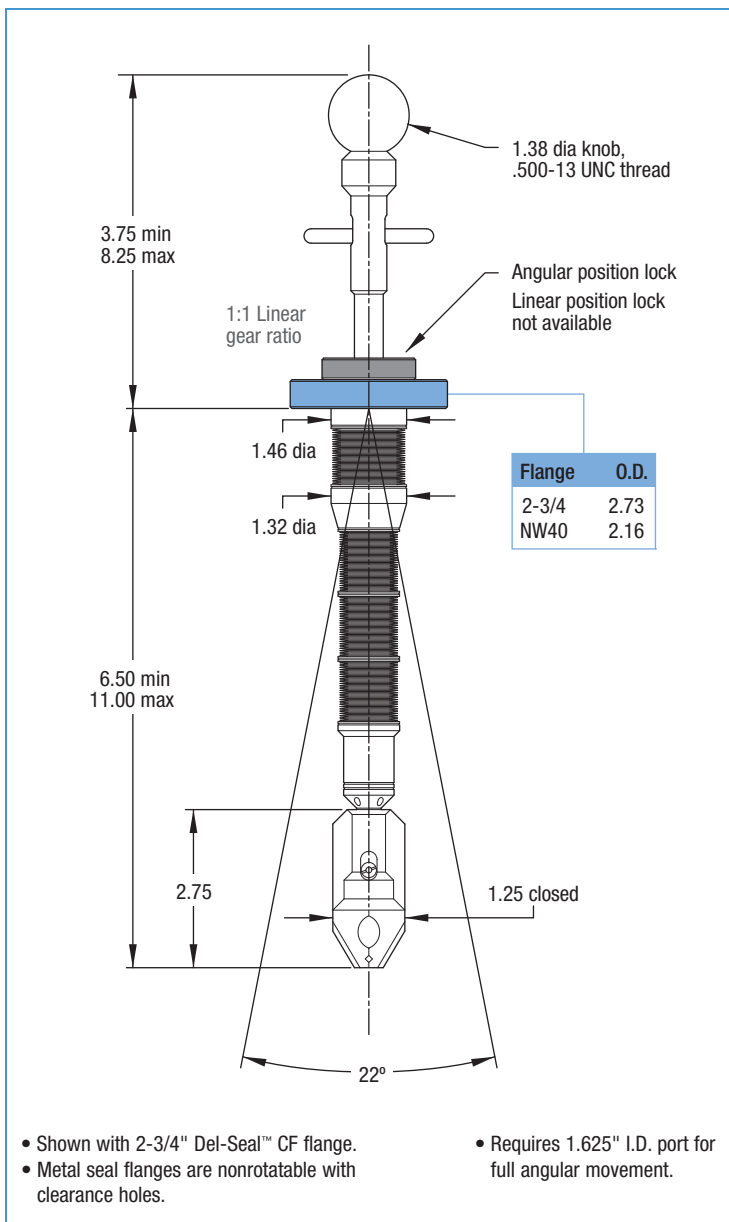
Weight & Dimensions See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4 UHV	3	VGU-275	695000

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW40 HV	2	K150-VGU	695001

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
JAW KIT, BLANK	1	DG-275-BJ	694001

¹ UHV units are bakeable to 230°C with actuator removed.





ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion, 4-1/2 inch linear travel and 22° wobble, with pincer-grip
- Manual actuator
- Linear and angular position locks
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 100°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

These products are rotary-linear-pincer action wobble sticks identical to the linear and linear-pincer wobble stick products with the addition of full 360° rotary motion. The pincer mechanism is activated via two shaft mounted finger grips allowing the pincer jaws to grip up to 0.880" sample diameters. These feedthroughs provide quick action rotary, linear and angular motion with an actuator shaft ball and socket joint design. Angular and linear positions can be locked with integral lock collars located on the port mount flange and actuator shaft. They are available on industry standard Del-Seal™ CF metal seal flanges or Kwik-Flange™ port mounts.

Specifications

Material

Flange / Actuator body 304ss / Aluminum

Shaft seal AM 350 welded bellows

Vacuum Range UHV / HV 1×10^{-11} Torr / 1×10^{-8} Torr

Temperature Range¹ UHV / HV -20°C to 100°C

Torque 50 oz-in maximum

Axial load 2 lb maximum

Lateral load 2 lb maximum

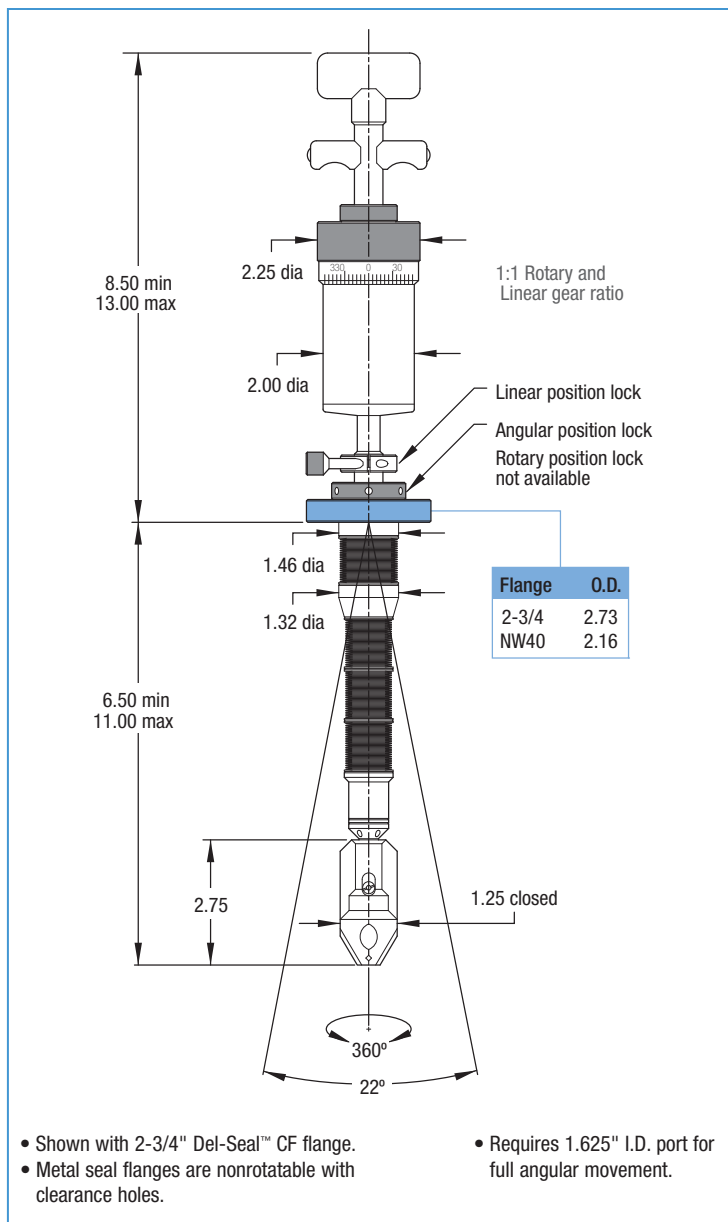
Weight & Dimensions See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
2-3/4 UHV	3	DG-275	694000

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW40 HV	2	K150-DG	694002

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
JAW KIT, BLANK	1	DG-275-BJ	694001

¹ UHV units are bakeable to 230°C with actuator removed.





ULTRAHIGH & HIGH VACUUM SERIES

Features

- 1/2 or 2 inch linear travel and 44° or 60° wobble, respectively
- Manual actuator
- UHV or HV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF and Kwik-Flange™ port mounts

Description

Wide angle wobble sticks, the most basic products of the wobble stick family provide an economical solution for light duty sample motion and manipulation. They are stripped down wobble sticks ideally suited for user customization. Under vacuum load the bellows are compressed and the shaft completely extended into the vacuum chamber. Offered in two models they provide 44° and 60° of angular displacement respectively. They are available with both Conflat® compatible Del-Seal™ CF metal seal flanges and Kwik-Flange™ ISO KF elastomer seal flanges.

Specifications

Material

Flange / Actuator body 304ss

Shaft seal AM 350 welded bellows

Vacuum Range UHV / HV 1×10^{-11} Torr / 1×10^{-8} Torr

Temperature Range

UHV -20°C to 230°C

HV -20°C to 150°C

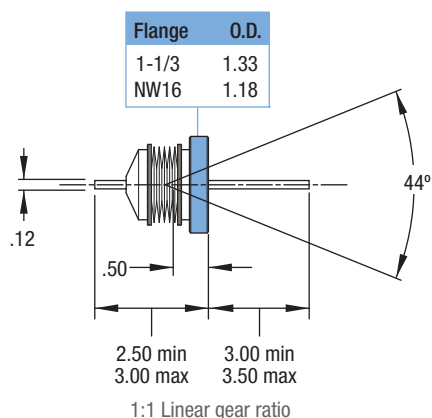
Weight & Dimensions

See table

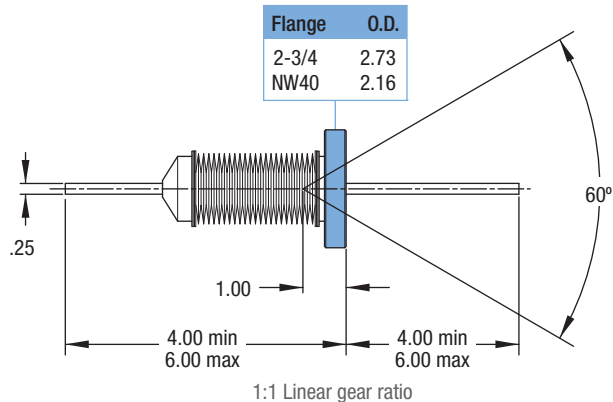
DESCRIPTION	WT LB	REFERENCE	PART NUMBER
1-1/3 UHV	3	WS-133	693001
2-3/4 UHV	3	WS-275	693000

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
NW16 HV	3	K075-WS	693002
NW40 HV	3	K150-WS	693003

1/2" Linear Travel, 44° Wobble



2" Linear Travel, 60° Wobble



- Requires 1.625" I.D. port for full angular movement.
- Position lock not available



Manipulation

Introductions	414, 430, 443
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XYZ Stages

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Triple axis micrometer driven XYZ Stages page 426

- V-Plane® XY and Z stages
- V-Plane® Guide Tubes
- Compact XY and Z stages
- Heavy duty Z stages
- Standard XY and Z stages
- Rotatable axis stages

V-Plane® XY and Z Stages

MDC's V-Plane® modular stages are building block components designed to streamline the implementation of a sample manipulation system. They can be used as stand alone components or combined with other V-Plane® instruments to attain customized motion and manipulation solutions. V-Plane® dual axis XY stages are micrometer driven and guided by cross roller bearing slides. MDC micrometers have unique laser etched plus-minus scales that indicate positive or negative port displacement. V-Plane® single axis stages employ handwheel and worm gear reduction drive mechanisms with linear displacement measured along the stage's frame mounted scale. Z axis linear travels of up to 36" are available. MDC V-Plane® stages provide precise sample motion and manipulation of samples inside ultrahigh vacuum environments. V-Plane® Z stages can also be fitted with guide tubes to further expand their capabilities. For a step-by-step pictorial description of a typical guide tube installation and usage reference page 421 of this catalog.

V-Plane® Guide Tubes

MDC guide tubes provide bellows support for V-Plane® manipulator stages fitted with long-stroke bellows as well as secondary rotary and linear motion feedthroughs installed on the stage. Guide tubes mount directly onto V-Plane® manipulator stages fitted with 2-3/4" Del-Seal™ CF port flanges with a bore clearance suitable for the 1.125" guide tube diameter. They are supplied with both rotary and linear bearing supports. Rotary bearings for .250" and .375" diameter shafts are

included. For applications requiring sample heating, cooling, high voltage biasing, thermocouple temperature measurements, etc., the guide tube tip has been fitted with two slots 180° apart through which wires or tubes can be fed. Four 1-1/3" and one 2-3/4" Del-Seal™ CF flange accessory ports allow the installation of up to five additional accessory components. When a manipulator stage is not under vacuum or is let up to air with the bellows in some state of compression, the compressed bellows' spring force may force the bellows to shift off-axis at some point during its travel. The off-axis shift could be sudden and violent causing user injury or damage to the bellows. MDC recommends that all long-stroke 1.50" diameter bore Z axis V-Plane® stages, with linear travels exceeding six inches, be fitted with guide tubes.

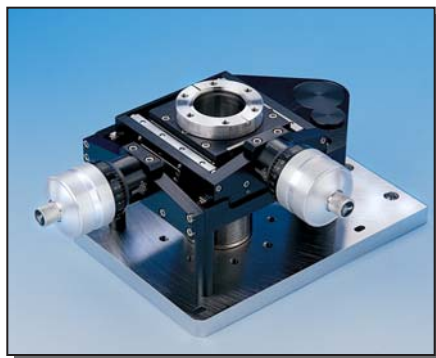
Rotatable Axis Stages

Rotatable axis stages replace conventional rotatable mounting tables previously offered by MDC. They provide 360° positioning with greater precision, control and ease of use. Rotatable stages are constructed with worm gear drive mechanisms which offer substantial mechanical advantage over non-g geared designs, a feature which allows effortless manual operation, even under a full vacuum load. High torque stepper motors are also available for these stages. MDC rotatable stages can be used to rotate heavy samples or sample support apparatus and structures. Two spring energized PTFE face seals are at the heart of the rotatable stage's sealing mechanism. With provision for differential pumping between the seals, these rotatable stages can be used in UHV environments with bakeout temperatures as high as 200°C.

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to discolor when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.



Dual axis, micrometer driven XY stage page 416



Single axis 360° rotating stages page 428

Standard XY and Z Stages

Standard XYZ stages are large bore stages which incorporate triple axis motion in a single stage. The XY travels are micrometer driven and guided by cross roller bearing slides. MDC micrometers have unique laser etched plus-minus scales that indicate positive or negative port displacement and are available for 0.500" or 1.00" of linear XY displacement. The Z axis employs a handwheel and worm gear reduction drive mechanism with displacement measured along the stage's frame mounted scale. Z axis linear travels of up to 12" are available. MDC standard stages provide precise sample motion and manipulation of samples inside ultrahigh vacuum environments.

Compact XY and Z Stages

Compact stages are small footprint single or triple axis stages and are ideally suited for applications with limited space. They are available in a Z only or XYZ configuration. They provide the means for precise sample manipulation inside ultrahigh vacuum environments.

Typical Installation

Precision Rotary-Linear drives can be found on page 404

Extended length rotary drives can be found on page 380

V-Plane® Guide Tubes include four 1-1/3" Del-Seal™ CF ports for electrical accessories

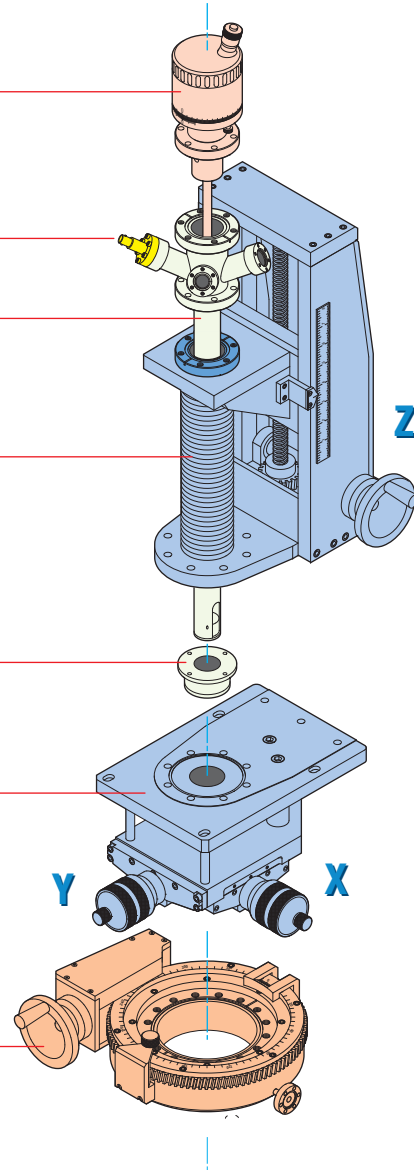
V-Plane® Guide Tubes can be found on page 420

V-Plane® Z axis stages can be found on page 418

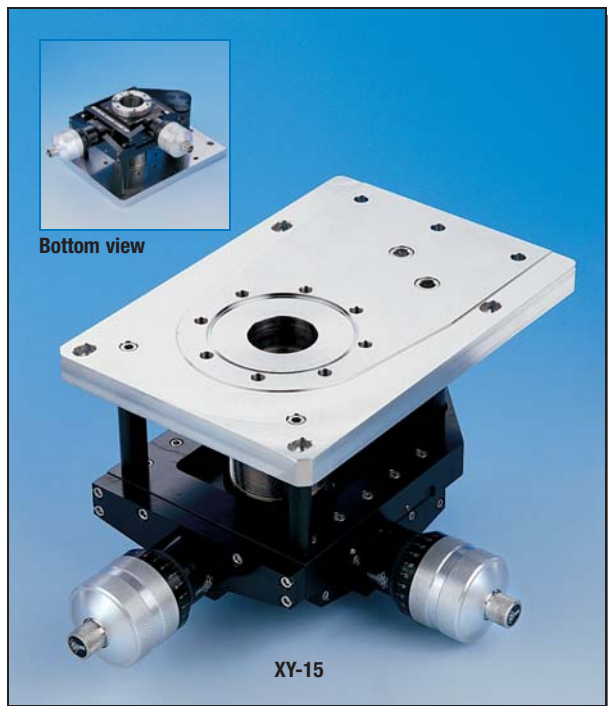
Linear and rotary bearing guides are included with the guide tubes

V-Plane® Dual axis XY stages can be found on page 416

Rotatable stages provide 360° of positioning and can be found on page 428



Intermediate hardware may be required for joining components.
These have been omitted for clarity.



Description

MDC's V-Plane® modular stages are building block components designed to streamline the implementation of a sample manipulation system. They can be used as stand alone components or combined with other V-Plane® instruments to attain customized motion and manipulation solutions.

V-Plane® dual axis XY stages are micrometer driven and guided by cross roller bearing slides. Micrometers have unique laser etched plus-minus scales that indicate positive or negative port displacement. MDC V-Plane® dual axis XY stages provide precise motion and manipulation of samples inside ultrahigh vacuum environments. Dual axis XY stages can be stacked with V-Plane® single axis Z stages and also fitted with guide tubes to further expand their capabilities. Look for the symbol for other mating building block components.

Specifications

Material	
Flange	304ss
Actuator body	Anodized aluminum
Bellows	AM 350
Vacuum Range	1×10^{-11} Torr
Temperature Range ²	-20°C to 230°C
Weight & Dimensions	See table

¹ Reference page 414 for related V-Plane® components.

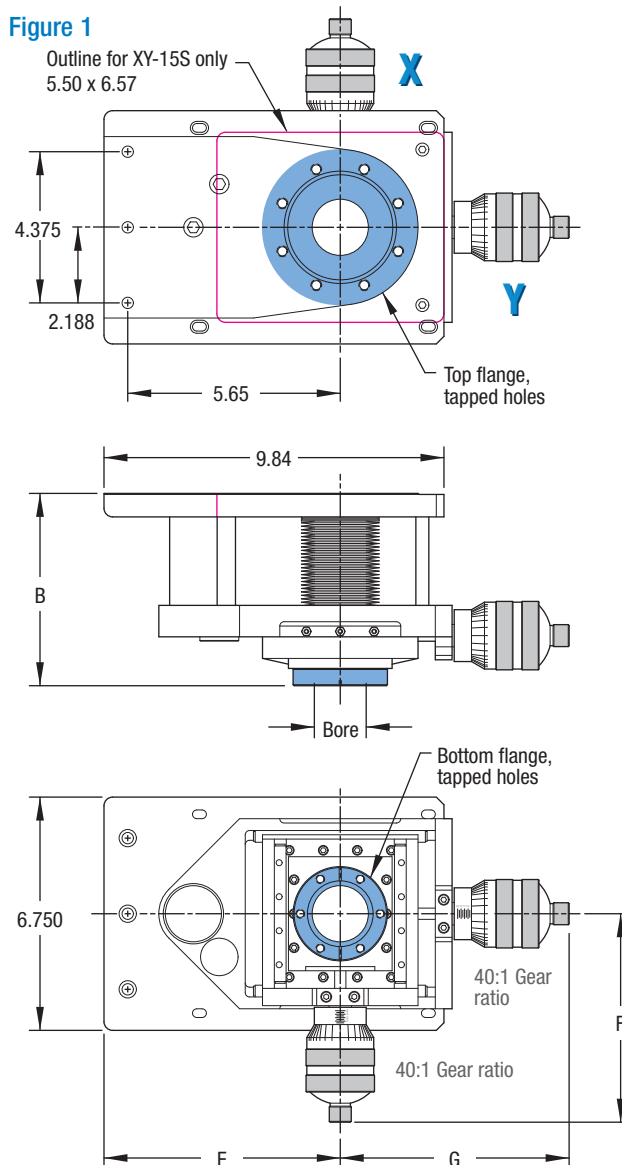
² Units are bakeable to 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

Features

- V-Plane® building block component¹
- Plus or minus 1/2 and 1 inch off center XY motion
- 1-1/2 to 4 inch bore diameters
- Manual or Motorized actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts

Figure 1



V-Plane®

Dual Axis XY Stage

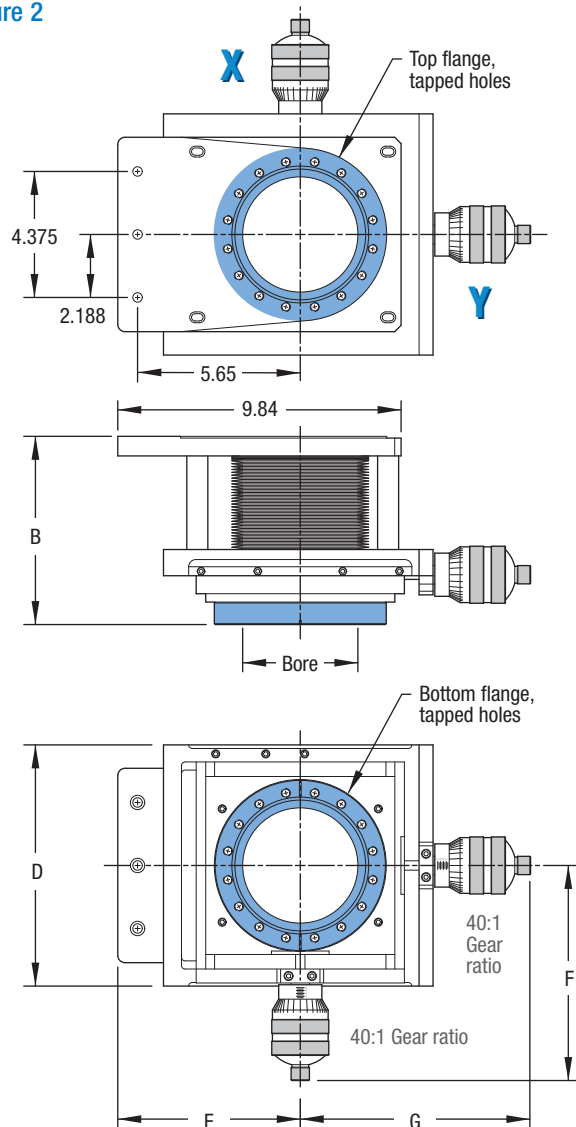
Section 7.2

BORE SIZE	TRAVEL ⁴	FIGURE	TOP FLANGE	BOTTOM FLANGE	B	D	E	F	G	H	J	WT LB	REFERENCE	PART NUMBER
1.50	0.50	1	2-3/4	2-3/4	5.00	-	3.25	5.75	6.18	7.63	8.23	24	XY-15S	677020
1.50	0.50	1	4-1/2	2-3/4	5.62	-	6.33	5.75	6.18	7.63	8.23	25	XY-15	677002
2.50	0.50	1	4-1/2	4-1/2	5.75	-	6.33	6.50	6.87	8.26	8.83	28	XY-25	677003
2.50	0.50	1	4-1/2	6	5.85	-	6.33	7.47	8.00	9.07	9.60	29	XY-26	677016
2.50	1.00	1	4-1/2	4-1/2	6.62	-	6.33	9.12	9.75	9.26	9.83	28	LXY-25	677006
2.50	1.00	1	4-1/2	6	6.72	-	6.33	9.12	9.75	10.07	10.60	29	LXY-26	677017
4.00 ³	0.50	2	4-1/2	6	6.50	8.37	6.33	7.47	8.00	9.07	9.60	30	XY-40	677004
4.00	0.50	2	6	6	6.50	8.37	6.33	7.47	8.00	9.07	9.60	32	XY-44	677005
4.00 ³	1.00	2	4-1/2	6	7.25	8.37	6.33	10.00	10.50	10.07	10.60	32	LXY-40	677007
4.00	1.00	2	6	6	7.25	8.81	6.33	10.25	10.05	10.07	10.60	34	LXY-44	677008

³ 4.00" bore diameter is reduced to 2.50" at 4-1/2" top flange

⁴ Match sample support structure and stage bore for maximum XY travel.

Figure 2

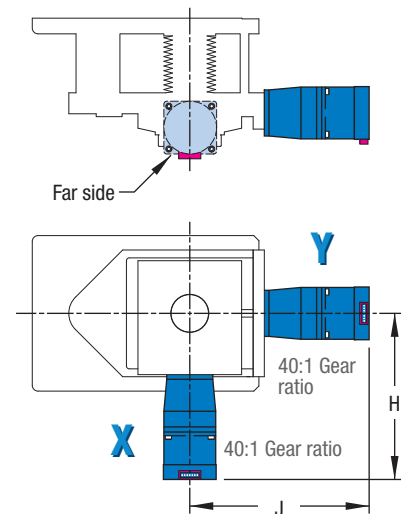


Motorization Options

⁵ When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 677020-01. For total unit weight, add option weight to component weight. Refer to page 460 for motor specifications.



MOTORIZATION ⁵	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
XY INLINE STEPPER	D	3	-01





Description

MDC's V-Plane® modular stages are building block components designed to streamline the implementation of a sample manipulation system. They can be used as stand alone components or combined with other V-Plane® instruments to attain customized motion and manipulation solutions. V-Plane® single axis stages employ handwheel and worm gear reduction drive mechanisms with linear displacement measured along the stage's frame mounted scale. Z axis linear travels of up to 36" are available. MDC V-Plane® stages provide precise sample motion and manipulation of samples inside ultrahigh vacuum environments. MDC recommends that all long-stroke 1-1/2" diameter bore Z axis V-Plane® stages, with linear travels exceeding six inches, be fitted with guide tubes. See page 420 for guide tube ordering information. Look for the ➤ symbol for other mating building block components.

Specifications

Material

Flange	304ss
Actuator body	Anodized aluminum
Bellows	AM 350

Vacuum Range 1x10⁻¹¹ Torr

Temperature Range ² -20°C to 230°C

Weight & Dimensions See table

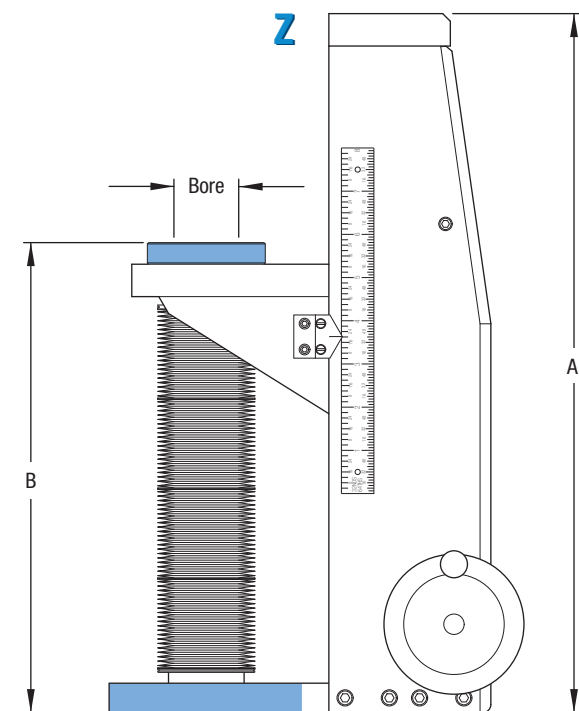
¹ Reference page 414 for related V-Plane® components.

² Units are bakeable to 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

Features

- V-Plane® building block component¹
- 6 to 36 inch Z-Axis travel
- 1-1/2 to 4 inch bore diameters
- Manual or Motorized actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts



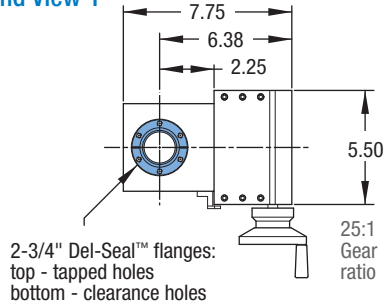
All LMTA flanges nonrotatable

ULTRAHIGH VACUUM SERIES

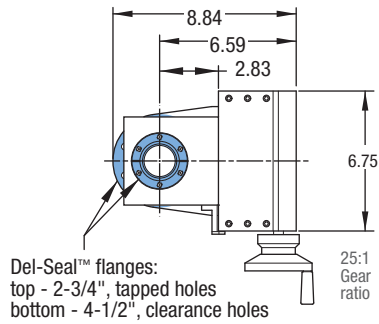
Del-Seal™ CF

230°C

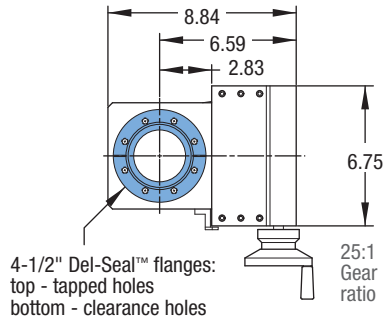
End View 1



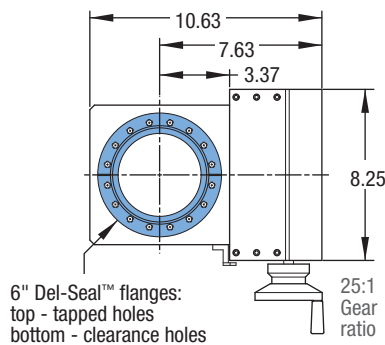
End View 2



End View 3



End View 4

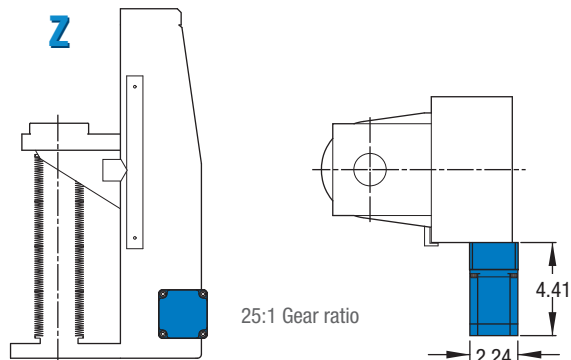


BORE SIZE	Z TRAVEL	END VIEW	A	B MIN - MAX	WT LB	REFERENCE	PART NUMBER
1.50	6.00	1	13.2	6.7 - 12.7	38	LMTA-1506S	665540
1.50	8.00	1	15.2	6.7 - 14.7	42	LMTA-1508S	665541
1.50	12.00	1	21.4	8.9 - 20.9	50	LMTA-1512S	665542
1.50	16.00	1	27.7	11.2 - 27.2	58	LMTA-1516S	665543
1.50	24.00	1	40.3	15.8 - 39.8	74	LMTA-1524S	665544
1.50	36.00	1	59.1	22.6 - 58.6	98	LMTA-1536S	665545
1.50	6.00	2	14.2	7.6 - 13.6	40	LMTA-1506	665528
1.50	8.00	2	16.2	7.6 - 15.6	44	LMTA-1508	665529
1.50	12.00	2	20.2	7.6 - 19.6	52	LMTA-1512	665530
1.50	16.00	2	26.2	9.6 - 25.6	60	LMTA-1516	665531
1.50	24.00	2	38.2	13.6 - 37.6	76	LMTA-1524	665532
1.50	36.00	2	56.2	19.6 - 55.6	100	LMTA-1536	665533
2.50	6.00	3	14.0	7.6 - 13.6	45	LMTA-2506	665552
2.50	8.00	3	16.0	7.6 - 15.6	49	LMTA-2508	665553
2.50	12.00	3	21.4	9.0 - 21.0	57	LMTA-2512	665554
2.50	16.00	3	26.7	10.3 - 26.3	65	LMTA-2516	665555
2.50	24.00	3	37.4	13.0 - 37.0	81	LMTA-2524	665556
2.50	36.00	3	53.4	17.0 - 53.0	105	LMTA-2536	665557
4.00	6.00	4	14.0	7.7 - 13.7	50	LMTA-4006	665564
4.00	8.00	4	16.0	7.7 - 15.7	54	LMTA-4008	665565
4.00	12.00	4	20.0	7.7 - 19.7	62	LMTA-4012	665566
4.00	16.00	4	25.0	8.8 - 24.8	70	LMTA-4016	665567
4.00	24.00	4	35.2	10.9 - 34.9	86	LMTA-4024	665568
4.00	36.00	4	50.3	14.0 - 50.0	110	LMTA-4036	665569

Motorization Options

MOTORIZATION ³	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
Z INLINE STEPPER	F	3	-01

³ When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 665540-01. For total unit weight, add option weight to component weight. Refer to page 461 for motor specifications.





ULTRAHIGH VACUUM SERIES

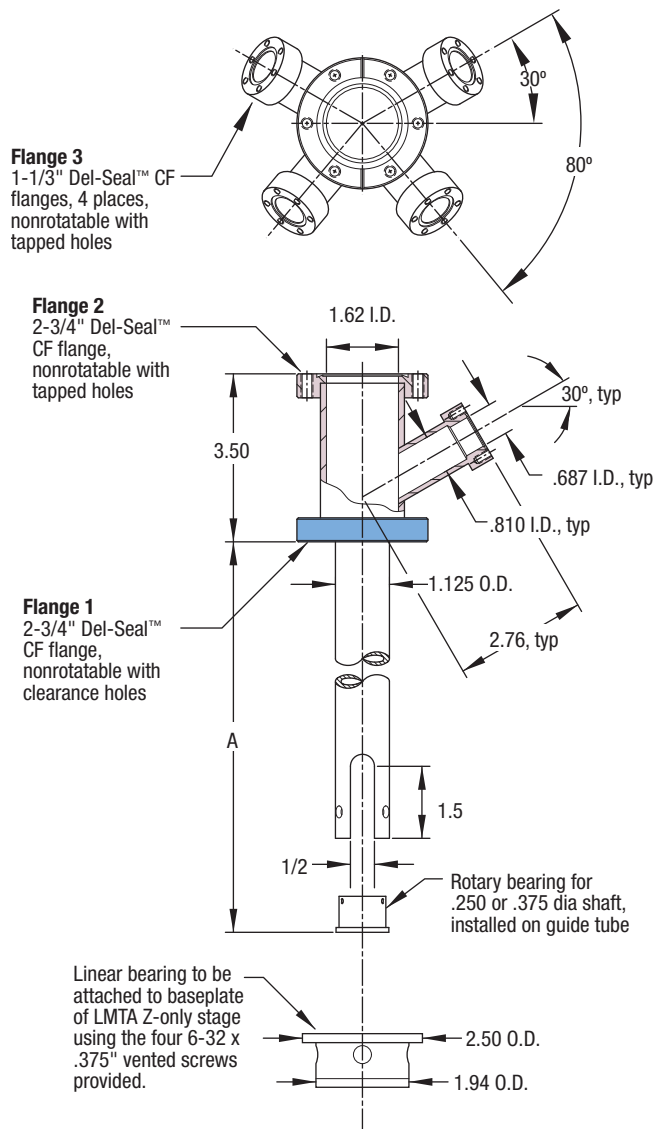
Features

- V-Plane® building block component¹
- Used with 1-1/2 inch bore Z-axis V-Plane® stages with greater than 6 inch travel
- Bakeable to 230°C
- 1-1/3 inch Del-Seal™ CF access ports
- Linear bearing guide tube support
- Includes 1/4 and 3/8 inch diameter shaft rotary bearing supports

Description

MDC guide tubes provide bellows support for V-Plane® manipulator stages fitted with long-stroke bellows as well as secondary rotary and linear motion feedthroughs installed on the stage. Guide tubes mount directly onto V-Plane® manipulator stages fitted with 2-3/4" Del-Seal™ CF port flanges with a bore clearance suitable for the 1.125" guide tube diameter. They are supplied with both rotary and linear bearing supports. Rotary bearings for .250" and .375" diameter shafts are included. For applications requiring sample heating, cooling, high voltage biasing, thermocouple temperature measurements, etc., the guide tube tip has been fitted with two slots 180° apart through which wires or tubes can be fed. Four 1-1/3" and one 2-3/4" Del-Seal™ CF flange accessory ports allow the installation of up to five additional accessory components. When a manipulator stage is not under vacuum or is let up to air with the bellows in some state of compression, the compressed bellows' spring force may force the bellows to shift off-axis at some point during its travel. The off-axis shift could be sudden and violent causing injury or damage to the bellows.

MDC recommends that all long-stroke 1.50" diameter bore Z axis V-Plane® stages, with linear travels exceeding six inches, be fitted with guide tubes. Look for the ➤ symbol for other mating building block components. Note that the linear bearing support on a guide tube requires a 2.5" bore in any mating component.



Specifications

Material

Flange / Body	304ss
Bearings	300 series stainless steel with Diconite® coating

Vacuum Range	1x10 ⁻¹¹ Torr
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Temperature Range	-200 to 230°C
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Weight & Dimensions	See table
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¹ Reference page 414 for related V-Plane® components.

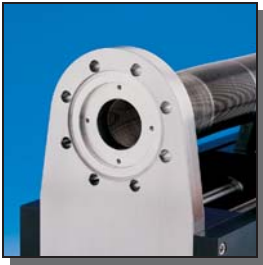
ULTRAHIGH VACUUM SERIES

Del-Seal™ CF 230°C

A	USE ² WITH	FLANGE 1	FLANGE 2	FLANGE 3	WT LB	REFERENCE	PART NUMBER
19.50	665528	2-3/4	2-3/4	1-1/3	8	GT-1506	665576
21.50	665529	2-3/4	2-3/4	1-1/3	8	GT-1508	665577
25.50	665530	2-3/4	2-3/4	1-1/3	9	GT-1512	665578
31.50	665531	2-3/4	2-3/4	1-1/3	10	GT-1516	665579
43.50	665532	2-3/4	2-3/4	1-1/3	12	GT-1524	665580
61.50	665533	2-3/4	2-3/4	1-1/3	14	GT-1536	665581

² Use with 1.50 inch bore, single axis Z stages on page 418.

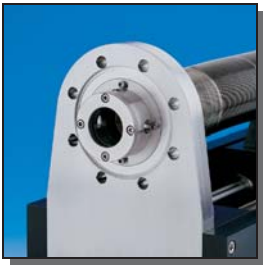
Typical Guide Tube Application



The 4-1/2" Del-Seal™ CF base flange on V-Plane® stages with 1-1/2" bore is fitted with a counterbore and four tapped holes. This counterbore and tapped holes provide the means of attaching the guide tube's linear bearing support.



The guide tube extends into vacuum beyond the linear bearing support. The rotary bearing radial screws, located at guide tube tip, may need removing to properly fit guide tube through linear bearing housing.



The linear bearing support is shown fastened to the 4-1/2" Del-Seal™ CF base flange of a V-Plane® single axis Z stage using four vented stainless steel socket head screws supplied with each guide tube assembly. The linear bearing support requires a 2.5" bore in any mating component.



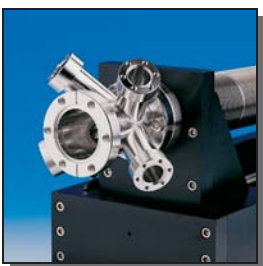
Other motion products may be attached to the guide tube's main flange. Shown here is a precision rotary-linear instrument found in Section 7.3, page 404.



Six threaded studs are fastened to the V-Plane® Z axis stage top flange prior to inserting the guide tube through the top flange and bellows.



The rotary-linear drive shaft extends into vacuum beyond the rotary bearing support on the guide tube tip.



The guide tube assembly is secured to the V-Plane® Z axis stage top flange using the nuts and washers supplied.



Four mini Del-Seal™ CF ports can be used for the input or output of sample voltage biasing as well as thermocouple and other instrumentation signals. Insulated wires exit into vacuum through slots on guide tube tip.



Description

Compact single axis Z stages have smaller footprints than V-Plane® and other stages. They are a practical and economical solution for applications with limited space. Models with one to four inches of linear travel and bore diameters from 0.50" to 2.50" are available. The instrument's precision drive employs a fine pitch lead screw mechanism. Approximate positions can be measured along a graduated machinist's scale with both inch and millimeter units included. Top and bottom port flanges are available in 1-1/3", 2-3/4" and 4-1/2" Conflat® compatible, tapped Del-Seal™ CF metal seal flanges. Edge welded stainless steel bellows are used to connect the port flanges on all com-pact stages.

Specifications

Material

Flange / Body 304ss

Bellows AM 350

Vacuum Range 1×10^{-11} Torr

Temperature Range ¹ -20°C to 230°C

Weight & Dimensions See table

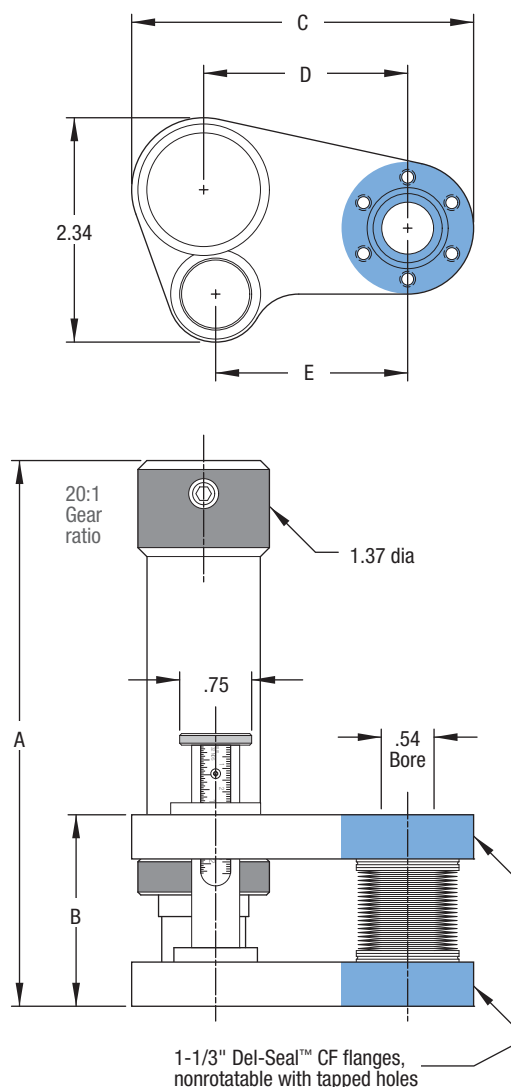
¹ Units are bakeable to 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

Features

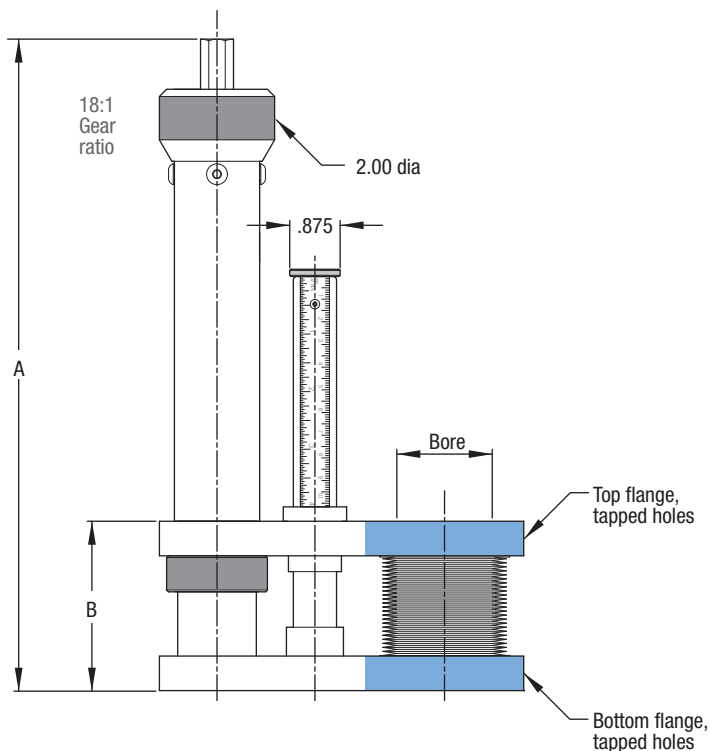
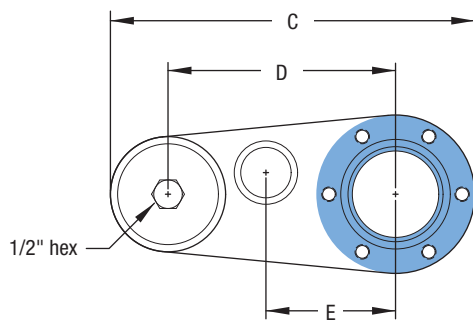
- 1 to 4 inch Z-axis travel
- 1/2, 1-1/2 and 2-1/2 inch bore diameters
- Manual or Motorized actuator
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts

Figure 1



BORE SIZE	LINEAR TRAVEL	FLANGE SIZE	FIGURE	A MIN - MAX	B MIN - MAX	C	D	E	F	G	WT LB	REFERENCE	PART NUMBER
0.54 ³	1.00	1-1/3	1	5.00 6.00	1.56 2.56	3.56	2.13	2.00	-	-	5	LMT-051	665516
0.54 ³	2.00	1-1/3	1	6.40 8.40	2.00 4.00	3.56	2.13	2.00	-	-	5	LMT-052	665517
1.50	1.00	2-3/4	2	8.71 9.71	2.20 3.20	6.33	3.95	2.25	8.62	8.33	8	LMT-151	665501
1.50	2.00	2-3/4	2	8.71 10.71	2.20 4.20	6.33	3.95	2.25	9.62	8.33	9	LMT-152	665503
1.50	4.00	2-3/4	2	11.32 15.32	2.95 6.95	6.33	3.95	2.25	15.25	5.25	11	LMT-154	665505
1.50	6.00	2-3/4	2	13.75 19.75	3.25 9.25	6.33	3.95	2.25	20.25	8.33	13	LMT-156	665520
2.50	1.00	4-1/2	2	8.71 9.71	2.20 3.20	8.13	4.60	2.88	8.62	9.85	8	LMT-251	665522
2.50	2.00	4-1/2	2	8.71 10.71	2.20 4.20	8.13	4.60	2.88	9.62	9.85	9	LMT-252	665523
2.50	4.00	4-1/2	2	11.32 15.32	2.95 6.95	8.13	4.60	2.88	15.25	9.85	11	LMT-254	665524

Figure 2



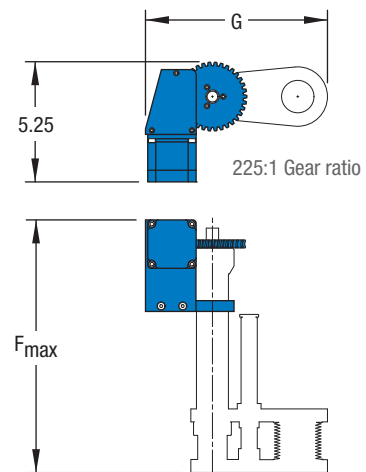
Motorization Options

² When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 665516-01. For total unit weight, add option weight to component weight. Refer to page 460 for motor specifications.

³ Motorization not available on 0.54" bore diameter stages.



MOTORIZATION ²	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
Z SIDE MOUNT	E	3	-01





Description

Compact triple axis XYZ stages have smaller footprints than V-Plane® stages. They are a practical and economical solution for applications with limited space. Models with two and four inch-es of linear travel and bore diameter of 1.50" and 2.50" are available. The instruments precision Z drive employs a fine pitch lead screw mechanism with approximate positions measured along a graduated machinist's scale with both inch and mil-limeter units included. The XY axes are micrometer driven and guided by cross roller bearing slides. Micrometers have unique laser etched plus-minus scales that indicate positive or nega-tive port displacement. MDC triple axis XY stages provide pre-cise motion and manipulation of samples inside ultrahigh vacu-um environments. Top and bottom port flanges are available in 2-3/4" and 4-1/2" Conflat® compatible, tapped Del-Seal™ CF metal seal flanges. Edge welded stainless steel bellows are used to connect the port flanges on all XYZ compact stages.

Specifications

Material

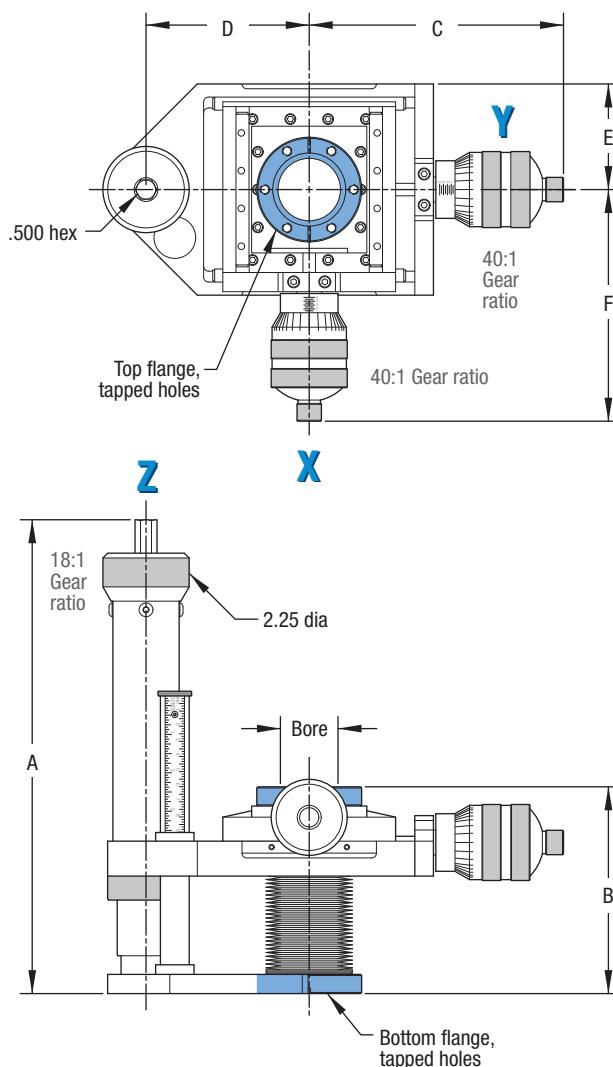
Flange	304ss
Actuator body	Anodized aluminum
Bellows	AM 350
Vacuum Range	1×10^{-11} Torr
Temperature Range¹	-20°C to 230°C
Weight & Dimensions	See table

¹ Units are bakeable to 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

Features

- 2 or 4 inch Z-axis travel
- Plus or minus 1/2 inch off center XY motion
- 1-1/2 and 2-1/2 inch bore diameters
- Manual or Motorized actuators
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts



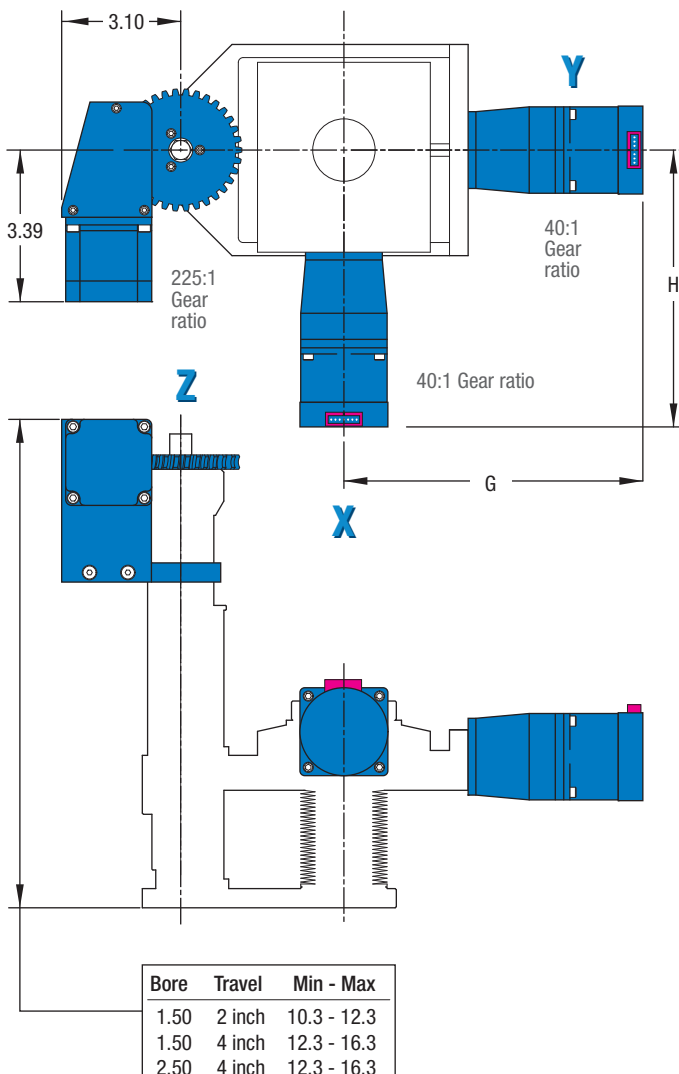
Triple Axis Compact XYZ Stage

Section 7.2



BORE SIZE	± XY TRAVEL	Z TRAVEL	FLANGE	A MIN - MAX	B MIN - MAX	C	D	E	F	G	H	WT LB	REFERENCE	PART NUMBER
1.50	0.50	2	2-3/4	9.8 11.8	4.9 6.9	6.45	4.13	2.75	5.90	8.50	7.78	24	PSM-1502	678004
1.50	0.50	4	2-3/4	11.8 15.8	4.9 8.9	6.45	4.13	2.75	5.90	8.50	7.78	25	PSM-1504	678005
2.50	0.50	4	4-1/2	13.92 17.92	5.8 9.8	7.00	5.25	3.40	6.37	8.96	8.21	28	PSM-2504	678006

Motorization Options



OPTION -01 XY MOTORIZATION



OPTION -02 Z MOTORIZATION



MOTORIZATION ¹	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
XY INLINE STEPPER	D	3	-01
Z SIDE MOUNT	E	3	-02

¹ When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 678004-01-02. For total unit weight, add option weight to component weight. Motor specifications are on page 460.



PSMA-1506

Description

Standard XYZ stages are large bore stages which incorporate triple axis motion in a single stage. The XY travels are micrometer driven and guided by cross roller bearing slides. MDC micrometers have unique laser etched plus-minus scales that indicate positive or negative port displacement and are available with either 0.50" or 1.00" of linear XY displacement. The Z axis employs a handwheel and worm gear reduction drive mechanism with displacement measured along the stage's frame mounted machinist's scale. Z axis linear travels of up to 12" are available. MDC standard stages provide precise sample motion and manipulation of samples inside ultrahigh vacuum environments. They are fitted with industry standard Conflat® compatible Del-Seal™ CF port flanges.

Specifications

Material

Flange 304ss

Actuator body Anodized aluminum

Bellows AM 350

Vacuum Range 1×10^{-11} Torr

Temperature Range¹ -20°C to 230°C

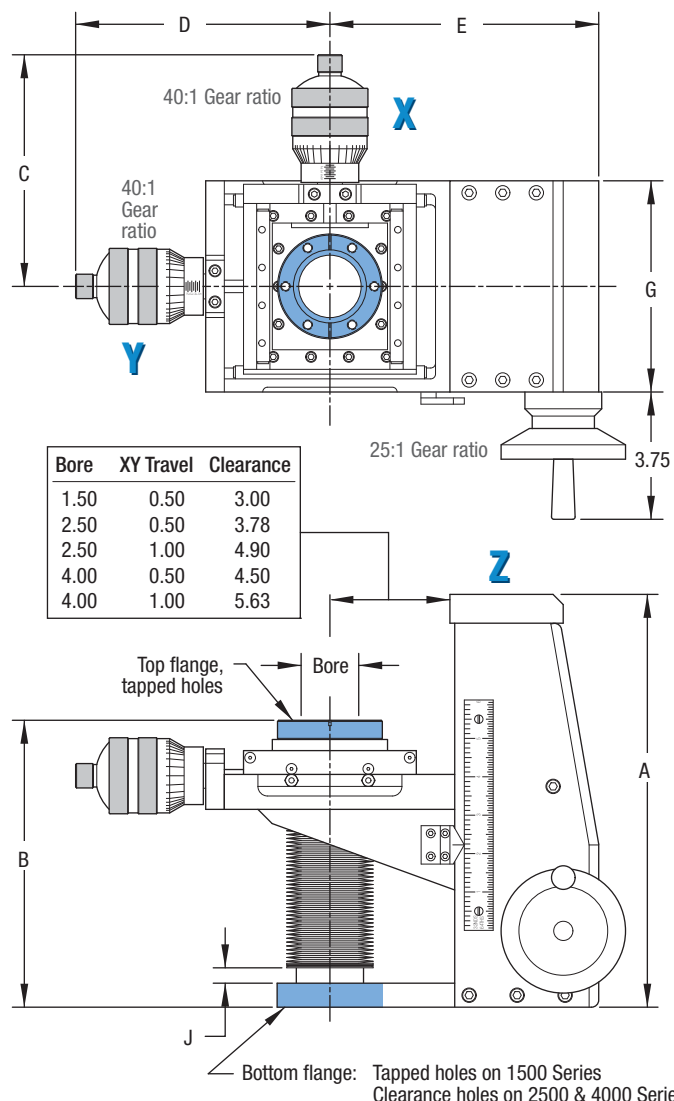
Weight & Dimensions See table

¹ Units are bakeable to 30°C maximum when motorized.

ULTRAHIGH VACUUM SERIES

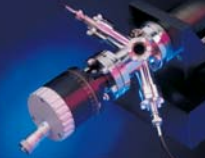
Features

- 4 to 12 inch Z-axis travel
- Plus or minus 1/2 and 1 inch off center XY motion
- 1-1/2, 2-1/2 and 4 inch bore diameters
- Manual or Motorized actuators
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mounts



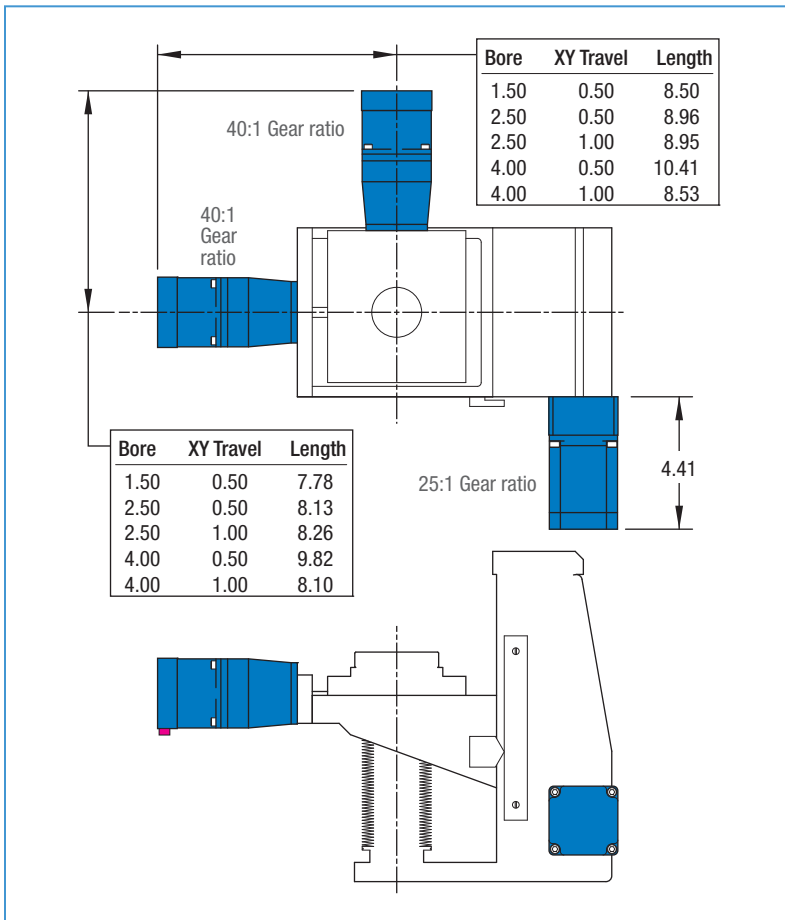
Triple Axis Standard XYZ Stage

Section 7.2



BORE	± X-Y TRAVEL	Z TRAVEL	FLANGE	A	B MIN - MAX		C	D	E	G	J	WT LB	REFERENCE	PART NUMBER
1.50	0.50	4.00	2-3/4	10.8	7.0	11.0	5.90	6.45	7.00	5.50	1.25	20	PSMA-1504	678026
1.50	0.50	6.00	2-3/4	12.8	7.0	13.0	5.90	6.45	7.00	5.50	1.25	25	PSMA-1506	678027
1.50	0.50	8.00	2-3/4	15.9	8.2	16.2	5.90	6.45	7.00	5.50	1.25	42	PSMA-1508	678028
1.50	0.50	12.00	2-3/4	22.2	10.5	22.5	5.90	6.45	7.00	5.50	1.25	46	PSMA-1512	678029
2.50	0.50	4.00	4-1/2	11.7	8.3	12.3	6.37	7.00	7.70	7.12	2.25	44	PSMA-2504	678034
2.50	0.50	6.00	4-1/2	13.7	8.3	14.3	6.37	7.00	7.70	7.12	2.25	46	PSMA-2506	678035
2.50	0.50	8.00	4-1/2	16.0	8.5	16.5	6.37	7.00	7.70	7.12	2.25	48	PSMA-2508	678036
2.50	0.50	12.00	4-1/2	20.2	8.8	20.8	6.37	7.00	7.70	7.12	2.25	51	PSMA-2512	678037
2.50	1.00	4.00	4-1/2	12.4	9.0	13.0	8.12	8.87	9.00	7.35	2.25	48	PSML-2504	678010
2.50	1.00	6.00	4-1/2	14.4	9.0	15.0	8.12	8.87	9.00	7.35	2.25	50	PSML-2506	678011
2.50	1.00	8.00	4-1/2	16.7	9.3	17.3	8.12	8.87	9.00	7.35	2.25	52	PSML-2508	678012
2.50	1.00	12.00	4-1/2	20.63	9.39	21.39	9.95	10.15	9.00	7.35	2.16	55	PSML-2512	678013
4.00	0.50	4.00	6	12.4	9.0	13.0	7.25	7.68	9.90	8.37	2.50	48	PSMA-4004	678042
4.00	0.50	6.00	6	14.6	9.3	15.3	7.25	7.68	9.90	8.37	2.50	50	PSMA-4006	678043
4.00	0.50	8.00	6	16.9	9.5	17.5	7.25	7.68	9.90	8.37	2.50	52	PSMA-4008	678044
4.00	0.50	12.00	6	21.0	9.7	21.7	7.25	7.68	9.90	8.37	2.50	56	PSMA-4012	678045
4.00	1.00	4.00	6	13.2	9.7	13.7	10.00	10.50	10.40	8.81	2.50	52	PSML-4004	678018
4.00	1.00	6.00	6	15.3	9.8	15.8	10.00	10.50	10.40	8.81	2.50	54	PSML-4006	678019
4.00	1.00	8.00	6	17.7	10.2	18.2	10.00	10.50	10.40	8.81	2.50	56	PSML-4008	678020
4.00	1.00	12.00	6	21.7	10.2	22.2	10.00	10.50	10.40	8.81	2.50	60	PSML-4012	678021

Motorization Options



MOTORIZATION ¹	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
XY INLINE STEPPER	D	3	-01
Z INLINE STEPPER	F	3	-02

¹ When ordering motorized options, add the option number and price to the desired UHV component part number listed above. For example: 678026-01-02. For total unit weight, add option weight to component weight. Motor specifications begin on page 460.

HIGH VACUUM SERIES



Description

Rotatable axis stages replace conventional rotatable mounting tables previously offered by MDC. They provide 360° positioning with greater precision, control and ease of use. Rotatable stages are constructed with worm gear drive mechanisms which offer substantial mechanical advantage over non-gearred designs, a feature which allows effortless manual operation, even under a full vacuum load. High torque stepper motors are also available for these stages.

MDC rotatable stages can be used to rotate heavy samples or sample support apparatus and structures. Two spring energized PTFE face seals are at the heart of the rotatable stage's sealing mechanism. With provision for differential pumping between the seals, these rotatable stages can be used in UHV environments with bakeout temperatures as high as 200°C. They are fitted with industry standard Conflat® compatible Del-Seal™ CF port mount flanges.

Specifications

Material

Flange	304ss
Actuator body	Anodized aluminum
Gasket Seals	PTFE

Vacuum Range

HV applications:	1x10 ⁻⁸ Torr
UHV applications:	Differentially pumped to 10 ⁻² Torr

Temperature Range¹	-20°C to 200°C
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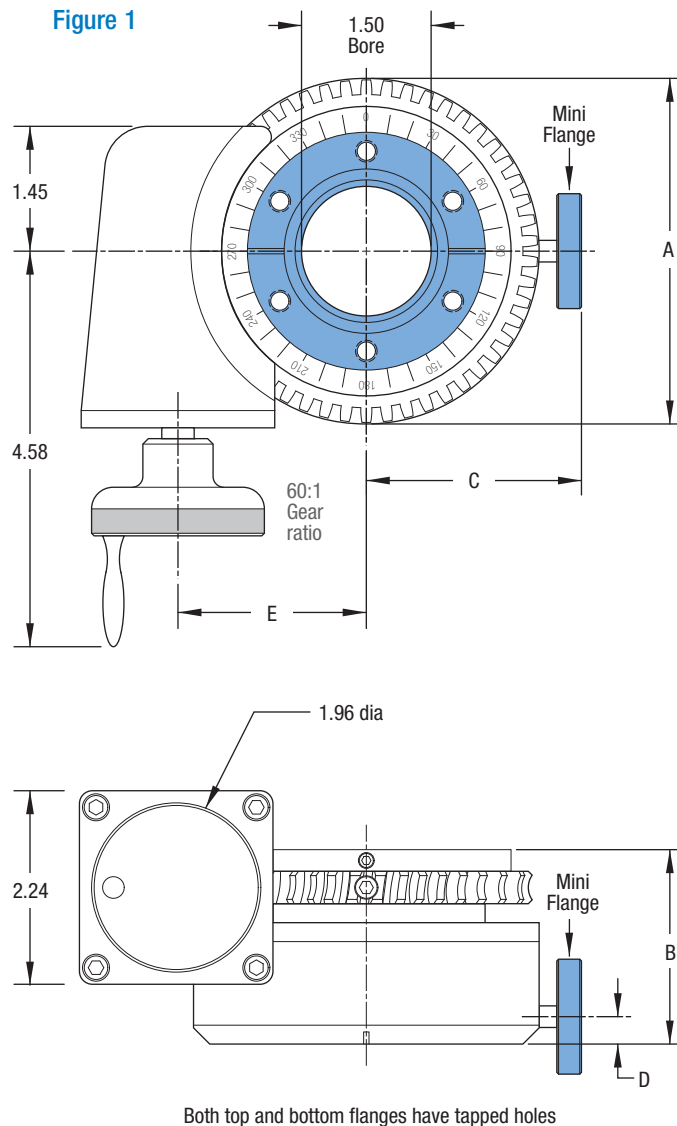
Weight & Dimensions	See table
--------------------------------	-----------

¹ Units are bakeable to 30°C maximum when motorized.

Features

- 360° continuous rotary positioning
- Manual or motorized actuator
- Rotary position lock
- Differentially pumped, dual PTFE elastomer seals
- HV compatible materials
- Bakeable to 200°C
- Del-Seal™ CF port mounts

Figure 1



Rotatable Axis

360° Adjustable Stage

Section 7.2

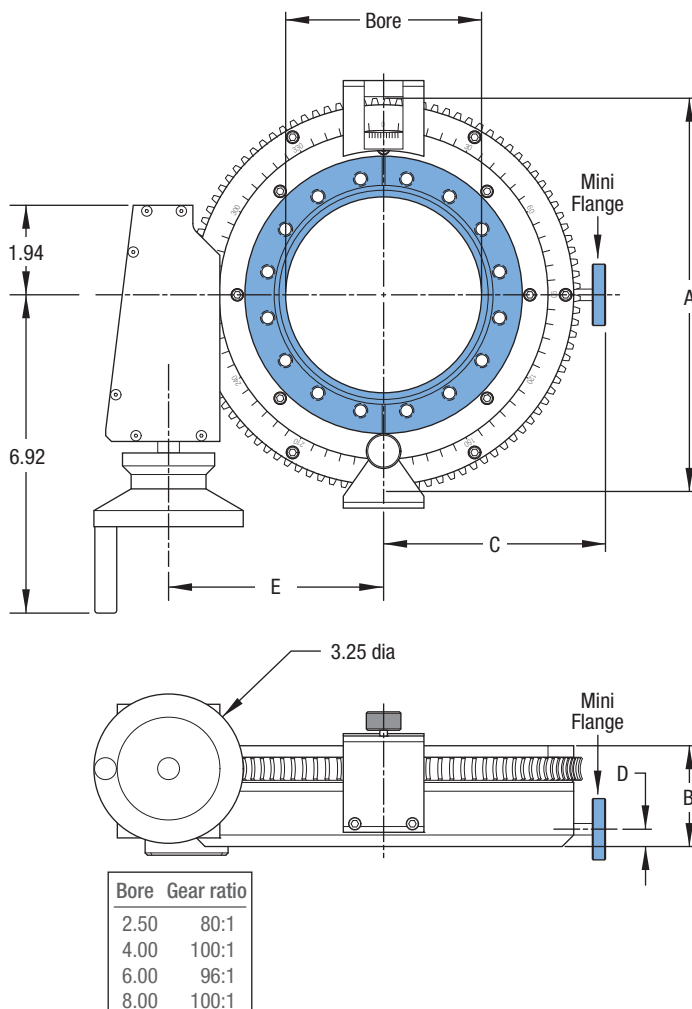
HIGH VACUUM SERIES

Del-Seal™ CF

200°C

BORE SIZE	FLANGE SIZE	FIG.	A	B	C	D	E	WT LB	REFERENCE	PART NUMBER
1.50 ³	2-3/4	1	4.00	2.25	2.49	0.31	2.18	10	RMTG-275	665410
2.50	4-1/2	2	6.81	2.19	4.50	0.44	2.67	20	RMTG-450	665411
4.25	6	2	8.35	2.19	4.82	0.38	4.67	25	RMTG-600	665412
6.25	8	2	12.25	2.44	6.25	0.38	6.75	40	RMTG-800	665413
8.25	10	2	12.75	2.44	7.25	0.38	7.00	55	RMTG-1000	665414

Figure 2



Both top and bottom flanges have tapped holes

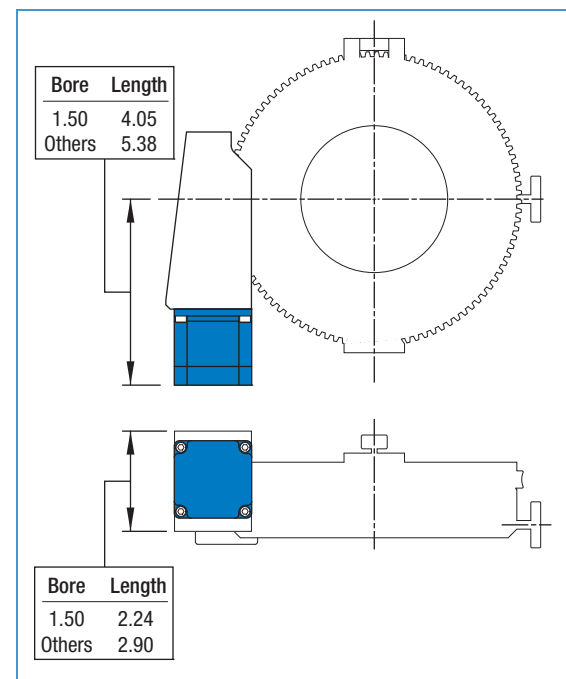
Motorization Options

² When ordering motorized options, add the option number and price to the desired HV component part number listed above. For example: 665410-01. For total unit weight, add option weight to component weight. Refer to page 461 for motor specifications.

³ The 1.50" bore stage uses specification E medium torque stepper motors.



MOTORIZATION ²	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
SIDE STEPPER	E & F	3	-01





Circular and rectangular entry Load-Lock systems, page 432

- Load-lock systems
- Sample staging chamber
- Gate valves
- Magnetic transporters
- Quick-access doors
- Observation Viewports
- Port Aligners

Load-Lock Systems

Load-lock systems are atmosphere to vacuum sample staging and entry systems typically mounted to larger research or process systems. They are a convenient and practical method for transferring samples in and out of vacuum systems. MDC load-lock systems are available with both circular and rectangular entry ports. Circular port systems will accommodate sample sizes of 1-3/8", 2-3/8" and 3-3/4" in diameter. Rectangular port systems will accommodate sample sizes 8" in diameter. All load-lock systems are comprised of five basic components including a sample staging chamber, gate valve, sample transporter, quick-access door and an observation window.

Sample Staging Chambers

Spherical sample staging chambers are constructed with seven vacuum ports, six of these are arranged in a six-way cross pattern. Four of the seven ports are occupied by load-lock system components including a circular gate valve, magnetic transporter, a side mounted quick-access door and an observation viewport. Two additional ports are used for system pumpdown and venting. The seventh and final port is blanked off and available for customer disposition.

Rectangular sample staging chambers are constructed with five vacuum ports, four of which are arranged in a four-way cross pattern. Three of the five ports are occupied by load-lock system components including a rectangular gate valve, magnetic transporter and a top mounted quick-access door with an integral observation window. The two remaining ports are used for system pumpdown and venting.

Gate Valves

The stainless steel vacuum gate valves used on load-lock systems incorporate a patented gate valve locking mechanism. No contact is made between the valve's body and the locking mechanism, a feature which markedly decreases vibration and insures smooth valve operation. Valve low outgassing characteristics can be attributed to a fusion welded stainless steel body, edge welded stainless steel bellows as well as small cross-section o-rings and the elimination of blind internal cavities.

The valve's gate and carriage can be removed through the valve's bonnet flange for gate seal replacement, cleaning, etc., without removing the valve body from the system. MDC gate valves require about half the number of moving parts found in comparable valves. This reduction in moving components minimizes wear and particulate generation which in turn provides valves of superior performance and reliability. Circular load-lock systems are offered with three gate valves sizes 1-1/2, 2-1/2 and 4 inch port diameters. Standard port mounts are Del-Seal™ CF metal seal flanges, which are ideal for ultrahigh vacuum systems. Gate valve actuation is manual with electropneumatic configurations available on request.

Rectangular valves are designed for use in high vacuum applications including semiconductor processing. Flange-to-flange body thickness is 2.75" (70mm). Load-lock systems are offered with a slit port 1.00" tall by 8.30" wide. These gate valves are fitted with manual actuators but can be ordered in electropneumatic configurations.

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to dis-color when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.



Small bore Load-Lock system

page 432



Viewport fitted Quick-Access doors

page 438

Magnetic Transporters

All load-lock systems are supplied with UHV magnetically coupled sample transporters. Sample transporters provide manually actuated linear travel and a full 360° sample rotation, ideal for transporting samples between the sample staging chamber and a main process chamber.

Linear positioning is controlled by sliding an external sleeve which is magnetically coupled with the transporter rod and sample holder inside the system. Optional linear guide rods can be added to circular entry load-lock systems. Rectangular entry load-lock systems include the guide rod option since rotation of large diameter samples is not possible on these systems. Guide rods prevent sample rotation during linear travel.

Magnetic transporters come ready to accept the complete range of Cab-Fast® in-vacuum sample handling accessories. Cab-Fast® sample handlers are specifically designed for use with the transporters featured in this catalog. Sample holding accessories are not included with base load-lock systems and must be purchased separately. Reference page 444 for the complete line of Cab-Fast® sample handling components and their specifications.

Quick-Access Doors

Quick-Access doors provide convenient and fast manual loading of samples in and out of sample staging chambers. Circular load-lock systems are fitted with blank stainless steel quick-access doors while the rectangular systems have quick-access doors with integral glass observation ports. Circular

load-lock systems can be fitted with viewport fitted doors if requested. All access doors are supplied with FKM / FPM fluoroelastomer elastomer seals. High temperature Kalrez® elastomers can be used to increase the systems maximum temperature rating.

Doors are hinged and use a swing-away hand knob locking mechanism. Viewport fitted doors are constructed with Corning type 7056 glass fused to Kovar® transition sleeves.

Observation Viewports

Load-lock system viewports are centered on the sample staging chamber directly above and perpendicular to the transporter's axis of motion. They are observation ports that allow visual monitoring of the sample loading process as well as subsequent sample rotation during transfer between chambers.

Circular load-lock systems are fitted with flange mounted viewports bolted to the staging chamber. Rectangular load-lock systems on the other hand have a limited number of ports and therefore have viewports installed directly to the quick-access door. Regardless of the method of installation, all viewports are constructed of vacuum compatible materials suitable for high and ultrahigh vacuum service. The viewport windows are manufactured of optical grade Corning type 7056 glass which is suitable for most vacuum optical applications. These glass viewports are bakeable to 400°C and limited only by elastomer seals elsewhere in the system. The 7056 glass is fused to a Kovar® metal sleeve which in turn is fusion welded to a stainless steel Del-Seal™ CF flange or

directly to a quick-access door. The Kovar® sleeve is a low expansion nickel-iron alloy ideally suited for glass to metal bonding. It provides flexibility necessary for the survival of the glass seal during thermal excursions. Care should be taken during the bakeout process of any glass to metal sealed component. The maximum recommended thermal gradient for glass to metal sealed components should not exceed 5°C per minute. Thermal gradients in excess of this can damage the glass to metal seal interface.

Port Aligners

Port aligners are adjustable port flange interfaces designed to correct mate-up between components with alignment imperfections.

Load-lock gimbals are unique port alignment instruments specifically designed for the precision alignment of magnetically coupled transporters as used with circular and rectangular entry load-lock systems presented herein. Load-lock gimbal port aligners are fitted with precision micrometer adjustments for both horizontal tilt (above and below a horizontal plane of travel) and side to side parallel axial displacement. They include a stainless steel formed bellows adapter which mates between the magnetic transporter and the sample staging chamber. See page 440 for more details on load-lock gimbal port aligners.

Other port alignment tools offered in this catalog include standard gimbals, precision off-axis and heavy duty off axis port aligners. For more details on these port alignment tools please reference page 441.



HV and UHV Magnetic Transporters page 436



Transporter alignment gimbals page 440



Cab-Fast® and Auto-Dock™ components page 443



LLC-412

ULTRAHIGH VACUUM SERIES

Features

- Circular port, manually actuated, UHV gate valve
- 1-3/8, 2-3/8 and 3-3/4 inch sample diameters
- Continuous rotary motion and 12 to 36 inch linear travel
- Magnetically coupled, guided or unguided transporters
- Rotary position lock on guided model transporters
- Sample chamber with viewport and quick-access door
- Vertical or horizontal installation
- UHV compatible materials
- Bakeable to 150°C
- Del-Seal™ CF port mounts

Description

Circular entry load-lock systems allow quick and easy loading or unloading of samples between connected vacuum chambers without breaking the main system vacuum. Samples are loaded onto the magnetically coupled transporter through a quick-access door on the spherical sample staging chamber. Loading can be monitored through the viewport located directly above the access door. After the transfer chamber has been evacuated to the desired vacuum level the chamber load-lock valve is opened for sample transfer into the main system chamber. The sample can be moved from 12 to 36 linear inches, depending on transporter model installed. Sample positioning is controlled by sliding an external actuator housing, fitted with permanent magnets, which magnetically couples with the transporter rod inside the sample chamber. These transporters are UHV compatible and fitted with a linear bearing shaft support. To prevent sample rotation, an optional transporter guide rod can be installed. Optional transporter alignment gimbals provide compensation for chamber port misalignment and other minor system imperfections. Transporter alignment gimbals must be purchased separately and are detailed on page 440 of this catalog.



The back side of circular entry load-lock systems are fitted with an auxiliary 2-3/4" Del-Seal™ CF port for attachment of other vacuum hardware. This port is shipped blanked-off and is available for customer hardware installation. Just below and to the left of this port is a 1-1/3" Del-Seal™ CF port used for the installation of an up to air valve.



The quick-access door swings clear for sample entry and removal. The tip of the magnetic transporter is accessible through this door and is shown here with a Cab-Fast® sample handling fork. The FKM / FPM fluoroelastomer elastomer seal is mounted to the chamber face. High temperature Kalrez® elastomer seals can be purchased separately to increase the system's bakeout temperature to 200°C.

Specifications

Gate Valves	See gate valve catalog
Transporter	See page 436
Quick-Access Doors	See page 438
Vacuum Range	1x10 ⁻¹⁰ Torr
Temperature Range¹	-20°C to 150°C
Weight & Dimensions	See table

¹ Magnets must be removed for 150°C rating; 30°C maximum when attached.



This is the LLC-112 circular entry load-lock system, which is specifically designed for 1-3/8" or smaller sample diameters. The quick-access door on these miniature load-lock systems has been redesigned with a 2.00" aperture to allow easy sample entry and removal. All load-lock systems are sold standard with UHV rated magnetic transporters.

ULTRAHIGH VACUUM SERIES

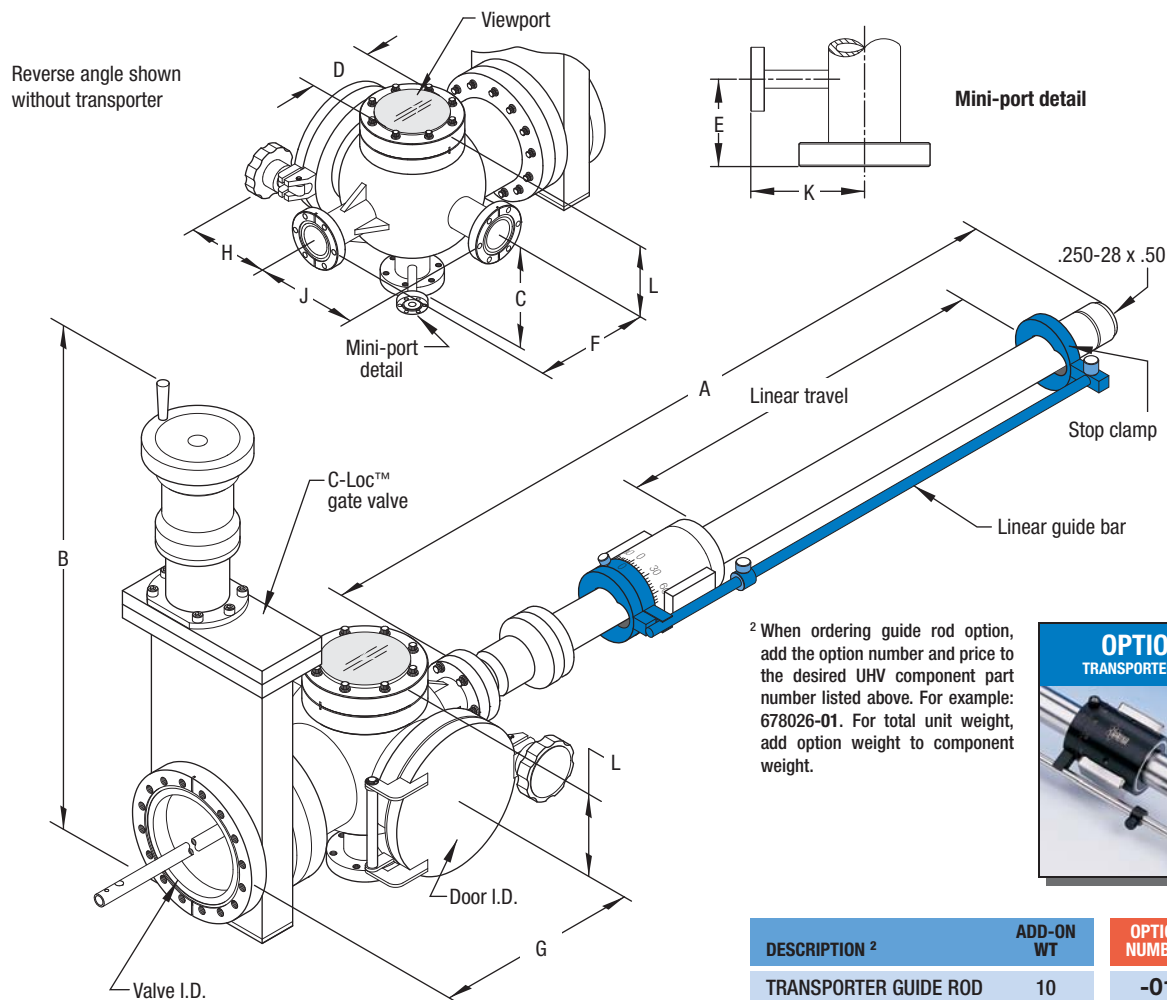
Del-Seal™ CF

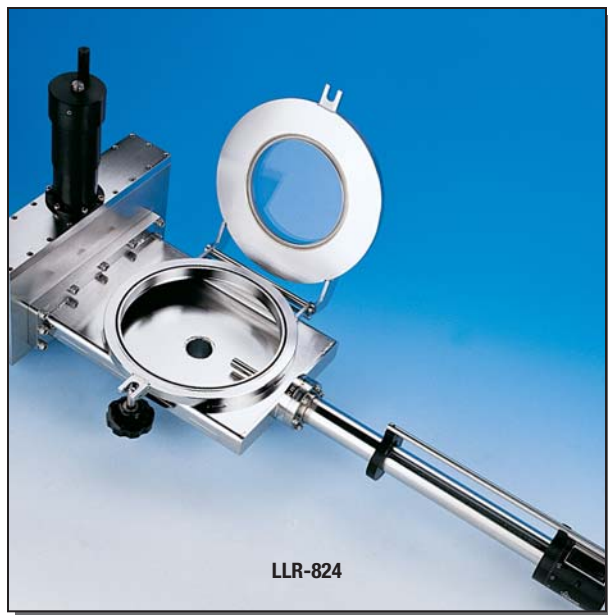
150°C

SAMPLE SIZE	LINEAR TRAVEL	DOOR ID	VALVE ID	A	WT LB	REFERENCE	PART NUMBER
1-3/8	12.0	2.00	1.50	27.50	20	LLC-112	665080
1-3/8	24.0	2.00	1.50	41.00	22	LLC-124	665081
1-3/8	36.0	2.00	1.50	53.00	24	LLC-136	665082
2-3/8	12.0	2.38	2.50	27.50	36	LLC-212	665083
2-3/8	24.0	2.38	2.50	41.00	38	LLC-224	665084
2-3/8	36.0	2.38	2.50	53.00	40	LLC-236	665085
3-3/4	12.0	3.83	4.00	27.50	55	LLC-412	665086
3-3/4	24.0	3.83	4.00	41.00	57	LLC-424	665087
3-3/4	36.0	3.83	4.00	53.00	59	LLC-436	665088

Additional drawing dimensions

SAMPLE SIZE	B	C	D	E	F	G	H	J	K	L
1-3/8	10.32	1.83	1.40	-	1.83	6.06	3.25	1.83	3.25	2.33
2-3/8	12.71	4.12	2.69	1.25	3.25	6.88	3.80	3.25	2.50	3.18
3-3/4	21.00	4.88	3.88	1.25	4.75	8.36	5.36	4.75	2.75	3.68





HIGH VACUUM SERIES

Features

- Rectangular port, manually actuated, HV gate valve
- 8 inch maximum sample diameter
- 12 to 36 inch linear travel
- Magnetically coupled guided transporter
- Rotary position lock
- Sample chamber with viewport fitted quick-access door
- Horizontal installation recommended
- HV compatible materials
- Bakeable to 150°C
- Del-Seal™ CF port mounts

Description

Rectangular entry load-lock systems allow quick and easy load-ing or unloading of samples between connected vacuum cham-bers without breaking the main system vacuum. Samples are loaded onto a magnetically coupled transporter through the quick-access door located on the rectangular sample staging chamber. After the staging chamber has been evacuated to the desired vacuum level, the rectangular load-lock valve is opened for access into the main vacuum chamber. The sample can be moved 12 to 36 linear inches, depending on transporter model installed. Sample positioning is controlled by sliding an external actuator housing, fitted with permanent magnets, which mag-netically couples with the transporter rod inside the sample chamber. These transporters are UHV compatible and fitted with a linear bearing shaft support. To prevent sample rotation trans-porter is fitted with an external linear guide rod. Optional trans-porter alignment gimbals provide compensation for chamber port misalignment and other minor system imperfections. Transporter alignment gimbals must be purchased separately and are detailed on page 440 of this catalog.



The quick-access door swings clear for sample entry and removal. The tip of the magnetic transporter is accessible through this door. Various sample handling accessories including Cab-Fast® and Auto-Dock™ sample handling systems are available. Doors are sealed with FKM / FPM fluoroelastomer elastomer gaskets. High temperature Kalrez® elastomers can be used to increase the systems bake-out temperature to 200°C.

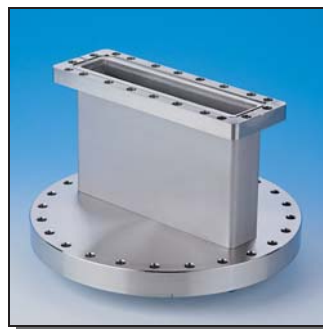


Rectangular entry load-lock systems are fitted with UHV rated magnetic transporters and include a transporter guide rod mechanism. The guide rod mechanism allows rotation lock during sample transfer. The magnets in the transporter actuator (black cylinder in photograph) must be removed for 150°C service or bakeout. The magnets must not be subjected to temperatures in excess of 30°C.

Specifications

Rectangular Gate Valve	See page 182
Magnetic Transporter	See page 436
Quick-Access Door	See page 438
Vacuum Range	1x10 ⁻⁸ Torr
Temperature Range¹	-20°C to 150°C
Weight & Dimensions	See table

¹ Magnets must be removed for 150°C rating; 30°C maximum when attached.



Rectangular to circular flange adapters provide connectability between rectangular entry load-lock system gate valves and any vacuum chamber fitted with a 13-1/4" Del-Seal™ CF mating flange. These flange adapters are also available in other sizes for use with the full range of MDC rectangular gate valves. See page 435.



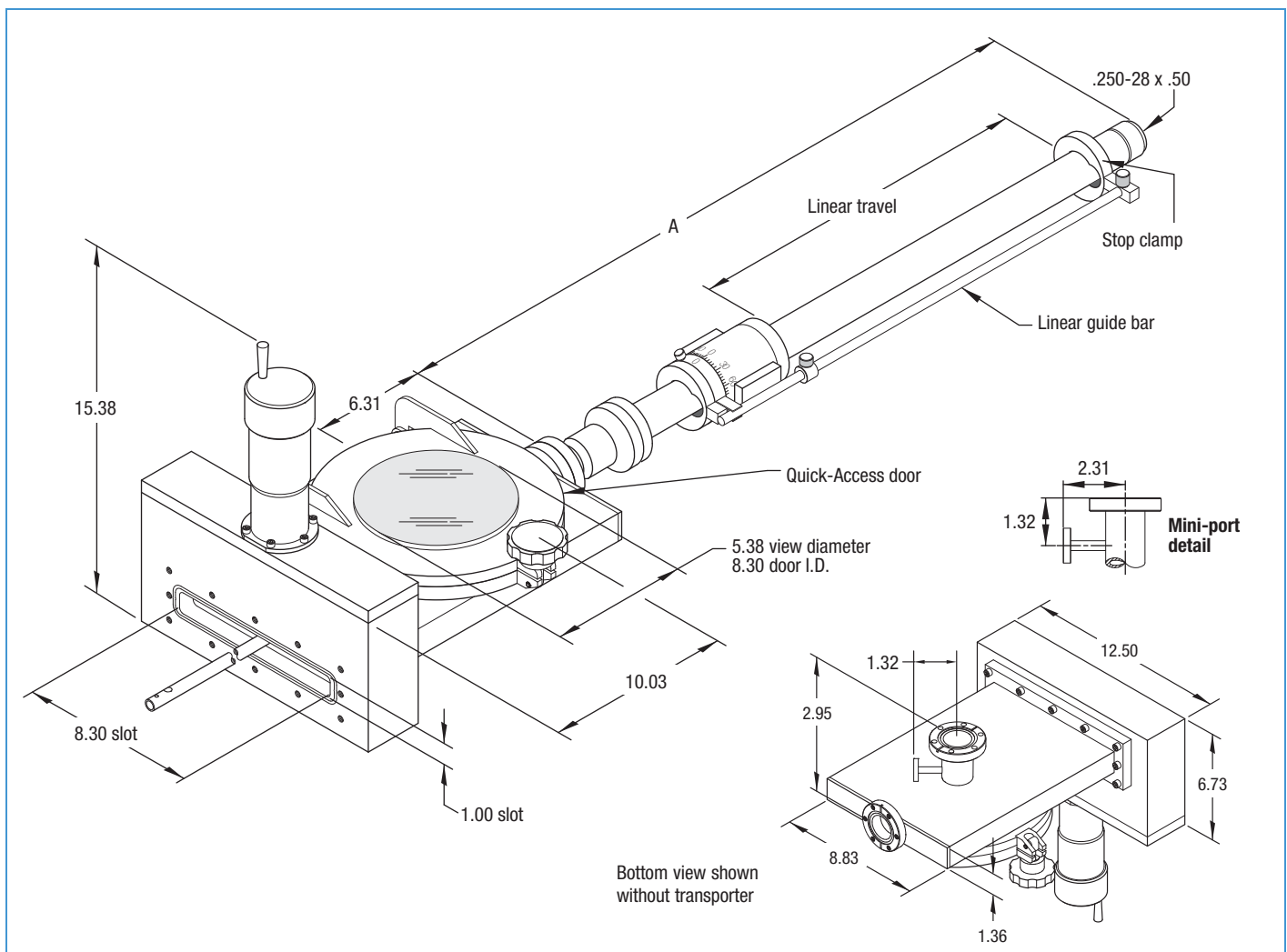
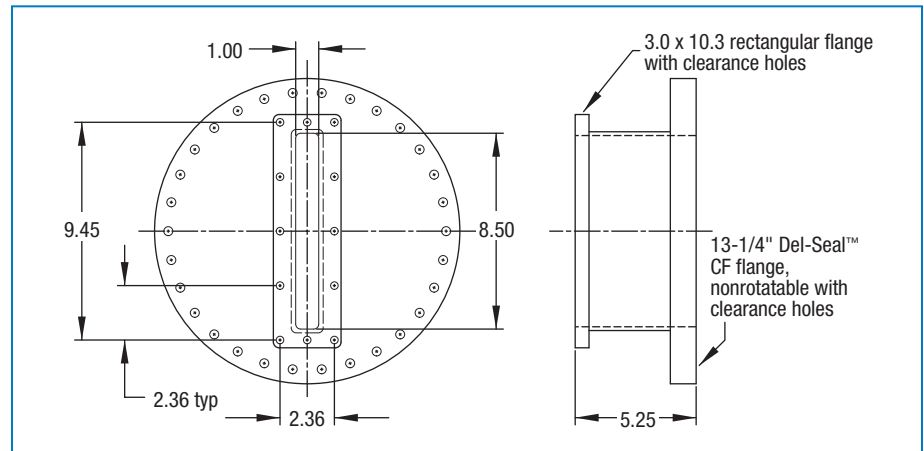
Elastomer Seal 150°C

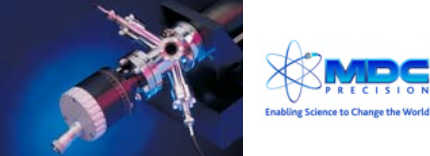
SAMPLE SIZE	LINEAR TRAVEL	A	VALVE APERTURE	WT LB	REFERENCE	PART NUMBER
8	12.00	27.50	1.0 x 8.3	105	LLR-812	665609
8	24.00	41.00	1.0 x 8.3	107	LLR-824	665610
8	36.00	53.00	1.0 x 8.3	110	LLR-836	665611

Flange Adapter

This drawing only represents the flange adapter used with the rectangular entry load-lock systems presented in this section. A photograph and description are detailed on the previous page.

REFERENCE	WT LB	PART NUMBER
F1x8	46	665801





Description

Sample transporters provide manually actuated linear travel and full 360° sample rotation, ideal for transporting samples between vacuum chambers. Linear positioning is controlled by sliding an external sleeve which is magnetically coupled with the transporter's rod and sample holder inside the system. The shaft is supported with Vespe[®] or stainless steel linear bearings. Optional linear guide rods can be added to these transporters to prevent sample rotation during linear travel. Magnetic transporters accept a complete range of Cab-Fast[®] and Auto-Dock[™] in-vacuum sample handling accessories. Cab-Fast[®] and Auto-Dock[™] sample handlers are specifically designed for use with the transporters featured in this catalog. Sample holding accessories are not included with transporters and must be purchased separately. Reference page 443 for the complete line of sample handling components and their specifications.

Specifications

Material

Flange and tube 304ss

Actuator housing and stop clamps Anodized aluminum

Bearings HV / UHV Vespe[®] / 300ss

Vacuum Range HV / UHV 1×10^{-9} Torr / 1×10^{-11} Torr

Temperature Range¹ HV / UHV 150°C / 200°C

Decoupling Axial load² 5 pounds maximum

Torque 8.5 lb-in maximum

Lateral load 20 lb maximum

Weight & Dimensions See table

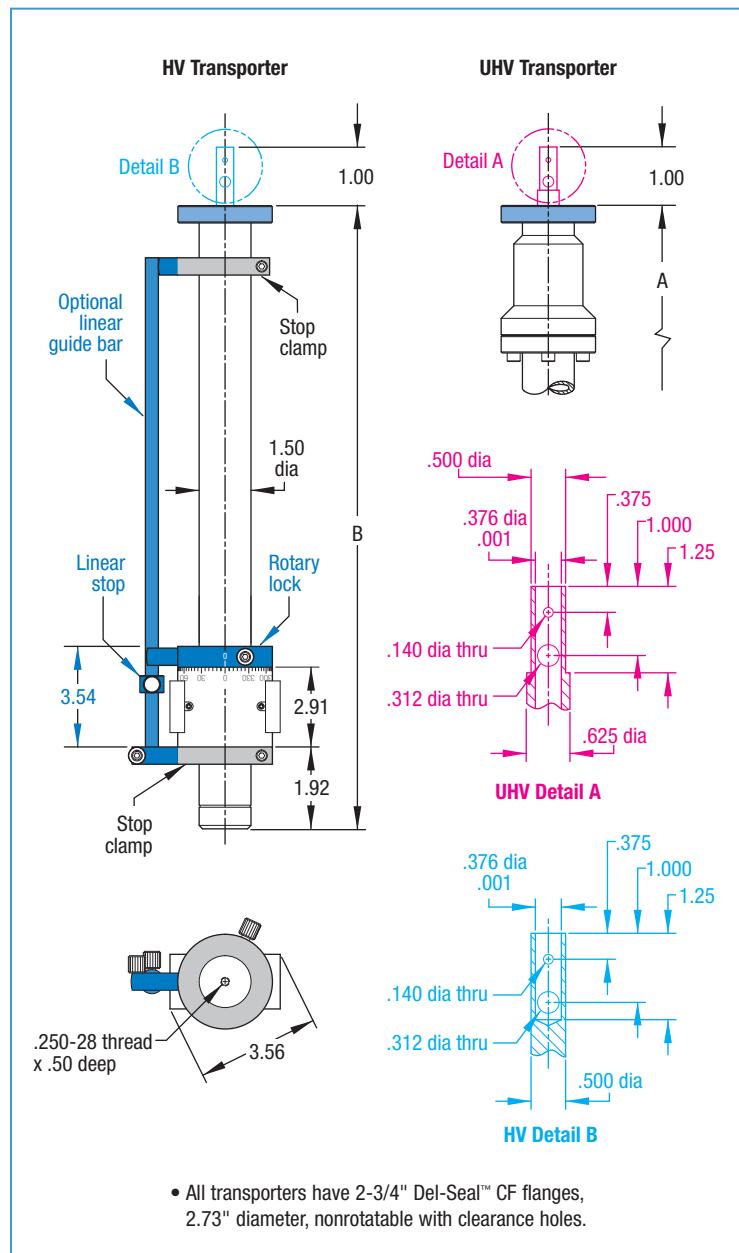
¹ 30°C maximum with magnets or motorized.

² Dual magnet configuration is available to increase axial load capacity.

ULTRAHIGH & HIGH VACUUM SERIES

Features

- Continuous rotary motion when unguided
- 12, 24 and 36 inch linear travel
- Manual or Motorized linear travel actuator
- Rotary position lock when guided
- UHV or HV compatible materials
- Bakeable to 200°C
- Del-Seal[™] CF port mounts



ULTRAHIGH VACUUM SERIES

Ball Bearings 200°C

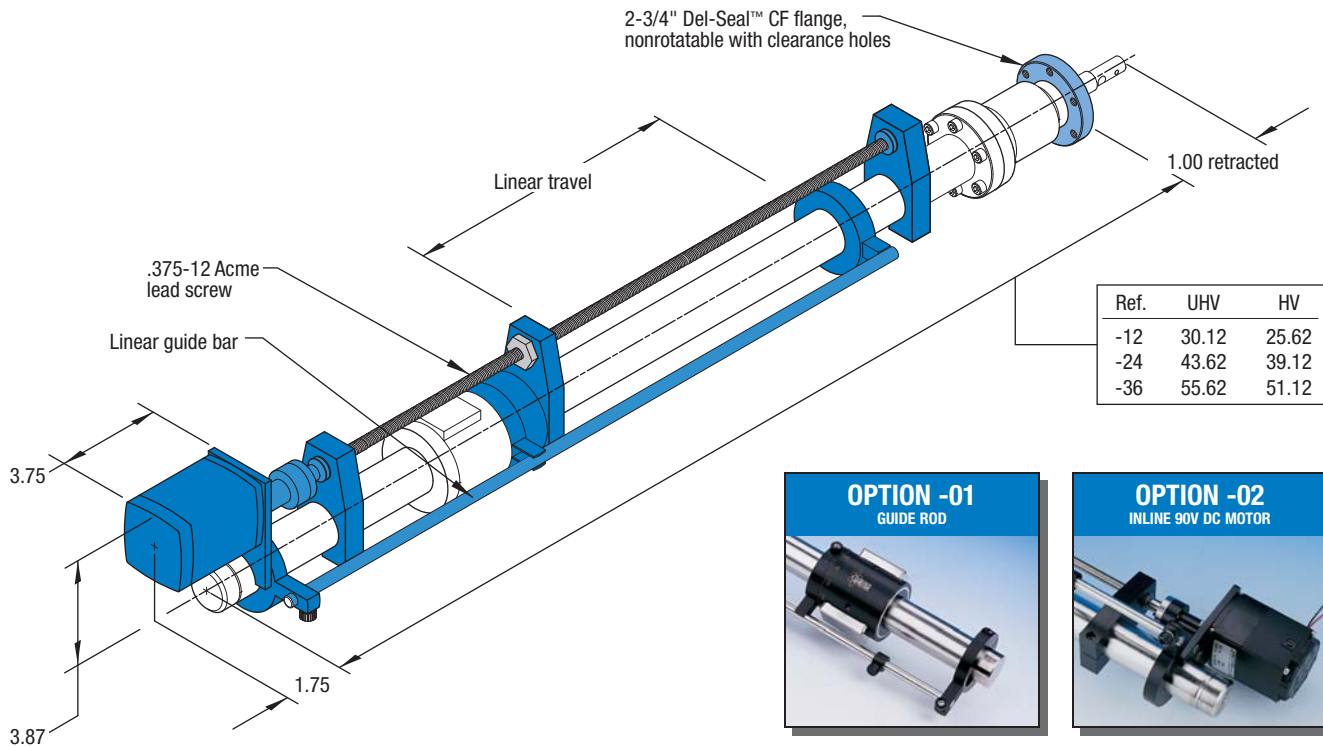
TRANSPORTER TYPE	NOMINAL TRAVEL	FLANGE SIZE	A	WT LB	REFERENCE	PART NUMBER
UNGUIDED	12.00	2-3/4	27.50	10	MTM-12	665700
UNGUIDED	24.00	2-3/4	41.00	12	MTM-24	665701
UNGUIDED	36.00	2-3/4	53.00	14	MTM-36	665702

HIGH VACUUM SERIES

Vespel® Bearings 150°C

TRANSPORTER TYPE	NOMINAL TRAVEL	FLANGE SIZE	B	WT LB	REFERENCE	PART NUMBER
UNGUIDED	12.00	2-3/4	23.00	10	MT-12	665100
UNGUIDED	24.00	2-3/4	36.50	12	MT-24	665101
UNGUIDED	36.00	2-3/4	48.50	14	MT-36	665102

Transporter Options



Motorized UHV Transporter

Motorized option includes a linear guide bar

OPTION -01 GUIDE ROD



OPTION -02 INLINE 90V DC MOTOR



DESCRIPTION ³	MOTOR SPEC	ADD-ON WT	OPTION NUMBER
GUIDE ROD	-	3	-01
MOTOR 90V DC ⁴	B	3	-02

³ When ordering transporter options, add the option number and price to the desired UHV or HV component part number listed above. For example: 665700-02. For total unit weight, add option weight to component weight. Refer to page 458 for motor specifications.

⁴ Variable speed motor controller must be purchased separately. Refer to page 464 for details.

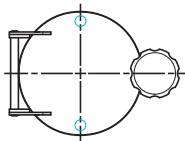


Specifications

Material

Flange	304ss
Door seal	FKM / FPM fluoroelastomer
Viewport	7056 Glass
Vacuum Range	1x10 ⁻⁸ Torr
Temperature Range ¹	-20°C to 150°C
Weight & Dimensions	See table
Bolt Hole Orientation	Reference

On centerline

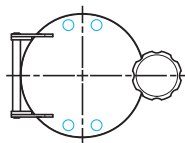


QD-275

QD-458

QD-675

Straddles centerline



QD-338

QD-450

QD-600

QD-800

QD-1000

QD-1200

QD-1325

QD-1400

QD-1650

¹ Contact factory for high temperature rating.

HIGH VACUUM SERIES

Features

- Blank or viewport fitted doors
- FKM / FPM fluoroelastomer elastomer door seal
- HV compatible materials
- Bakeable to 150°C
- Del-Seal™ CF port mounts
- Tapped or clearance hole mounting port flange

Description

Quick-Access doors provide convenient and fast manual loading of samples in and out of vacuum chambers. Doors are hinged and fitted with a swing-away hand knob locking mechanism. Viewport fitted doors are constructed with Corning type 7056 glass fused to a Kovar® nickel-iron transition sleeve. All access doors are supplied with FKM / FPM fluoroelastomer elastomer seals suitable for high vacuum service. High temperature Kalrez® elastomers can be used to increase a door's maximum temperature rating.

Quick-Access doors with clearance mounting holes are intended for installation on chamber ports with tapped holes. To order this hardware, reference the hardware table below. Note that the mounting hardware listed below is not long enough to join a clearance hole door with a clearance hole flange.

Quick-Access doors with tapped mounting holes are intended for installation on chamber ports with clearance holes. The hardware required to mount tapped hole doors is the same as for joining a standard clearance hole and tapped hole Del-Seal™ CF flange combination. To order this hardware reference Section 1.1 for Del-Seal™ CF flanges. Note that the mounting hardware listed below is not long enough for installation of a Quick-Access door with tapped mounting holes.

Non-opening viewports may be found in Section 5.1, page 306.

Bolt Kits for Quick-Access Doors with Clearance Holes

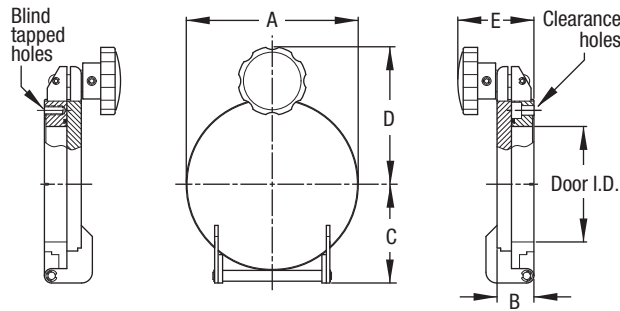
DOOR FLANGE	BOLT SIZE	QUANTITY PER PACK	WT LB	REFERENCE	PART NUMBER
2-3/4	.250-28 x 1/2	6	1	BQD-275-CH	190138
3-3/8	.312-24 x 3/4	8	1	BQD-450-CH	190139
4-1/2	.312-24 x 3/4	8	1	BQD-450-CH	190139
4-5/8	.312-24 x 1	20	2	BQD-800-CH	190140
6	.312-24 x 1	20	2	BQD-800-CH	190140
6-3/4	.312-24 x 1	20	2	BQD-800-CH	190140
8	.312-24 x 1	20	2	BQD-800-CH	190140
10	.312-24 x 1-1/4	24	2	BQD-1000-CH	190141
12	.312-24 x 1-1/2	32	3	BQD-1200-CH	190152
13-1/4	.375-24 x 1-1/2	36	3	BQD-1325-CH	190142
14	.375-24 x 1-1/2	36	3	BQD-1325-CH	190142
16-1/2	.375-24 x 1-1/2	36	3	BQD-1325-CH	190142

Quick-Access Doors

Blank & Viewport

Section 7.2

BLANK DOOR BLIND TAPPED HOLES



BLANK DOOR CLEARANCE HOLES

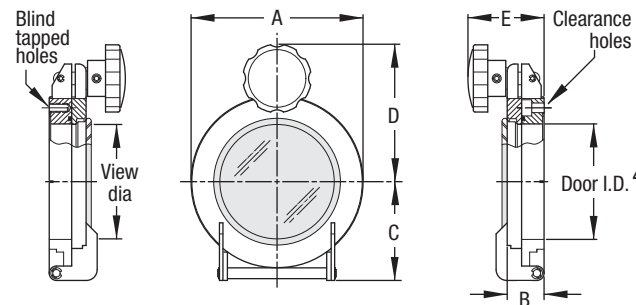


PART NUMBER	REFERENCE	FLANGE SIZE	TAPPED HOLES	CLEAR HOLES	DOOR ID	A	B	C	D	E	WT LB
665200	QD-275	2-3/4	.250-28	.265	1.60 ²	2.73	0.89	1.74	2.25	1.46	2
665236	QD-338	3-3/8	.312-24	.332	2.00	3.37	1.00	2.06	2.56	1.59	3
665201	QD-450	4-1/2	.312-24	.332	2.51	4.47	1.06	2.97	3.76	1.86	5
665220	QD-458	4-5/8	.312-24	.332	3.01	4.63	1.13	2.84	3.83	1.95	6
665202	QD-600	6	.312-24	.332	4.01	5.97	1.28	4.04	4.77	2.64	11
665224	QD-675	6-3/4	.312-24	.332	4.88	6.75	1.35	3.83	5.17	2.71	12
665203	QD-800	8	.312-24	.332	6.02	7.97	1.38	5.03	5.78	2.78	20
665204	QD-1000	10	.312-24	.332	8.02	9.97	1.51	5.63	6.77	2.91	25
665254	QD-1200	12	.375-24	.332	10.00	12.05	1.65	6.75	7.82	3.07	30
665228	QD-1325	13-1/4	.375-24	.390	10.77	13.25	1.77	7.74	8.42 ³	3.17	35
665232	QD-1400	14	.375-24	.390	11.63	14.00	1.77	8.24	8.79 ³	3.17	40
665250	QD-1650	16-1/2	.375-24	.390	14.00	16.50	1.77	4.25	10.04	3.17	50

REFERENCE	PART NUMBER
QD-275-CH	665210
QD-338-CH	665237
QD-450-CH	665211
QD-458-CH	665221
QD-600-CH	665212
QD-675-CH	665225
QD-800-CH	665213
QD-1000-CH	665214
QD-1200-CH	665255
QD-1325-CH	665229
QD-1400-CH	665233
QD-1650-CH	665251

Dimensions given in the center tables above and below apply to both the doors with tapped holes on the left and the doors with clearance holes on the right.

VIEWPORT DOOR BLIND TAPPED HOLES



VIEWPORT DOOR CLEARANCE HOLES



PART NUMBER	REFERENCE	FLANGE SIZE	TAPPED HOLES	CLEAR HOLES	VIEW DIA	A	B	C	D	E	WT LB
665205	QD-275-VP	2-3/4	.250-28	.265	1.40	2.73	0.89	1.74	2.25	1.46	2
665238	QD-338-VP	3-3/8	.312-24	.332	1.40	3.37	1.00	2.06	2.56	1.59	3
665206	QD-450-VP	4-1/2	.312-24	.332	2.69	4.47	1.06	2.97	3.76	1.86	5
665222	QD-458-VP	4-5/8	.312-24	.332	2.69	4.63	1.13	2.84	3.83	1.95	6
665207	QD-600-VP	6	.312-24	.332	3.88	5.97	1.28	4.04	4.77	2.64	11
665226	QD-675-VP	6-3/4	.312-24	.332	3.88	6.75	1.35	3.83	5.17	2.71	12
665208	QD-800-VP	8	.312-24	.332	5.38	7.97	1.38	5.03	5.78	2.78	20
665209	QD-1000-VP	10	.312-24	.332	5.38	9.97	1.51	5.63	6.77	2.91	25
665256	QD-1200-VP	12	.375-24	.332	5.38	12.05	1.65	6.75	7.82	3.07	30
665230	QD-1325-VP	13-1/4	.375-24	.390	5.38	13.25	1.77	7.74	8.42 ³	3.17	35
665234	QD-1400-VP	14	.375-24	.390	5.38	14.00	1.77	8.24	8.79 ³	3.17	40
665252	QD-1650-VP	16-1/2	.375-24	.390	5.38	16.50	1.77	4.25	10.04	3.17	50

REFERENCE	PART NUMBER
QD-275-VP-CH	665215
QD-338-VP-CH	665239
QD-450-VP-CH	665216
QD-458-VP-CH	665223
QD-600-VP-CH	665217
QD-675-VP-CH	665227
QD-800-VP-CH	665218
QD-1000-VP-CH	665219
QD-1200-VP-CH	665257
QD-1325-VP-CH	665231
QD-1400-VP-CH	665235
QD-1650-VP-CH	665253

² Nominal I.D. of door gasket is 1-3/8".

³ Includes two latches at 45° above horizontal centerline.

⁴ For viewport door I.D., use blank door I.D. in table above



ULTRAHIGH VACUUM SERIES

Features

- 10° horizontal tilt
- 1/8 inch axial displacement
- Micrometer actuators with position lock
- Formed bellows seal
- Bakeable to 200°C
- Del-Seal™ CF port mounts
- Includes magnetic transporter extension kit
- Horizontal orientation

Description

Port aligners are adjustable port flange interfaces that provide motion instruments with angular tilt and axial shift. They can also be used to correct mate-up between components with minor alignment imperfections.

Load-lock gimbals are unique port alignment instruments specifically designed for the precision alignment of magnetically coupled transporters as used with circular and rectangular entry load-lock systems. Load-lock gimbal port aligners are fitted with precision micrometer adjustments for both horizontal tilt (above and below a horizontal plane of travel) and side to side parallel axis displacement. Load-lock gimbals are intended for horizontal installation with its tilt adjustment micrometer at a bottom 6 o'clock position. They include a stainless steel formed bellows adapter which mates between the magnetic transporter and the sample staging chamber. A transporter shaft extension kit to compensate for the increase in the transporters overall length is also included. For bellows assembly replacements reference part number 400003 found in Section 1.1, page 68.

Specifications

Material

Flange	304ss
Body	Anodized Aluminum
Bellows, Formed	316ss

Vacuum Range 1x10⁻¹¹ Torr

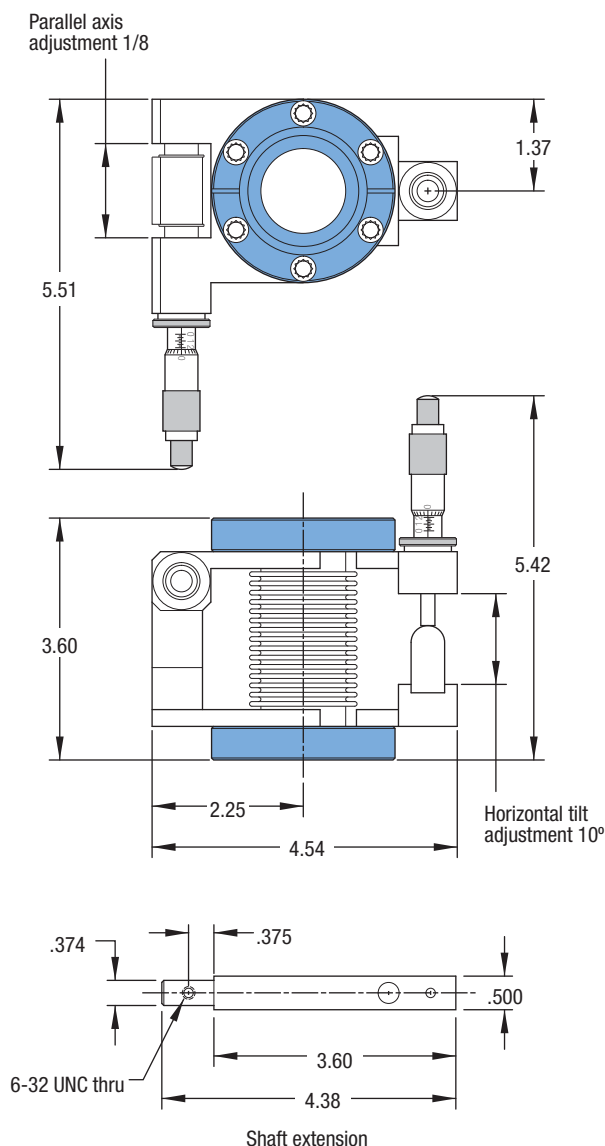
Temperature Range -20°C to 200°C

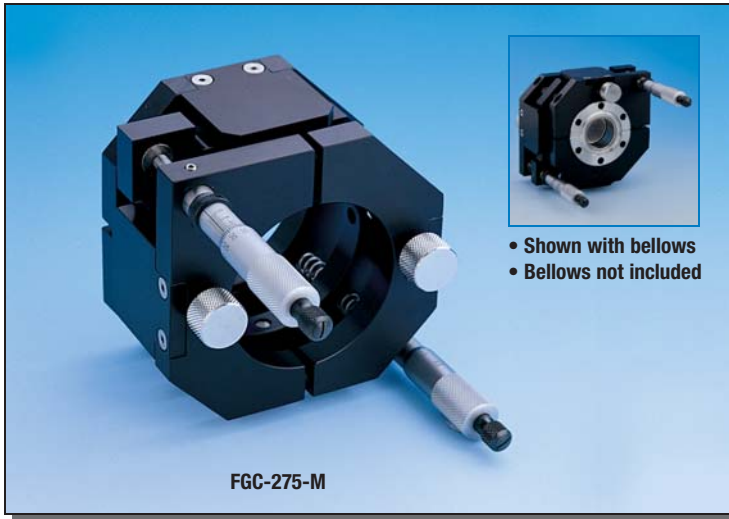
Maximum Load Rating 25 lbs

Weight & Dimensions See table

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
ALIGNMENT GIMBAL	2	AG-150	665300

AG-150





ULTRAHIGH VACUUM SERIES

Features

- Independent planes provide 15° tilt about x and y axes
- Tilt position lock for each plane
- Micrometer or screw adjustment actuators
- UHV compatible materials
- Bakeable to 230°C with screw type actuators
- Designed for use with Del-Seal™ CF port mount formed bellows adapters

Description

The standard gimbal geometry consists of three parallel and equidistant aluminum plates interconnected in a universal joint geometry. The top and bottom plates are equally spaced from the center plate and held in a parallel and neutral position with eight coil springs. Top and bottom plates are fitted with precision micrometers used to produce a 15° tilt about the center plates X and Y axis respectively. When all adjustment mechanisms are disengaged the springs force the plates back to a neutral and parallel position. Economical screw type adjustments are also available in place of micrometers.

Standard gimbals are designed for use with MDC formed bellows flexible adapters with 1.25" and 2.00" bore diameters. Flexible bellows adapters are not included with standard gimbal assemblies and must be purchased separately.

Specifications

Material

Flange	304ss
Body	Anodized Aluminum

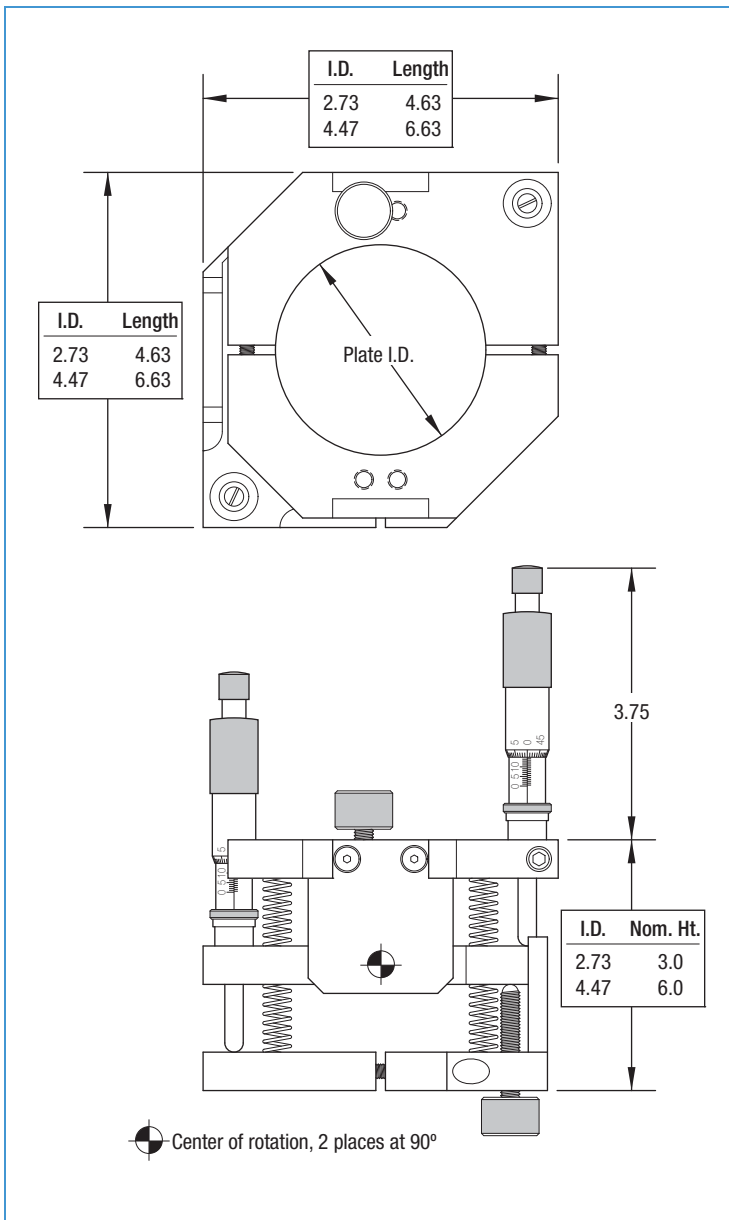
Vacuum Range	1x10 ⁻¹¹ Torr
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Temperature Range

Screw Type	-20°C to 230°C
Micrometer Type	-20°C to 100°C

Weight & Dimensions	See table
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PLATE I.D.	TYPE	WT LB	REFERENCE	PART NUMBER
2.73	MICROMETER	4	FGC-275-M	676000
2.73	SCREW	4	FGC-275-S	676001
4.47	MICROMETER	6	FGC-450-M	676002
4.47	SCREW	6	FGC-450-S	676003
2.73	BELLOWS	1	150-X	400003
4.47	BELLOWS	4	250-X	400005





Precision Off-Axis Port Aligner

Features

- 10° off-axis alignment
- Manual adjustment
- UHV compatible materials
- Welded bellows seal
- Del-Seal™ CF port mount

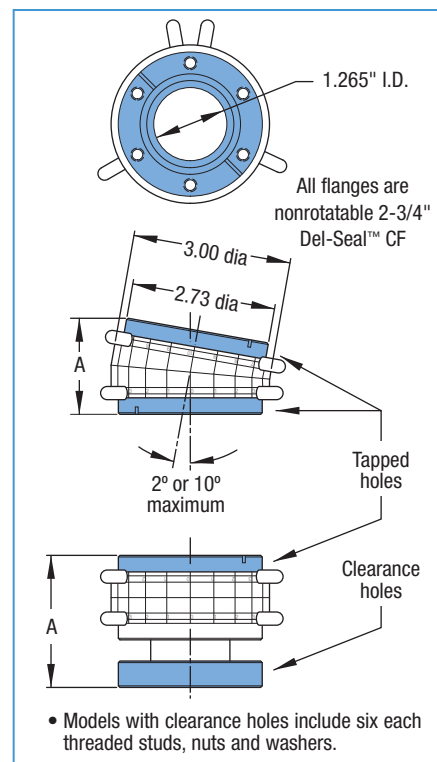
Specifications

Material	
Flange	304ss
Adjustment rings	Black oxide bronze
Seal	AM 350 welded bellows
Vacuum Range	1x10 ⁻¹¹ Torr
Temperature Range	230°C
Weight & Dimensions	See table

Description

Precision port aligners provide 2° or 10° of off-axis angular displacement. Aligners are offered with tapped or clearance hole Del-Seal™ CF flanges. These port aligners are for light duty service and are not suitable for moment load conditions. See heavy duty port aligners below for 15 pound load capacity.

GIMBAL TYPE	HOLE OR THREAD	A MAX AT 0°	A MAX AT 2°	A MAX AT 10°	WT LB	REFERENCE	PART NUMBER
2°	.250-28	1.59	1.64	-	2	PAT-2	675000
10°	.250-28	1.37	1.43	1.63	2	PAT-10	675002
2°	.265	2.27	2.33	-	2	PAC-2	675001
10°	.265	2.06	2.11	2.32	2	PAC-10	675003



Heavy Duty Off-Axis Port Aligner

Features

- 25° off-axis alignment
- Moment loading to 15 lb
- Position lock
- UHV compatible materials
- Welded bellows seal
- Bakeable to 230°C
- Del-Seal™ CF port mount

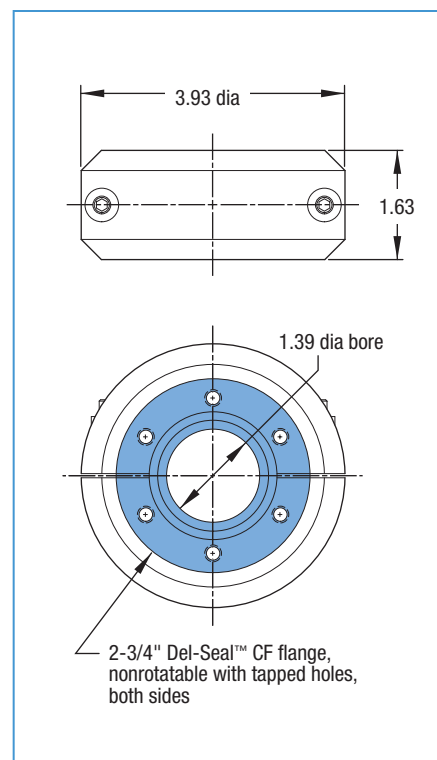
Specifications

Material	
Flange	304ss
Adjustment rings	Anodized Aluminum
Seal	AM 350 welded bellows
Vacuum Range	1x10 ⁻¹¹ Torr
Temperature Range	230°C
Weight & Dimensions	See table

Description

Heavy duty port aligners provide up to 25° of angular port adjustment. Tightening the clamp ring bolts to 100 lb-in of torque will allow this port aligner to support up to 15 pounds on a twelve inch moment arm. Metal seal flanges are 2-3/4" Del-Seal™ CF with .250-28 threaded holes. Graduation for angular displacement is not provided on the PA-25. Port alignment must be measured through external means.

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
HEAVY DUTY PORT ALIGNER	2	PA-25	675020





Rotary-linear accessories for use with most rotary and linear motion instruments page 450

- Cab-Fast®
Right angle sample handlers
- Auto-Dock™
Inline sample handlers
- Mini-Scaffold™ mounting system
- Rotary-linear accessories

Cab-Fast® Right-Angle Sample Handlers

The Cab-Fast® sample handling system provides a simple yet versatile means of loading samples for transportation to manipulators, parking carousels, deposition stations and other locations inside ultrahigh vacuum systems. They allow the transfer of samples between linear drive instruments positioned at right angles. Samples are first secured to platens using sample mounting strips. The loaded platen is placed inside a load-lock sample staging chamber through the chambers quick-access door. Inside, the platen is secured and attached to the platen fork previously installed to the tip of a magnetic transporter. Once the staging chamber is evacuated to the desired vacuum level and the gate valve is opened the sample is ready for transfer.

Auto-Dock™ Inline Sample Handlers

The MDC's Auto-Dock™ sample handling system is a patented group of modular sample handling components ideally suited for the transfer of samples between chambers and typically used in tandem with MDC magnetic transporters. In contrast with the Cab-Fast® system, Auto-Dock™ allows the transfer of samples between linear drive instruments positioned inline with each other. The Auto-Dock™ system is comprised of three basic components, a sample-holder plate, a vacuum-dock and a transport-dock. Samples are shuttled back and forth between a vacuum process chamber and a load-lock's sample staging chamber attached to it by fastening samples to the sample-holder plate. The sample-holder plate is manually secured to a transport-dock fixed to the tip of an MDC magnetic transporter inside the load-lock's sample staging chamber. The sample is then transported to the process chamber where the vacuum-dock component is strategically

positioned and ready to receive the sample-holder plate.

Mini-Scaffold™ Mounting System

Mini-Scaffold™ mounting system is a versatile in-vacuum erector set comprised of interchangeable building block components that can be assembled in a variety of combinations. This unique in-vacuum system was designed to take advantage of existing vacuum ports for the temporary or permanent installation of sample support structures inside high and ultrahigh vacuum environments. They are ideally suited for situations where permanent mounts are not included or to expand the capabilities of existing vacuum chambers. The in-vacuum structure's foundation is the Mini-Scaffold™ patented port clamp. The port clamp is fastened to the inside diameter of an available 1-1/2" or 2-1/2" chamber port creating the base from which an apparatus or structure will rise. In addition to port clamps an assortment of components are available to complement the Mini-Scaffold™ system, some of these include extension rods, universal ball joints, rod clamps, sample mounting plates, specimen holders, rotary and linear bearing mounts, mirror and lens mounts, gear boxes, etc.

Rotary-Linear Accessories

Rotary-linear accessories are an assortment of in-vacuum hardware components used to complement and expand the capabilities of MDC rotary and linear motion and manipulation instruments. Various drive shaft attachments are offered including universal joints, bellows couplings, extension couplings, rotary and linear bearings and bearing mounts, ground shaft stock, set-screw collars and vented cap screws.

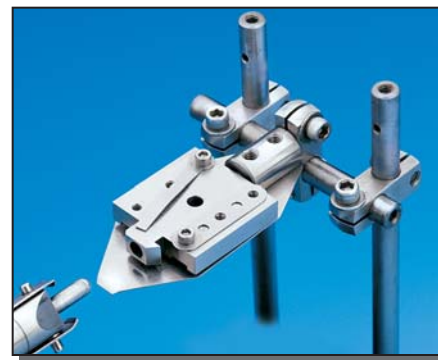
All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to discolor when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.



Cab-Fast® and Auto-Dock™ sample handling



Mini-Scaffold™ mounting system



Cab-Fast® Right-Angle Sample Handlers

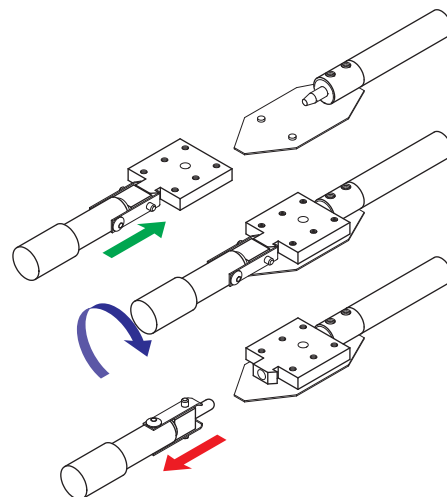
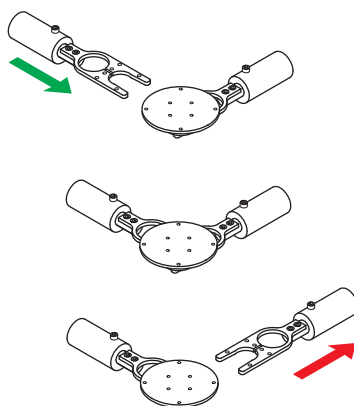
The Cab-Fast® sample handling system provides a simple yet versatile means of loading samples for transportation to manipulators, parking carousels, deposition stations and other locations inside ultra-high vacuum systems. They allow the transfer of samples between linear drive instruments positioned at right angles to each other. They are ideally suited for use with magnetically coupled transporters and other motion and manipulation instruments.



Auto-Dock™ Inline Sample Handlers

The Auto-Dock™ sample handling system is a group of modular sample handling components ideally suited for the transfer of samples between vacuum chambers when used with MDC magnetic transporters. Auto-Dock™ allows the transfer of samples between linear drive instruments positioned inline with each other. The Auto-Dock™ system is comprised of three basic components, a docking sample holder, a vacuum-dock and a transport-dock.

Cab-Fast® sample handling tools are designed to transport samples in and out of vacuum systems. This diagram shows a dual instrument arrangement which allows right angle sample transfer.

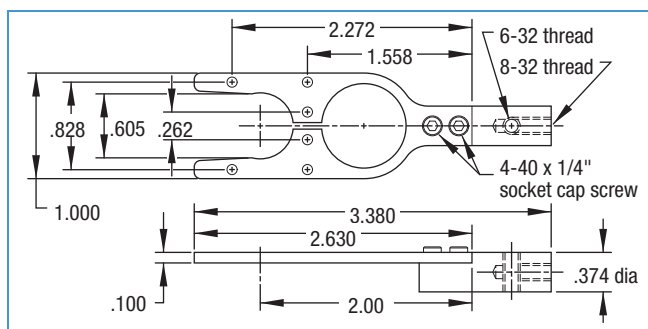


Auto-Dock™ sample handling tools are ideally suited for use with MDC magnetic transporters in sample transfer load-lock systems. They are designed for inline sample transfer.

Features

- UHV sample handling
- Fast sample transfer
- 304ss construction

Platen Fork

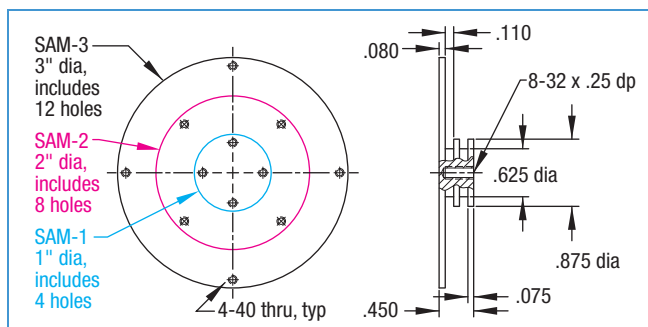


REFERENCE
FOR-1

PART NUMBER
665029

Cab-Fast® platen forks are designed to lock on to and hold Cab-Fast® platens during the transport and transfer of samples between chambers or other motion and manipulation instruments. Quantity of 1.

Platen Sample Holder



REFERENCE

PART NUMBER

SAM-1	665026
SAM-2	665027
SAM-3	665028

Cab-Fast® sample platens are designed to hold samples during in-vacuum sample processing. Samples can be secured in place using sample mounting strips and screws. Quantity of 1.

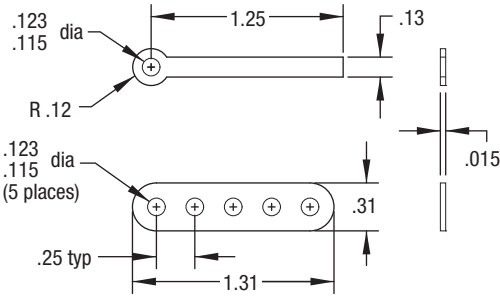
Sample Mount Strips

SAM-M2



SAM-M1

SAM-M1

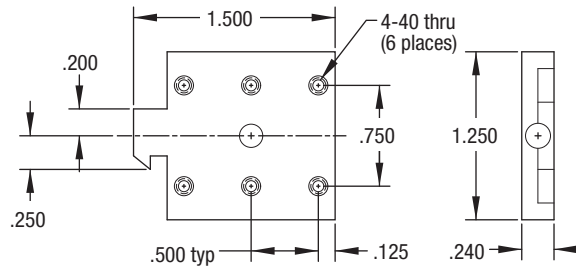


SAM-M2

REFERENCE	PART NUMBER
SAM-M1	665039
SAM-M2	665040

MDC sample mounting strips offer a versatile means of fastening samples to Cab-Fast® sample platens and Auto-Dock™ docking sample-holders. Sold in packages of 5.

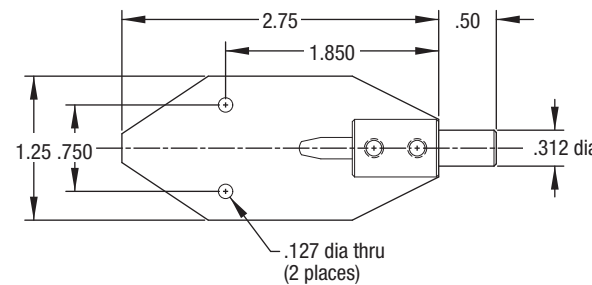
Dock Sample-Holder



REFERENCE	PART NUMBER
STA-1	665016

Auto-Dock™ docking sample-holders are designed to hold samples during in-vacuum sample processing. Samples are secured in place using sample mounting strips and screws. Quantity of 1.

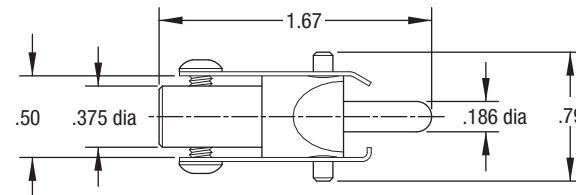
Vacuum-Dock



REFERENCE	PART NUMBER
STA-2	665017

Auto-Dock™ vacuum-docks are designed to receive and hold Auto-Dock™ sample-holders during in-vacuum sample processing. They are typically fixed inside a vacuum chamber as part of a sample processing structure. Quantity of 1.

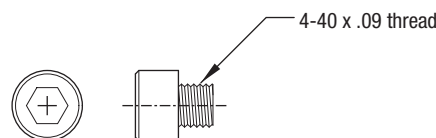
Transport-Dock



REFERENCE	PART NUMBER
STA-3	665018

Auto-Dock™ transporter-docks are designed to receive, hold and transport Auto-Dock™ sample-holders in and out of vacuum sample processing chambers. They are attached to the end of MDC magnetic transporter shafts. Quantity of 1.

Screws, non-vented



REFERENCE	PART NUMBER
SAM-S1	665041

Socket head screws made of 300ss ideal for Cab-Fast® and Auto-Dock™ sample handling systems and come in packages of 25 pieces. These screws are not vented and should only be installed into tapped through holes.



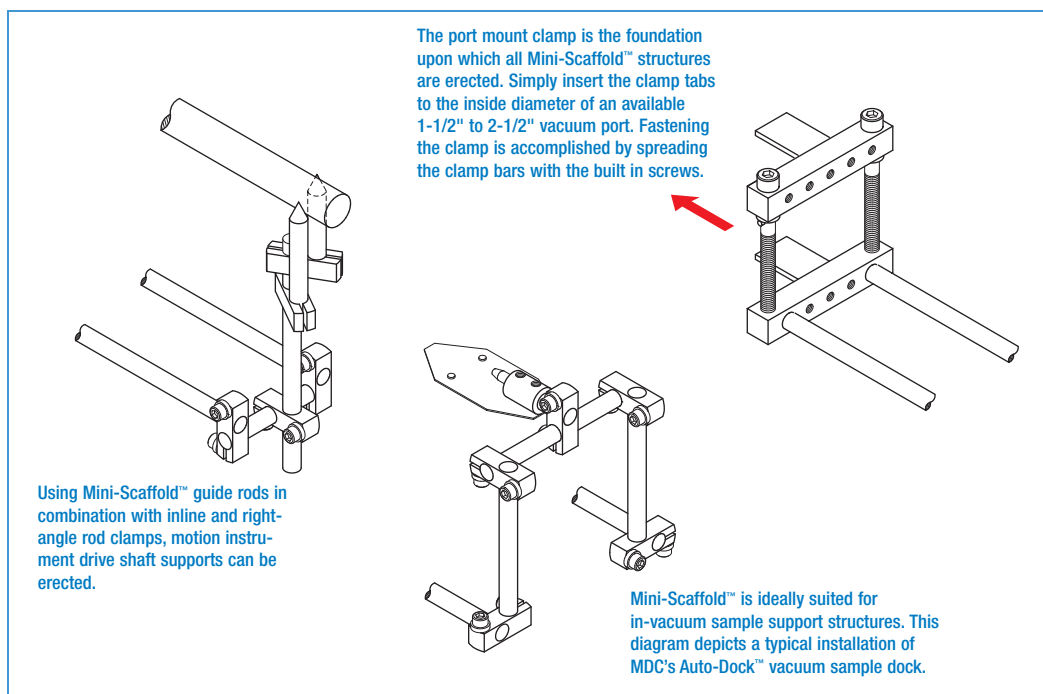
Mini-Scaffold™ Mounting System

Mini-Scaffold™ mounting systems are versatile in-vacuum interchangeable building block components that can be assembled in a variety of combinations. This unique in-vacuum system was designed to take advantage of existing vacuum ports for the temporary or permanent installation of sample support structures inside ultrahigh vacuum environments. They are ideally suited for situations where permanent mounts are not included or to expand the capa-

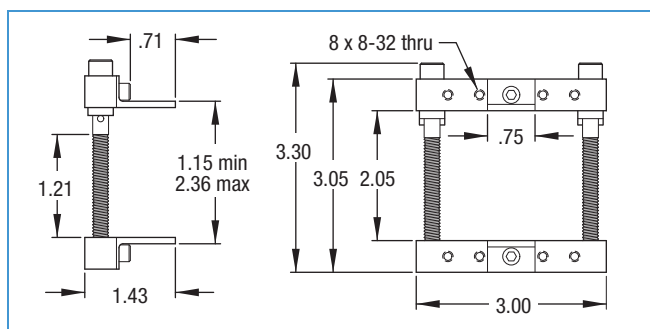
bilities of existing vacuum chambers. The in-vacuum structure's foundation is the Mini-Scaffold™ patented port clamp. The port clamp is fastened to the inside diameter of an available 1-1/2" or 2-1/2" chamber port creating the base from which an apparatus or structure will rise. In addition to port clamps, an assortment of components are available to complement the Mini-Scaffold™ system. The diagrams below depict the basic usage of Mini-Scaffold™ in-vacuum mounting systems.

Features

- UHV sample handling
- Fast sample transfer
- 300 series stainless steel



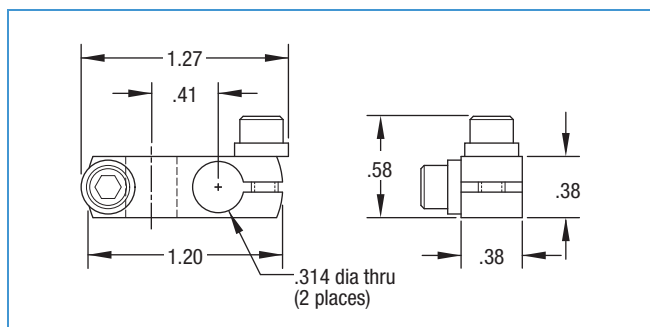
Port Clamp Mount



REFERENCE	PART NUMBER
PCM-1	680020

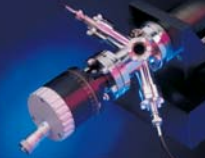
Port clamp mounts can be mounted to the inside diameter of any 1-1/2" or 2-1/2" vacuum port. Once they are secured these clamps become the foundation upon which other Mini-Scaffold™ components are attached. Quantity of 1.

Rod Clamp 90°

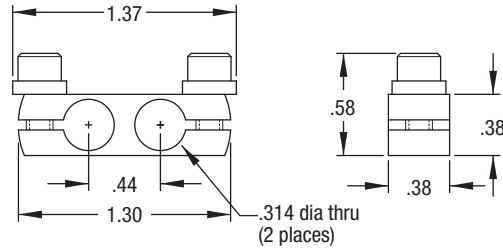


REFERENCE	PART NUMBER
URC-1	680040

90° universal rod clamps provide the means of fastening 5/16" diameter shafts in right angle configurations. Socket head fasteners and washers are included with these products. Quantity of 1.



Rod Clamp 180°



REFERENCE

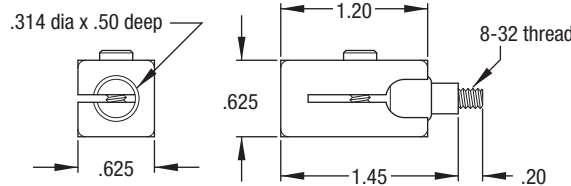
URC-2

PART NUMBER

680041

180° universal rod clamps provide the means of fastening 5/16" diameter shafts in parallel configurations with a .440" center to center spacing. Socket head fasteners and washers are included with these products. Quantity of 1.

Universal Ball Joint



REFERENCE

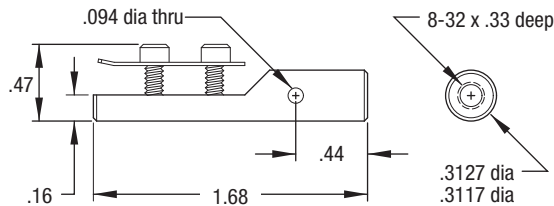
UBJ-1

PART NUMBER

680080

Universal ball joints with built-in lock screw provide infinite sample position adjustment. One end accepts a .312" diameter shaft and the other is fitted with an 8-32 UNC male thread for attaching to other Mini-Scaffold™ components. Quantity of 1.

Specimen Holder



REFERENCE

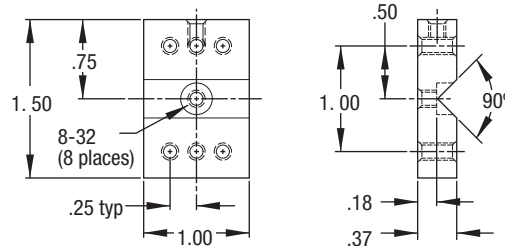
SH-1

PART NUMBER

680160

Specimen holders hold samples during sample processing inside a vacuum chamber. Two socket head screws and a blade clamp secure the sample to the holder. 8-32 UNC female thread allows attachment of other Mini-Scaffold™ components. Quantity of 1 per pack.

Mounting Plate, Small



REFERENCE

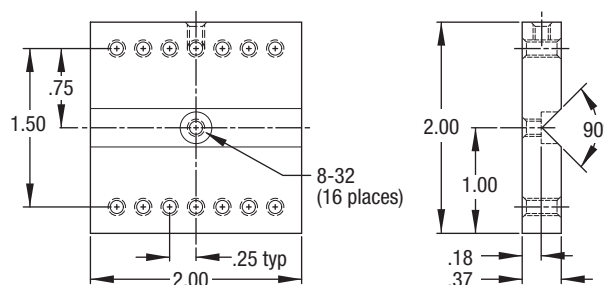
SMP-1

PART NUMBER

680120

Small mounting plates hold samples or other structures during sample processing inside a vacuum chamber. 8-32 UNC female threads allow a means of sample fastening or the attachment of other Mini-Scaffold™ components. Quantity of 1.

Mounting Plate, Large



REFERENCE

SMP-2

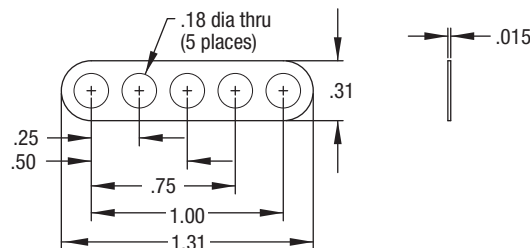
PART NUMBER

680121

Large mounting plates hold samples or other structures during sample processing inside a vacuum chamber. 8-32 UNC female threads allow a means of sample fastening or the attachment of other Mini-Scaffold™ components. Quantity of 1.



Mounting Strap



REFERENCE

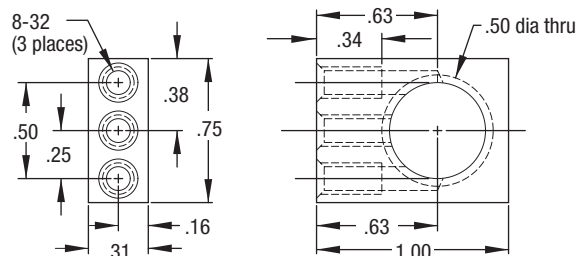
SMS-1

PART
NUMBER

680140

Sample mounting straps offer a versatile means of fastening samples to Mini-Scaffold™ small and large mounting holding plates. Quantity of 5 per package.

Bearing Mount, Radial



REFERENCE

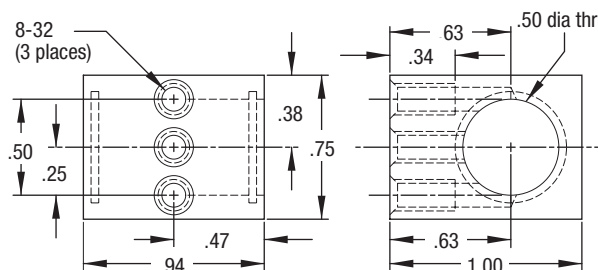
BMB-1

PART
NUMBER

680180

Radial bearing mounts are made of vacuum grade aluminum. They are designed to accept a radial bearing for a .250" shaft diameter and used with part number 686000 found on page 451. It includes two retainer rings to hold the bearing assembly in place. Quantity of 1.

Bearing Mount, Linear



REFERENCE

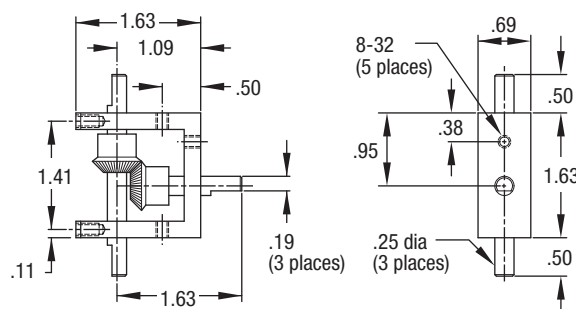
BML-1

PART
NUMBER

680200

Linear bearing mounts are made of vacuum grade aluminum. They are designed to accept a linear bearing for a .250" shaft diameter and used with part number 687000 found on page 452. It includes two retainer rings to hold the bearing assembly in place. Quantity of 1.

Gear Box - 90°



REFERENCE

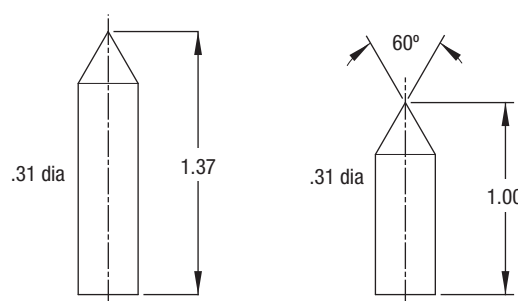
GB-1

PART
NUMBER

680300

This 90° gear box provides three .250" drive shafts for in vacuum rotary motion. It provides output rotation to a shaft which is perpendicular to the input shaft. Drive shaft locations are at 12, 3 and 6 o'clock positions. Quantity of 1.

Rod Guide



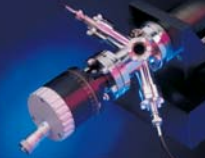
REFERENCE

RG-1

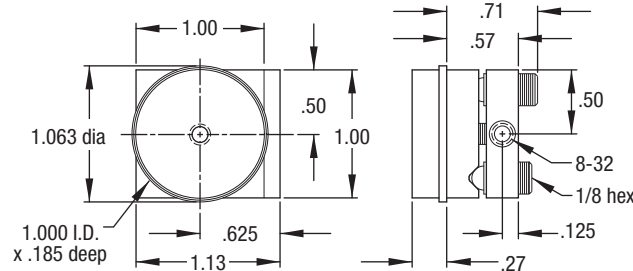
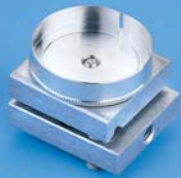
PART
NUMBER

680220

Rod guides provide a means of supporting long shafts inside a vacuum system. They are an inexpensive solution used in place of linear or rotary bearing mounts. They are intended for light duty rotation and linear support. Quantity of 1 each per package.



Mirror Mount



REFERENCE

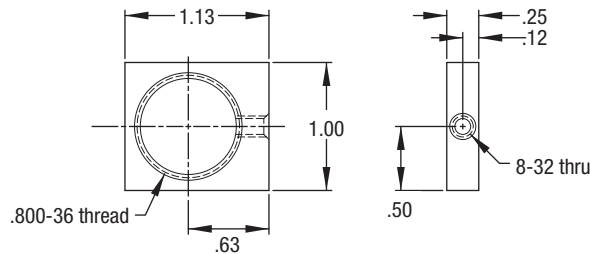
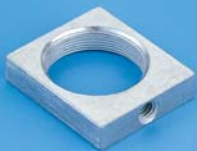
MM-1

PART NUMBER

680240

MDC adjustable tilt mirror mounts are used for the installation of 1" diameter mirrors inside a vacuum system. They are constructed of vacuum grade aluminum and are fitted with mirror tilt adjustment screws. Quantity of 1.

Lens Mount



REFERENCE

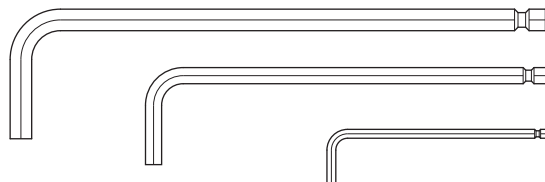
MOM-1

PART NUMBER

680260

Microscope objective lens mounts are designed to accept standard optical lenses fitted with an .800-36 mounting thread. They are constructed of vacuum grade aluminum and suitable for UHV service. Quantity of 1.

Wrench Kit



REFERENCE

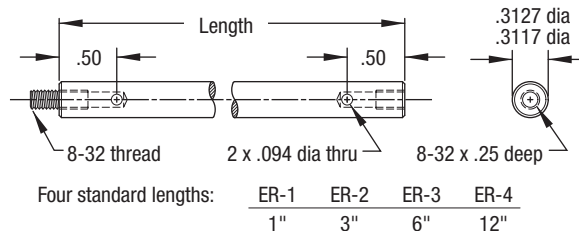
WK-1

PART NUMBER

680280

This is a set of three tempered steel Allen wrenches consisting of one each of the following hexagonal sizes: 5/64", 9/64" and 3/16". They are ideally suited for use with the complete line of Mini-Scaffold™ accessories and components.

Extension Rods



REFERENCE

ER-1
ER-2
ER-3
ER-4

PART NUMBER

680060

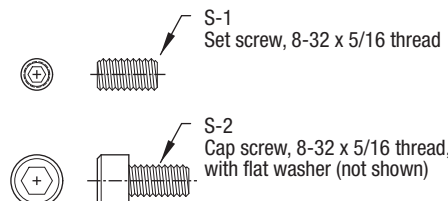
680061

680062

680063

Extension rods have 8-32 UNC male and female threads on opposite ends. They can be connected end to end for custom length structures. Quantity of 1.

Screws, non-vented



REFERENCE

S-1
S-2

PART NUMBER

680100

680101

These are 300 series stainless steel socket head screws for use with all Mini-Scaffold™ hardware. They come in packages of 25 pieces. They are not vented since all Mini-Scaffold™ components use through holes.



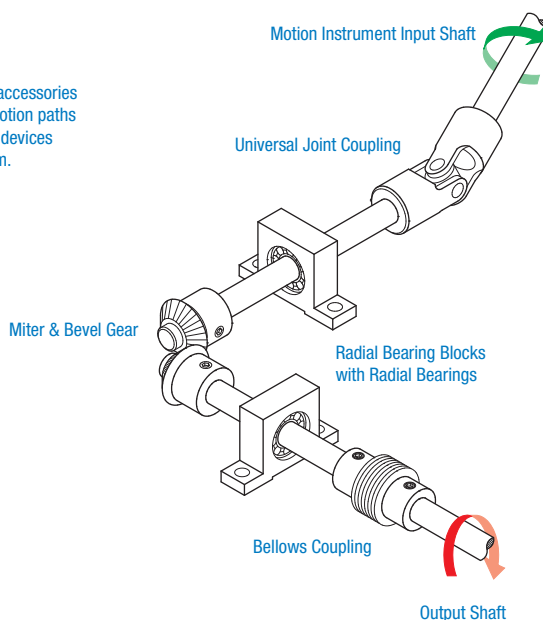
Rotary-Linear Accessories

Rotary-linear accessories are an assortment of in-vacuum hardware components used to complement and expand the capabilities of MDC rotary and linear motion and manipulation instruments. Various drive shaft attachments are offered including universal joints, bellows couplings, extension couplings, rotary and linear bearings and bearing mounts, ground shaft stock, set-screw collars and vented cap screws.

The components presented in this section can also be used in combination with products presented in the Cab-Fast®, Auto-Dock™ and Mini-Scaffold™ accessories sections of this catalog. Custom designed hardware is also available if required. Please contact MDC's technical sales engineers with your inquiries.



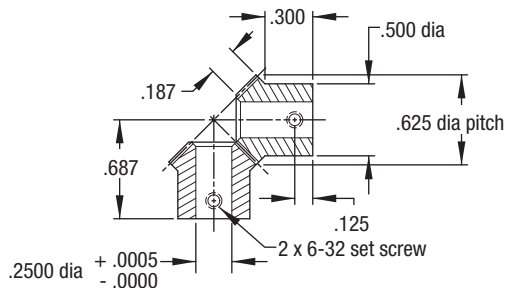
MDC rotary and linear accessories can provide intricate motion paths to mobilize samples or devices inside a vacuum system.



Features

- UHV sample handling
- Fast sample transfer
- 300 series stainless steel

Miter & Bevel Gear

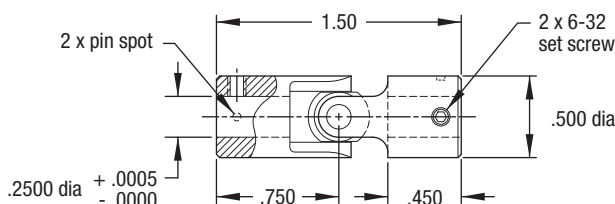


REFERENCE
AM48-1-S

PART NUMBER
685000

Miter & bevel gears provide the means of rotary input with 90° output rotation. They accept .250" diameter shafts and come in a set of two gears fitted with 6-32 UNC set screws for fastening to shafts. Quantity of 1.

Universal Joint

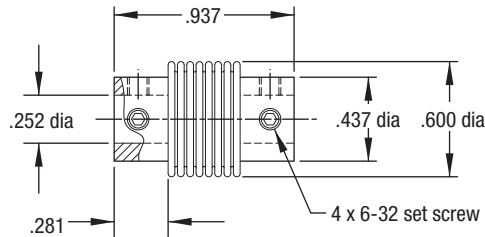


REFERENCE
AUJ-3

PART NUMBER
680000

Universal joints provide rotary motion input with variable angle rotary output for .250" shaft diameters. The maximum operating angle is 30° at low speeds and 10° at high speeds. They are constructed of 300 series stainless steel and phosphor bronze. Quantity of 1.

Bellows Coupling



REFERENCE

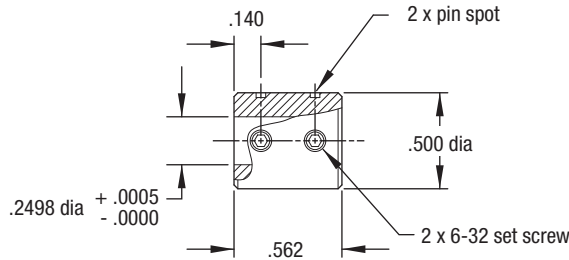
AC04-4

PART
NUMBER

682000

Bellows couplings for .250" shaft diameters provide 50 oz-in maximum torque at a maximum tilt angle of 5° or maximum axial misalignment of 0.010". They provide zero backlash and uniform angular velocity with low vibration. Quantity of 1.

Sleeve Coupling



REFERENCE

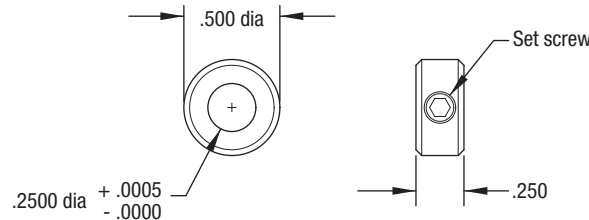
ACT-3

PART
NUMBER

683000

Sleeve couplings are used to customize and extend .250" diameter shafts inside a vacuum system. They are fitted with two 6-32 UNC set screws to lock shafts in position and are constructed of 300 series stainless steel. Quantity of 1.

Set Screw Collar



REFERENCE

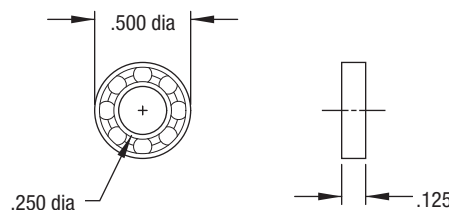
ACS-22

PART
NUMBER

690000

Set screw collars are used to create mechanical stops along a shaft's length. They are constructed of 300 series stainless steel and are supplied with 6-32 UNC set screws for position lock. Quantity of 1.

Radial Ball Bearing



REFERENCE

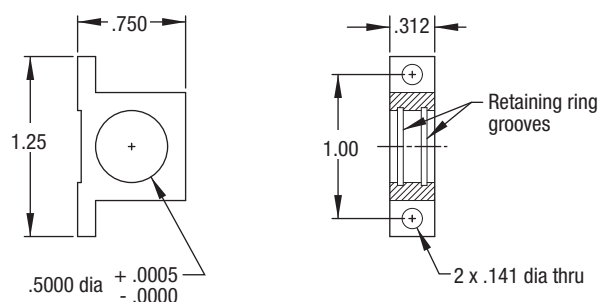
ABI-32

PART
NUMBER

686000

Rotary bearings are used to support .250" diameter rotary shafts. They are constructed of 440C stainless steel and coated with Dicronite® dry lubricant suitable for UHV service. Rotary bearing housings are offered below and on page 448. Quantity of 1.

Bearing Mount, Radial



REFERENCE

ABME-1

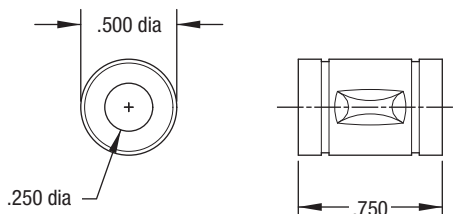
PART
NUMBER

688000

Radial bearing mounts are made of vacuum grade aluminum. They are designed to accept a radial bearing for a .250" shaft diameter. They include two retainer rings to hold the bearing assembly in place. Also see page 448 for alternate version. Quantity of 1.



Linear Ball Bearing



REFERENCE

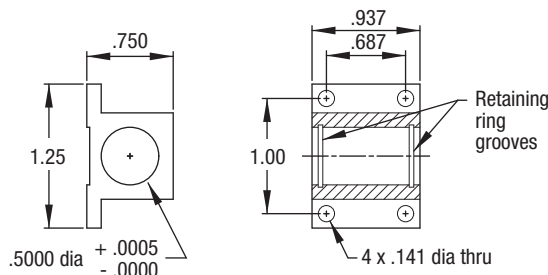
ALMB-1

PART NUMBER

687000

Linear bearings support .250" diameter linear motion drive shafts. They are constructed of 300 series stainless steel and coated with Dicronite® dry lubricant suitable for UHV service. Linear bearing housings are offered below and on page 448.

Bearing Mount, Linear



REFERENCE

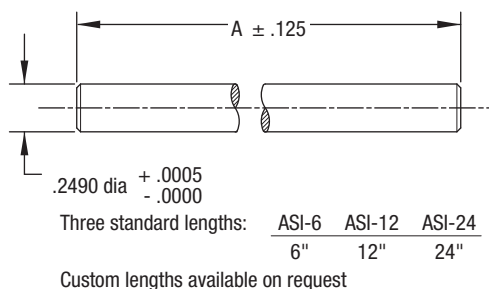
ALME-1

PART NUMBER

689000

Linear bearing mounts are made of vacuum grade aluminum. They are designed to accept a linear bearing for a .250" shaft diameter. They include two retainer rings to hold the bearing assembly in place. Also see page 448 for alternate version.

Ground Stock



REFERENCE

ASI-6

PART NUMBER

684000

ASI-12

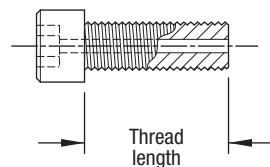
684001

ASI-24

684002

Precision ground 304 stainless steel shafts offered in 6, 12 and 24 inch lengths. With coupling accessories these shafts can be used to extend motion instrument drive shafts.

Vented Screws



DESCRIPTION

HEAD DIAMETER

6-32 UNC x 1/4

.22

6-32 UNC x 1/2

.22

6-32 UNC x 3/4

.22

8-32 UNC x 1/4

.27

8-32 UNC x 1/2

.27

8-32 UNC x 3/4

.27

8-32 UNC x 1

.27

10-32 UNC x 1/4

.31

10-32 UNC x 1/2

.31

10-32 UNC x 3/4

.31

10-32 UNC x 1

.31

10-32 UNC x 1-1/2

.31

.250-28 UNF x 1/2

.37

.250-28 UNF x 3/4

.37

.250-28 UNF x 1

.37

REFERENCE

AC-604

PART NUMBER

691000

AC-608

691001

AC-612

691002

AC-804

691003

AC-808

691004

AC-812

691005

AC-816

691006

AC-1004

691007

AC-1008

691008

AC-1012

691009

AC-1016

691010

AC-1024

691011

AC-2808

691012

AC-2812

691013

AC-2816

691014

These are 300 series stainless steel socket head screws ideally suited for fastening inside an ultrahigh vacuum system. The screws have been drilled through their entire length to eliminate the possibility of virtual leaks caused by the trapped volume of air at the bottom of blind tapped holes. They come in packages of 10 pieces.



Motorization

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Motor Option Specifications

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Direct current stepper motors

page 460

- Motor specifications
- AC motors
- Analog DC motors
- Miniature DC motors
- DC Stepper motors
- In-vacuum stepper motors
- Motor controls

Motor Specifications

Featured throughout this catalog are motion and manipulation instruments which are suitable for motorization. Motorization options for specific instruments are listed on the page in which they appear. Specifications for each motor option are identified with a single letter code ("A" through "F") listed as "Motor Spec" in the options description table. Detailed specifications for each motor are listed in this section and are arranged alphabetically by letter code.

Alternating Current Motors

MDC reversible AC motors are an economical motorization solution for continuous motion applications. These motors are equipped with a load limiting clutch rated for 50 oz-in of torque to prevent instrument overload conditions. Motors come with three wire leads and a capacitor which must be wired by the customer to suit application circuit requirements. Motor direction reversal is accomplished by wiring reversal. Current applied to the blue and red leads produces a clockwise rotation while applying current to the blue and black leads produces counterclockwise rotation.

Direct Current Motors, Analog

MDC 90 volt direct current reversible motors are of the permanent magnet type featuring high efficiency, no field supply requirement, low heat and linear speed-torque characteristics. Two leads with integral connector provide easy mating with 90 volt motor controller. These motors are furnished with an integral gear unit with 180:1 gear

reduction. The gearing is of the helical-spur design with helical gears in the primary stage for quiet operation and hardened spur gears in the secondary stages. Mounting dimensions conform to NEMA 2-11 standards.

Miniature DC Motors

Miniature DC motors are used on all MDC motorized miniature rotary and linear motion instruments. The built in gear head with a 262:1 gear ratio gives this motor a maximum torque load of 20 oz-in. Devices fitted with these miniature motors are constructed with a load limiting clutch to prevent motor burnout. Motors are mounted to motion instruments inside anodized aluminum housings with inline or side mount drive geometries. Inline geometries can also be purchased with a 16 pulse per revolution magnetic encoder.

DC Stepper Motors

Stepper motors are devices which position loads by operating in discrete increments or steps. The stepping action is accomplished by switching the power to the motor windings so that the motor phases are energized in a specific sequence. Stepper motors are capable of very precise positioning without the use of complicated and expensive feedback devices.

MDC uses SLO-SYN® DC stepper motors on all motion and manipulation instruments fitted with stepper motors. These are brushless, permanent magnet motors that have full-step increments of 1.8°. They can also be made to operate in increments of 0.9° to 0.014° when half stepping or

All dimensions in this catalog are given in inches unless specified otherwise.

Caution

Anodized aluminum finishes will begin to discolor when baked in excess of 150°C. This is only a cosmetic condition which does not impact performance or reliability.



Alternating current motors

page 458



Direct current, analog motors

page 458

microstepping techniques are employed. SLO-SYN® motors have permanent magnet rotors and eight-pole stators. They do not have brushes, ratchets or detents to wear out and they use shielded, lubricated-for-life ball bearings to insure maximum reliability and long life. Tests indicate a typical minimum life of five years. These stepper motors operate on phase-switched DC power. The motor shaft advances in steps of 1.8° (200 steps per revolution) when a four step (full-step mode) input sequence is used and in steps of 0.9° (400 steps per revolution) when an eight-step (half-step mode) input sequence is used.

Microstepping is a method of stepper motor control that allows the rotor to be positioned at places other than the 1.8° and 0.9° positions provided by the full-step and half-step methods. Microstepping occurs between these two angular points in the rotation of the rotor. These stepper motors are suitable for 1/10 and 1/125 microstep increments. A benefit of microstepping is that it reduces the amplitude of the resonance which occurs when the motor is operated at its natural frequency or subharmonics of that frequency.

In-Vacuum Stepper Motors

In-vacuum stepper motors are ideally suited for the precision movement of delicate specimens such as silicon wafers in ultrahigh vacuum. The use of in-vacuum stepper motors results in considerable savings in mechanical complexity with resultant gains such as cost reduction, improved reliability and decreased backlash. In some cases the use of in-vacuum motors can mean the complete elimination of edge

welded bellows. The particulate generation of these stepper motors is minimized by the total absence of metal to metal sliding surfaces. This and their low outgassing characteristics make these motors especially suitable for sensitive semiconductor handling applications. Other applications for which these motors have been employed include precision in-vacuum UHV manipulators, monochromator mechanisms for synchrotrons, ion beam lithography and sample transport in UHV.

Motor Controls

All motor controls are sold separately and are not included in the motorization option prices.

Alternating current (AC) motors do not require motor controls since they are designed to be wired directly into an alternating current wall circuit.

DCM-SC-90 controllers are designed for use with 90 VDC motorized instruments. This controller provides bidirectional motor control in continuous and jog modes. Motor speed is adjustable from 0 to 10 rpm via voltage regulation. Feedback circuitry uses the motor's "Back-EMF" to provide a flat torque-speed curve. Additional features include transient and surge protection, line voltage compensation, soft start, discrete silicon-controlled rectifiers and diodes for higher amperage output and better heat dissipation. Controller is wired for 115VAC input and is provided with a 2 conductor cable for direct connection to MDC 90V motorized components.

DCM-SC-12 controllers are designed for use

with 12 VDC motorized instruments in this catalog. This controller provides bidirectional motor control in continuous and jog modes. It provides motor speed adjustment from 0 to 20 rpm via voltage regulation. Feedback circuitry uses the motor's "Back-EMF" to provide a flat torque-speed curve. The controller is wired for 115VAC input and is provided with a 2 conductor cable for direct connection to MDC 12V motorized components via a standard 2.5-mm plug. Rear panel voltage switch allows the DCM-SC-12 to accept 110 or 220 VAC line voltage.

SMC-M controllers are designed for all air and in-vacuum stepper motorized instruments. Current control output is vital in any stepper motor controller. MDC stepper motor controllers employ the time-tested bipolar chopper regulation of current. Output current is set to 0.6 amperes as required for the low torque motors. Output current is adjustable for the medium and high torque motors. Current output adjustment is accomplished by resetting the six internal DIP switches.

The SMC-1 indexer is a powerful and user friendly tool capable of complex motion profile control when interfaced with an IBM compatible PC. The indexer comes with the necessary software for programming via ASCII commands and a 37 pin Type-D subminiature interface provides the user with TTL input and output access.



Direct current miniature analog motors page 459



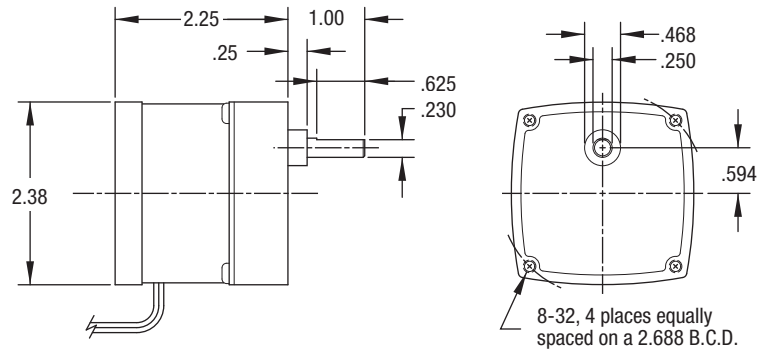
In-vacuum direct current stepper motors page 462



Motor controls and electronics page 464



Motor Specification "A"
115V AC MOTOR



MDC reversible AC motors are an economical motorization solution for continuous motion applications. These motors are equipped with a load limiting clutch rated for 50 oz-in of torque to prevent instrument overload conditions. Motors come with three wire leads and a capacitor which must be wired by the customer to suit application circuit requirements. Motor direction reversal is accomplished by wiring reversal. Current applied to the blue and red leads produces a clockwise rotation while applying current to the blue and black leads produces counter-clockwise rotation.

Specifications

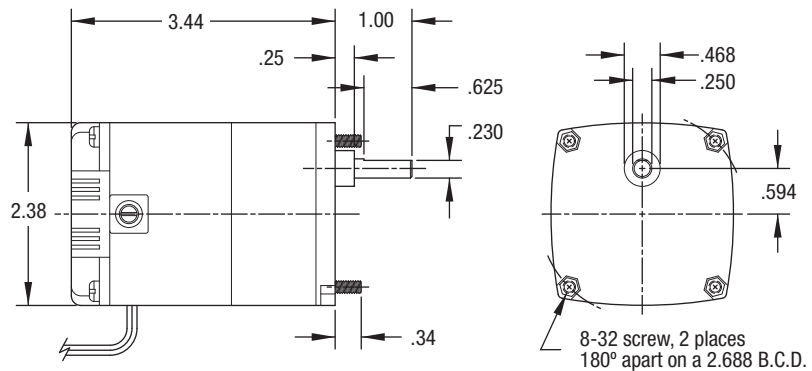
Connections

Type	leads
Number of wires	3
Input Voltage	115 VAC / 60 Hz
Power	7.50 W
Temperature Range	-40°C to 65°C
Dimensions	See drawing

Torque

With load limiting Clutch	50 oz-in
Motor	126 oz-in @ 10 rpm
Weight	3 Lb

Motor Specification "B"
90V DC MOTOR



MDC 90 volt direct current reversible motors are of the permanent magnet type featuring high efficiency, no field supply requirement, low heat and linear speed-torque characteristics. Two leads with integral connector provide easy mating with 90 volt motor controller. These motors are furnished with an integral gear unit with 180:1 gear reduction. The gearing is of the helical-spur design with helical gears in the primary stage for quiet operation and hardened spur gears in the secondary stages. Mounting dimensions conform to NEMA 2-11 standards.

Specifications

Connections

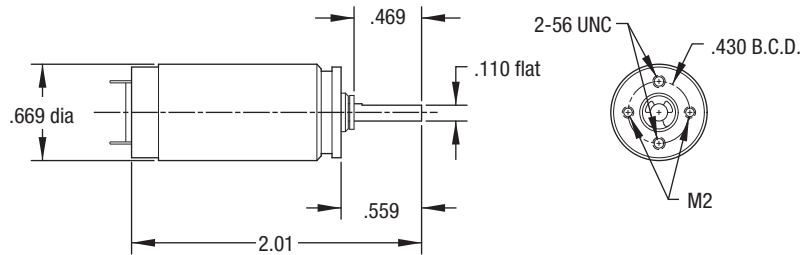
Type	Connector
Number of pins	2
Input Voltage	90 VDC
Power input	2.25 W
Temperature Range	-20°C to 65°C
Dimensions	See drawing

Torque

With load limiting clutch	50 oz-in
Motor Geared @ 180 : 1	72 oz-in @ 10 rpm
Speed	0.7 to 10 rpm
Weight	6 Lb



Motor Specification "C" 12V DC MOTOR



Miniature DC motors are used on all MDC motorized miniature rotary and linear motion instruments. The built in gear head with a 262:1 gear ratio gives this motor a maximum torque load of 20 oz-in. Devices fitted with these miniature motors are constructed with a load limiting clutch to prevent motor burnout. Motors are mounted to motion instruments inside anodized aluminum housings with inline or side mount drive geometries.

Miniature rotary and linear motion instruments, which have inline geometries, can also be purchased with a magnetic encoder.

- Square wave output
- TTL / CMOS compatible
- 16 pulses per revolution
- 2 channels, 90° phase shift

Specifications

Connections

Type	2 contact coaxial
Number of wires	2
As Motion Option 4	2.5 mm plug
Input Voltage	12 VDC
Input Current	140 mA
Temperature Range	-30°C to 65°C
Dimensions	See drawing

Torque

Friction	0.006 oz-in
Stall	0.13 oz-in
Motor Geared @ 262 : 1	20 oz-in
Armature Resistance	80 ohm
Armature Inductance	1.2 mH
Weight	0.43 oz

Magnetic Encoder Specifications

Nominal Power Requirement

	5mA max. @ 5 VDC @ 22°C
Max. Operating voltage	15.0 VDC
Signal Phase Shift and Tolerance	90° ±45° (2 phase signal)
Maximum Signal Frequency	7.2 kHz

Temperature Range

Operating	-20°C to 85°C
Storage	-40°C to 110°C
Connection	Ansley low-profile DIP plug, 8-pin
Maximum Asymmetry	10°
Signal Rise Time	less than 5 microseconds

DC Motor Controls, see page 464

DC Controller 12V DC MOTOR



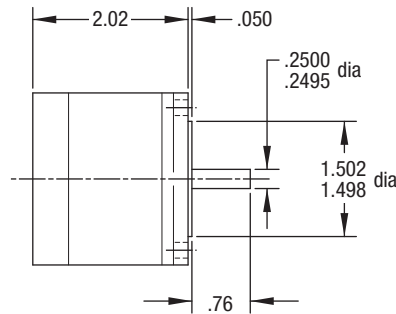
DC Controller 90V DC MOTOR





Motor Specification "D"

LOW TORQUE STEPPER MOTOR



The M061-CS02 stepper motor is designed to NEMA standards 23D frame size specifications and is ideally suited for use on various MDC motion and manipulation devices. It has a $\pm 3\%$ noncumulative step accuracy and a 48-50 tooth pitch configuration which give it smooth operating soft step motion, less resonance and instability. This motor is connector fitted with 6 wire contacts. The motor specifications provided are for an in series bipolar wiring configuration. Motors can be used in a unipolar configuration. However, current, voltage and torque ratings would change. Contact factory for details.

Specifications

Connections

Type	Connector
Number of pins	6
Input Voltage	5 VDC
Input Current	0.7 A
Temperature Range	-40°C to 65°C
Dimensions	See drawing

Steps per Revolution

200

Torque

Holding with 2 phases on	75 oz-in
Residual	1 oz-in

Rotor Inertia

0.04 Lb-in²

Overhang Load

15 Lb

Thrust Load

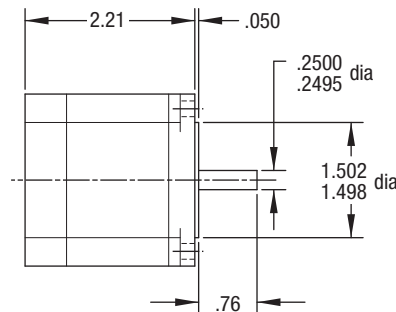
25 Lb

Weight

1.5 Lb

Motor Specification "E"

MEDIUM TORQUE STEPPER MOTOR



The KML061S04 stepper motor is designed to NEMA standards 23D frame size specifications, and is ideally suited for use with various MDC motion and manipulation devices. It has a $\pm 2\%$ noncumulative step accuracy and can operate in full-step (1.8°) or half-step (0.9°) increments. It can be microstepped to achieve increments as small as .0072° and operate at rates to 20,000 steps per second (6,000 rpm). The motor specifications provided are for in series bipolar wiring configuration.

Specifications

Connections

Type	Connector
Number of pins	6
Input Voltage	3 VDC
Input Current	2 A
Temperature Range	-40°C to 65°C
Dimensions	See drawing
Steps per Revolution	200

Torque

Holding with 2 phases on	170 oz-in
Residual	1 oz-in

Rotor Inertia

0.0034 oz-in²

Overhang Load

15 Lb

Thrust Load

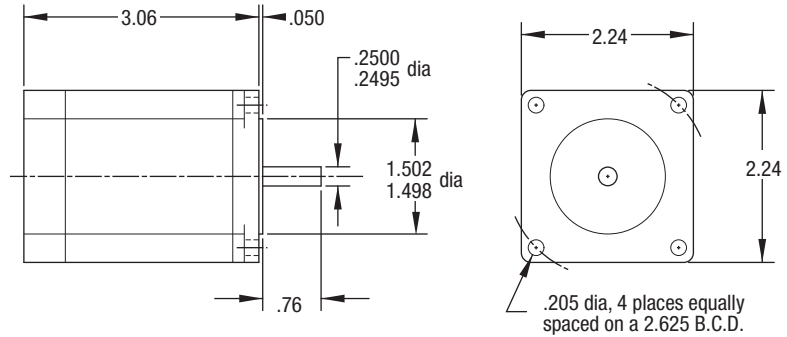
25 Lb

Weight

1.6 Lb



Motor Specification "F" HIGH TORQUE STEPPER MOTOR



KML062S04 stepper motors are designed to NEMA standards 23D frame size specifications. The dual-stack construction of this motor produces double the torque of standard motors. It has a $\pm 2\%$ noncumulative step accuracy and can operate in full-step (1.8°) or half-step (0.9°) increments. It can be microstepped to achieve increments as small as $.0072^\circ$ and operate at rates to 20,000 steps per second (6,000 rpm). Motor specifications represent an in series bipolar wiring configuration.

Specifications

Connections

Type	Connector
Number of pins	6
Input Voltage	4.67 VDC
Input Current	2.12 A
Temperature Range	-40°C to 65°C
Dimensions	See drawing
Steps per Revolution	200

Torque

Holding with 2 phases on	250 oz-in
Residual	1.4 oz-in

Rotor Inertia	0.0056 oz-in ²
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Overhang Load	15 Lb
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Thrust Load	25 Lb
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Weight	2.3 Lb
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Stepper Motor Controls, see page 465

Controller

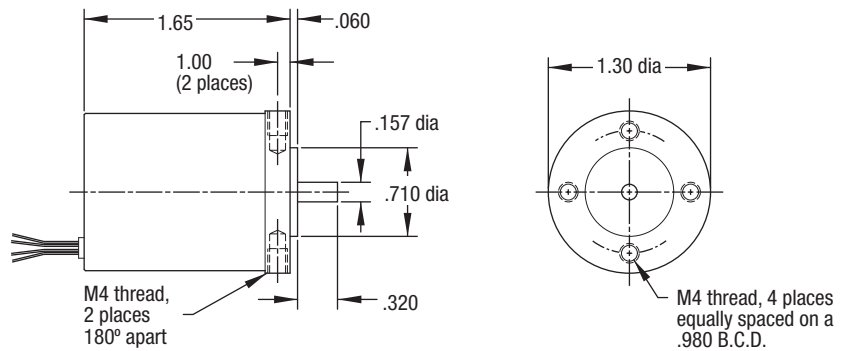


Indexer





MINIATURE HV HIGH VACUUM STEPPER MOTOR



Specifications

Connections	
Type	Kapton® insulated 1 / 0.6mm
Electrical wires	4
Thermocouple wires	Not available
Input Voltage	3.12 VDC
Input Current	1.2 A
Temperature Range	-40°C to 150°C
Dimensions	See drawing

Steps per Revolution	200
Vacuum Range	5x10 ⁻⁸ Torr
Torque	
Holding	7.5 oz-in
Detent	0.5 oz-in
Winding Resistance	2.6 Ohm
Winding Inductance	1.2 mH
Weight	0.5 Lb

With 200 steps per revolution, these in-vacuum stepper motors are ideally suited for the precision movement of delicate specimens inside a high vacuum system. Their low out-gassing characteristics, make these motors especially suitable for sensitive semiconductor handling and many other high vacuum applications.

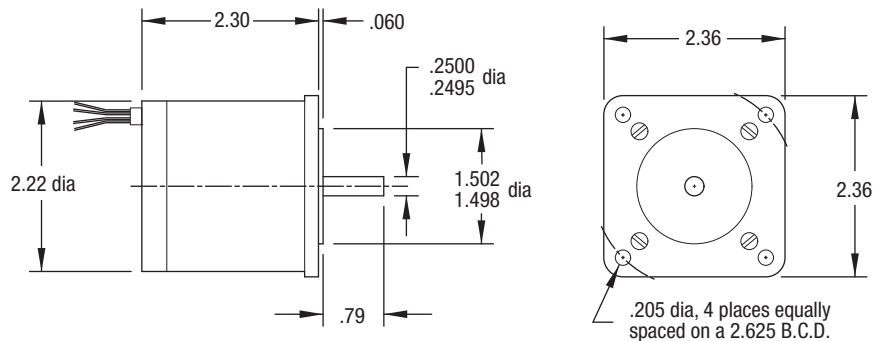
REFERENCE

SM13-HV

PART
NUMBER

665921

HIGH TORQUE HV HIGH VACUUM STEPPER MOTOR



Specifications

Connections	
Type	Kapton® insulated 1 / 0.6mm
Electrical wires	4
Thermocouple wires	Not available
Input Voltage	6.8 VDC
Input Current	1.2 A
Temperature Range	-40°C to 150°C
Dimensions	See drawing

Steps per Revolution	200
Vacuum Range	5x10 ⁻⁸ Torr
Torque	
Holding	60 oz-in
Detent	4.5 oz-in
Winding Resistance	5.7 Ohm
Winding Inductance	6.7 mH
Weight	1.5 Lb

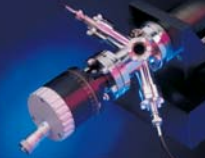
With 200 steps per revolution, these in-vacuum stepper motors are ideally suited for the precision movement of delicate specimens inside a high vacuum system. Their low out-gassing characteristics, make these motors especially suitable for sensitive semiconductor handling and many other high vacuum applications.

REFERENCE

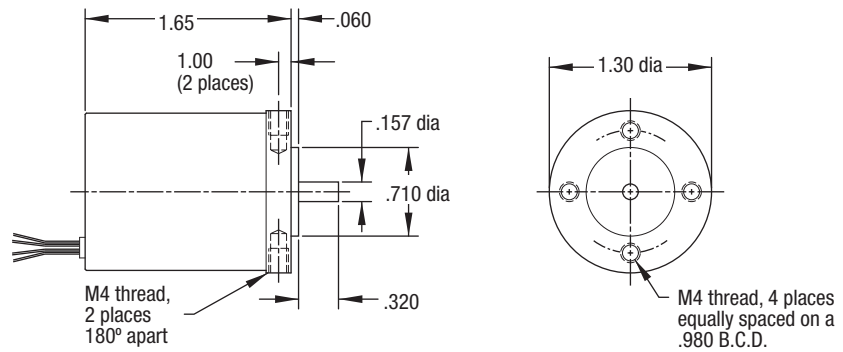
SM23-HV

PART
NUMBER

665911



MINIATURE UHV ULTRAHIGH VACUUM STEPPER MOTOR



Specifications

Connections

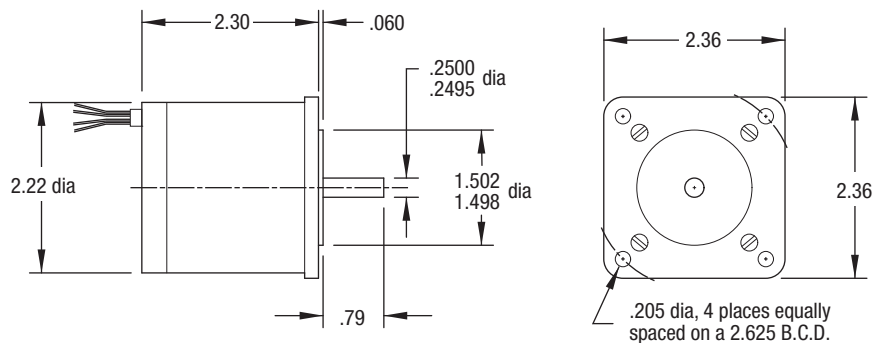
Type	Kapton® insulated 1 / 0.6mm
Electrical wires	4
Type K thermocouple wires	2
Input Voltage	3.12 VDC
Input Current	1.2 A
Temperature Range	-40°C to 250°C
Dimensions	See drawing

Steps per Revolution	200
Vacuum Range	1x10 ⁻¹⁰ Torr
Torque	
Holding	7.5 oz-in
Detent	0.5 oz-in
Winding Resistance	2.6 Ohm
Winding Inductance	1.2 mH
Weight	0.5 Lb

With 200 steps per revolution, these in-vacuum stepper motors are ideally suited for the precision movement of delicate specimens inside ultrahigh vacuum system. The particulate generation of these stepper motors is minimized by the total absence of metal to metal sliding surfaces. Their low outgassing characteristics, make these motors especially suitable for many sensitive ultrahigh vacuum applications.

REFERENCE	PART NUMBER
SM13-UHV	665922

HIGH TORQUE UHV ULTRAHIGH VACUUM STEPPER MOTOR



Specifications

Connections

Type	Kapton® insulated 1 / 0.6mm
Electrical wires	4
Type K thermocouple wires	2
Input Voltage	6.8 VDC
Input Current	1.2 A
Temperature Range	-40°C to 250°C
Dimensions	See drawing

Steps per Revolution	200
Vacuum Range	1x10 ⁻¹⁰ Torr
Torque	
Holding	60 oz-in
Detent	4.5 oz-in
Winding Resistance	5.7 Ohm
Winding Inductance	6.7 mH
Weight	1.5 Lb

With 200 steps per revolution, these in-vacuum stepper motors are ideally suited for the precision movement of delicate specimens inside ultrahigh vacuum system. The particulate generation of these stepper motors is minimized by the total absence of metal to metal sliding surfaces. Their low outgassing characteristics, make these motors especially suitable for many sensitive ultrahigh vacuum applications.

REFERENCE	PART NUMBER
SM23-UHV	665912

Miniature 12V DC Motor Controller

Description

DCM-SC-12 controllers are designed for use with MDC 12 VDC motors featured in this catalog. For detailed motor specifications reference motor specification "C" on page 459. This controller provides bidirectional motor control in both continuous and jog modes. Motor speed is adjustable from 0 to 20 rpm via a convenient dial potentiometer. A feedback circuit using the motor's "Back-EMF" provides a flat torque-speed curve. Controller comes factory wired for 115VAC input and is provided with a pre-wired 2 conductor cable for direct connection to MDC 12V motorized components via a standard 2.5-mm plug. A rear panel voltage switch allows the DCM-SC-12 to accept 110 or 220 line voltage. Motor controls are not included as part of feedthrough motorization options and must be purchased separately.

Features

- Run and jog modes
- Variable voltage speed control
- Forward and reverse operation
- 12 volt DC output

Specifications

Controls

Run / Jog Momentary toggle

Speed Adjustable voltage potentiometer

Input Voltage 115 / 220 VAC

Input Current 0.25 A maximum

Output Voltage Variable 0-12 VDC

Output Current 4 A maximum

Temperature Range -20°C to 85°C

Weight 2 lb

Dimensions 6.75 x 5.80 x 2.85



REFERENCE

DCM-SC-12

PART
NUMBER

692002

Standard 90V DC Motor Controller

Description

DCM-SC-90 controllers are designed for use with MDC 90 VDC motors featured in this catalog. For detailed motor specifications reference motor specification "B" on page 458. This controller provides bidirectional motor control in both continuous and jog modes. Motor speed is adjustable from 0 to 10 rpm via a convenient dial potentiometer. A feedback circuit using the motor's "Back-EMF" provides a flat torque-speed curve. Additional built-in features include transient and surge protection, line voltage compensation, soft start, discrete silicon-controlled rectifiers and diodes for higher amperage output and better heat dissipation. Controller comes factory wired for 115VAC input and is provided with a pre-wired 2 conductor cable for direct connection to MDC 90V motorized components. Motor controls are not included as part of feedthrough motorization options and must be purchased separately.

Features

- Run and jog modes
- Variable voltage speed control
- Forward and reverse operation
- 90 volt DC output

Specifications

Controls

Run / Jog Momentary toggle

Speed Adjustable voltage potentiometer

Input Voltage 115 VAC

Input Current 1 A

Output Voltage Variable 0-90 VDC

Output Current 0.50 A

Temperature Range -20°C to 85°C

Weight 2 lb

Dimensions 6.75 x 5.80 x 2.85



REFERENCE

DCM-SC-90

PART
NUMBER

692007

Stepper Motor Controller

Description

SMC-M controllers are designed for use with MDC stepper motors featured in this catalog. Stepper motor specifications "D, E and F" can be found starting on page 460. This controller is also recommended for use with the high and ultrahigh, in-vacuum stepper motors detailed on page 462. Current control output is vital in any stepper motor controller; MDC stepper motor controllers employ the time-tested, bipolar chopper regulation of current. Output current is factory set to 0.6 amperes required for the low torque "D" motor. Output current must be adjusted to 2.0 amperes for the medium and high torque motors, "E" and "F" respectively. Resetting current output for 2.0 amperes is accomplished by adjusting the six internal DIP switches to the off position. Stepper motor controls are not included with motorization options, and must be purchased separately.

Features

- Run and jog modes
- Variable speed control
- Forward and reverse operation
- 5 volt DC output

Specifications

Step Counter	Four digit LED
Resolution	Half-step increments
Controls	Manual Dial, Forward / Reverse
Input Voltage	115 VAC
Input Current	1 A
Output Voltage	5 VDC, 2 Phase
Output Current	Adjustable from 0.5 to 2.5 A
Temperature Range	-20 to 85°C
Weight	9 Lb
Dimensions	8.60 x 9.50 x 5.05



REFERENCE	PART NUMBER
CONTROLLER SMC-M	692005

Stepper Motor Indexer

Description

The SMC-1 indexer is a powerful and user friendly tool capable of complex motion profile control when interfaced with an IBM compatible PC. The indexer comes with the necessary software for programming via ASCII commands. The 37 pin Type-D subminiature interface provides the user with TTL input and output access. Please note that stepper motor controllers and indexer are not included with motorization options, and must be purchased separately.

Features

- Bidirectional ramping
- RS-232C interface
- Programmable via host computer

Specifications

Interface	RS-232C
Input / Output	37 pin Type-D subminiature
Controller Interface	9 pin Type-D subminiature
Memory	100 Block programs, 512 bytes
Control	Via IBM compatible PC
Input Voltage	115 VAC
Speed	23,000 Steps / second maximum
Distance	65,000 Steps / move command
Temperature Range	-20 to 85°C
Weight	4 Lb
Dimensions	8.50 x 9.50 x 2.85



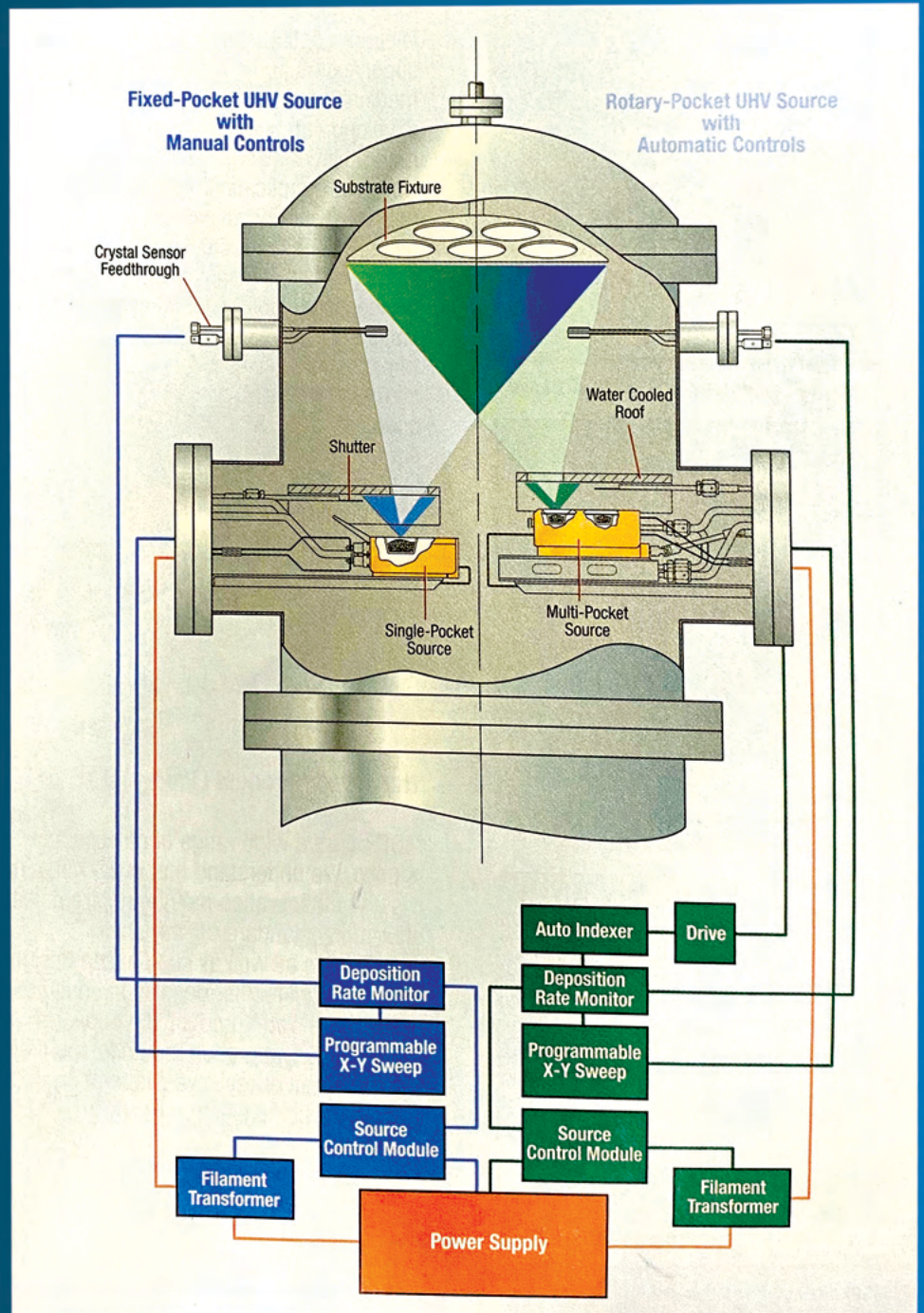
REFERENCE	PART NUMBER
INDEXER SMC-1	692006

Thin Film Deposition

8

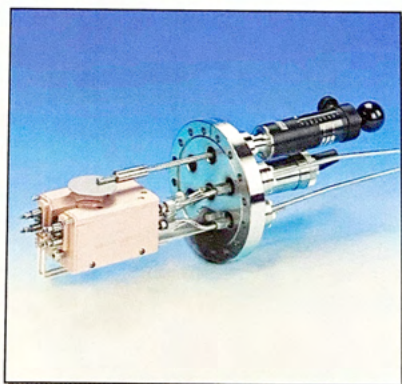


Section 8





Frame 5 Electron Beam Source



Mighty Source™ mounted on a 6-inch CF flange



XY Programmable Sweep Controller



CVS High Voltage Power Supply

e-Vap® Summary

Vacuum coating technology has evolved from an art form to a precise science over the past 40 years. It is now commonplace to evaporate metals, alloys, compounds and polymers, and control their desired thicknesses from mere atomic layers to actual microns.

Thin Film Deposition

MDC produces state-of-the-art thin film vacuum coating equipment. We currently supply users in the optical, metallurgical, medical, semiconductor, research & development, university and OEM marketplace.

Numerous applications include sunglasses, mirrors, laser optics, camera lenses, optical filters, infrared detectors, anti-reflective coatings, nano-technologies, medical devices, superconductors, telecommunications, automotive decorative trim, costume jewelry, corrosion resistant coatings, stage & entertainment lighting, fiber optic coating, display technologies and MEMs technology.

The e-Vap® Product Line

MDC offers a wide range of choices and options. We understand that every vacuum system configuration may be different. We offer many standard off-the-shelf components as well as customized designs to suit your particular deposition equipment need. The e-Vap® product line supports two distinct evaporation methods: the first being thermal or resistive evaporation and the second being electron beam evaporation.

Resistive Evaporation

The *Re-Vap™* resistive sources are by far the most economical and reliable method of depositing thin films onto surfaces. In general terms, electric current passes through a resistive element that generates sufficient heat to melt and evaporate various coating materials. Materials commonly evaporated include iron, nickel, aluminum, copper, tin, silver, gold and chrome. Three basic resistive element designs are offered: filament coil, metal foil and oxide crucible types. Filament coil designs are the most popular. All resistive elements are relatively inexpensive and can be discarded after each use or after several uses.

Electron Beam Evaporation

MDC offers an unprecedented selection of electron beam evaporation sources and control electronics. Electron beam evaporation is the most versatile means of vacuum evaporation and deposition.

This technique allows the production of thin film coatings from pure elements, numerous alloys and compounds. Electron beam evaporation offers several advantages over competing processes including precise control of low or high deposition rates, excellent material utilization, sequential & co-deposition and uniform low temperature deposition. It also offers relatively high evaporation rates, freedom from source contamination, precise film compositions and cooler substrate temperatures. The materials used for evaporation are available in near limitless shapes and forms, the most common being pellets, slugs and disks. Since the 1950s, the development of higher performance films and complex coating processes has been obstructed by the lack of modern electron beam evaporation equipment and technology. The e-Vap® product line has taken this challenge head-on and provides electron beam evaporation sources and control electronics that incorporate leading edge technologies unmatched in the industry.

For all e-Vap® products
visit our website:

www.mdcvacuum.com

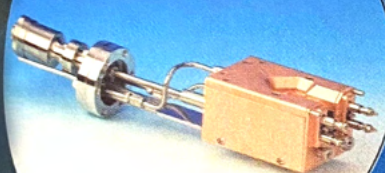


e-Vap® Source



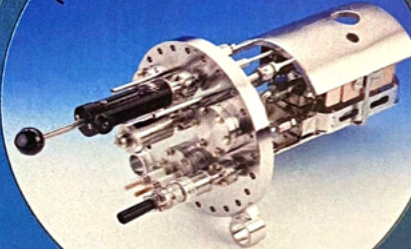
Single pocket • Multi pocket • UHV • Flange-mounted

Mighty Source™

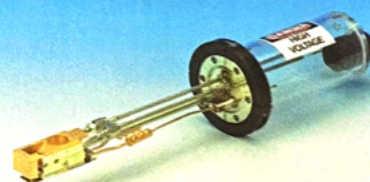


Multi pocket

Flange-mounted UHV Source

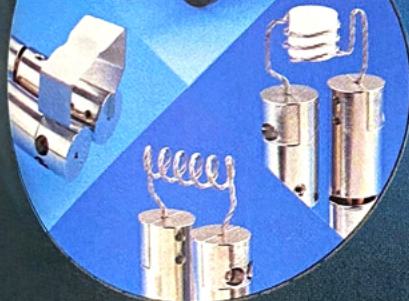


e-Vap® 3000

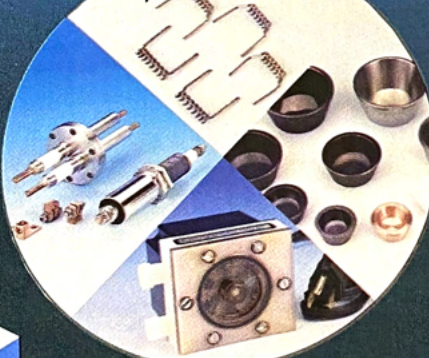


Single pocket

Re-Vap™ 900 System



Accessories



For a complete listing of all e-Vap® products, visit our website at...

www.mdcprecision.com

Blank

9

Chambers



Section 9

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Stainless Steel Bell Jars	474
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Feedthrough Collars	476
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Typical stainless steel bell jar system

- Stainless steel bell jars
- Feedthrough collars
- Baseplates
- Base wells

Stainless Steel Bell Jars

MDC stainless steel bell jars are designed for use with MDC baseplates, base wells and feedthrough collars. A dovetail groove in the jar's base flange holds a FKM / FPM fluoroelastomer elastomer gasket, which makes the vacuum seal with one of the forementioned components. All stainless steel bell jars are fitted with a four inch view diameter Pyrex® viewport. All vacuum welds are internal and provide UHV compatibility. For added convenience, all bell jars are fitted with a hoist or lift-ring that is welded to the chamber's domed top. These chambers can be purchased with an optional electropolished finish.

Feedthrough Collars

MDC feedthrough collars are used to expand the capabilities of conventional bell jars by providing radially oriented access ports. Four, eight, or eighteen ports fitted with either 2-3/4 inch Del-Seal™ CF metal seal flanges or ISO KF NW40 Kwik-Flange™ flanges are available. These ports accept a variety of standard MDC vacuum components such as electrical, fluid and motion feedthroughs. Installation of a feedthrough collar also requires the use of an MDC baseplate. The feedthrough collar is positioned between a bell jar and the baseplate. The feedthrough collar / baseplate seal is made with either an L-gasket or circular cross section elastomer, depending on which collar model is used. The feedthrough collar seal is made with an L-gasket elastomer. Stainless steel bell jars would use a circular cross section elastomer in the jar's dovetail groove to make this seal.

Baseplates

MDC base plates are required for installation of both bell jars and feedthrough collars. They provide a flat and stable platform upon which bell jar systems can be built. Baseplates are typically mounted atop a vacuum pump or the gate valve fitted to the pump. MDC offers three baseplate interface flanges for mating with standard pumps or gate valves. Interface flanges include ANSI ASA elastomer seal flanges, Del-Seal™ CF metal seal flanges and bolt style Large-Flange™ ISO LF elastomer seal flanges. Baseplates are available with baseplate flange diameters suitable for 12, 18 and 24 inch chamber body diameters.

Base Wells

Base wells are the product of integrating both a baseplate and a feedthrough collar. They provide the functionality of both components and replace one vacuum seal with a weld joint. They are available with radially oriented access ports in four, eight, or eighteen port configurations and are fitted with either 2-3/4 inch Del-Seal™ CF metal seal flanges or ISO KF NW40 Kwik-Flange™ flanges. These ports accept a variety of standard MDC vacuum components such as electrical, fluid and motion feedthroughs. Both baseplates and base wells connect to the vacuum pumping system with a choice of standard smooth face ASA ANSI flanges, optional Del-Seal™ CF metal seal flanges or ISO LF bolt-style Large-Flange™ flanges. Gasket seals for any flange or port are not included with baseplates or base wells and must be purchased separately. For pump port or access port flange hardware, refer to individual flange specifications in the Flanges & Fittings section of this catalog.

All dimensions in this catalog are given in inches unless specified otherwise.



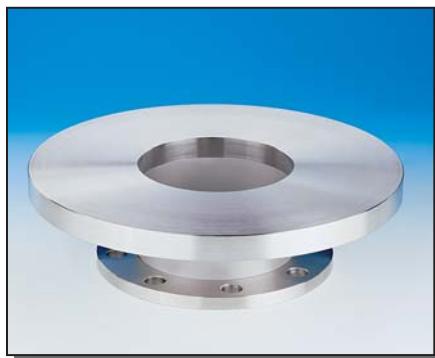
Stainless steel bell jar

page 474



Multi-port feedthrough collar

page 476



Baseplate

page 478

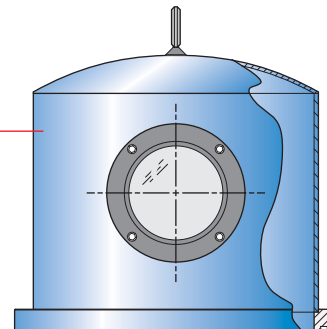


Base well

page 478

Typical bell jar chamber installation

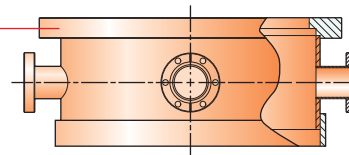
Stainless steel bell jars are found on page 474



O-rings are on page 475



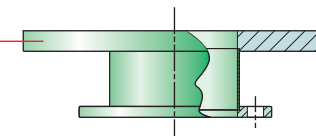
Multi-port feedthrough collars begin on page 476



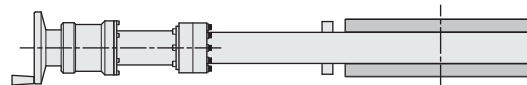
L-gaskets are on page 477



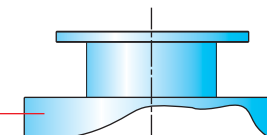
Baseplates and Base Wells are found on page 478



Gate valves are in Section 2.1, page 163



Cryogenic Sorption roughing pumps are in Section 3.2, page 259 — High vacuum pumps are customer supplied



Typical configuration shown without connecting hardware for clarity



Stainless Steel Bell Jar

Description

Type 304 Stainless Steel Bell Jars are designed to be used with flat Baseplates, Base Wells and Feedthrough Collars. A dovetail groove in the jar's base flange holds a FKM / FPM fluoroelastomer O-ring, supplied with each unit, which makes the vacuum seal with a baseplate. A PVP-4 Pyrex® Viewport with a four-inch diameter viewing area is included. All welds are internal. A single top-center lift ring is included. Electropolished finish option is available.

Specifications

Material

Bell Jar 304ss

Gasket, elastomer FKM / FPM fluoroelastomer

Seal

Gasket, elastomer O-ring

Method Gravity

Vacuum Range 1×10^{-6} Torr

Temperature Range Ambient to 150°C

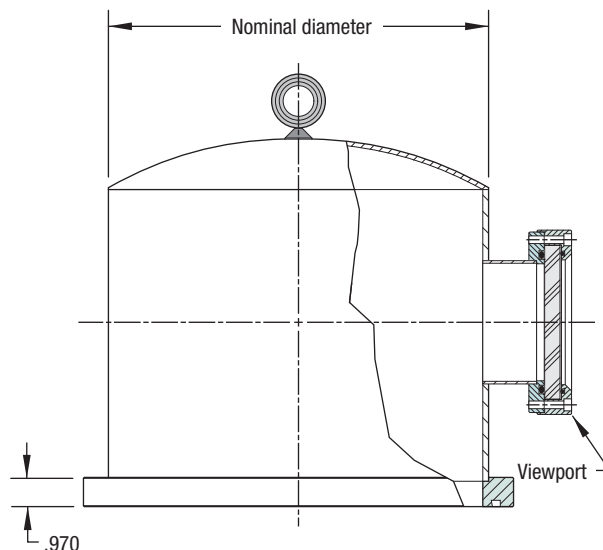
Weight & Dimensions See table

HIGH VACUUM SERIES

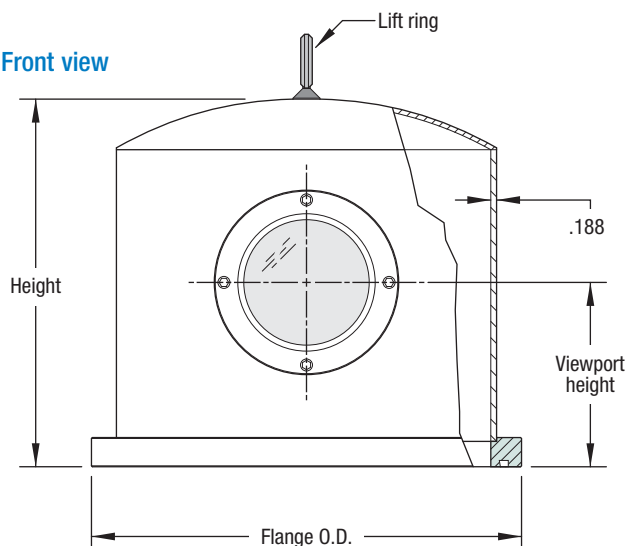
Features

- 304ss material
- FKM / FPM fluoroelastomer gasket seal
- Three standard sizes
- Pyrex® viewport PVP-4

Side view



Front view



Chambers

Stainless Steel Bell Jars



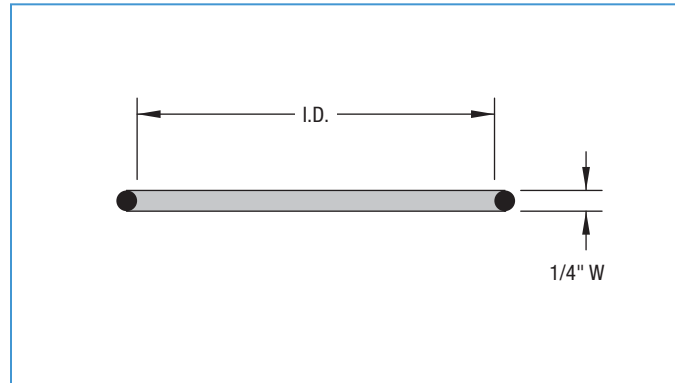
Section 9.1

Bell Jar



NOM. SIZE	I.D.	FLANGE O.D.	HEIGHT W/O RING	VIEWPORT HEIGHT	WT LB	REFERENCE	PART NUMBER
12	12.00	14.00	12.00	6.00	65	SSBJ-12	524000
18	18.00	20.00	30.00	12.00	195	SSBJ-18	524001
24	24.00	26.00	30.00	12.00	250	SSBJ-24	524002

O-ring



- Use with Stainless Steel bell jar
- FKM / FPM fluoroelastomer material
- Three standard sizes
- Also used with stainless steel Feedthrough Collars on page 476

NOMINAL SIZE	NOMINAL I.D.	WT LB	REFERENCE	PART NUMBER
10	12-1/2	1/8	OR-12	521003
12	18-1/2	1/8	OR-18	521004
18	25	1/8	OR-24	521005

Viewport spares



DESCRIPTION	WT LB	REFERENCE	PART NUMBER
REPLACEMENT GLASS, 7740 PYREX OPTICAL 5" O.D.	1	-	045010
BOLT, SOCKET HEAD, STAINLESS STEEL, .250-28 x 1" LONG (Pkg of 4)	1/4	-	190166
O-RING, GLASS-TO-FLANGE	1/4	-	041346
O-RING, GLASS-TO-RETAINER	1/4	-	041243

For viewport details, see page 310.



Feedthrough Collar, O-ring sealed



Feedthrough collar, L-gasket sealed

Features

- Choice of 2-3/4" Del-Seal™ CF flange or Kwik-Flange™ KF port connections.
- All type 304 stainless steel construction
- Elastomer seal on collar, one included

Description

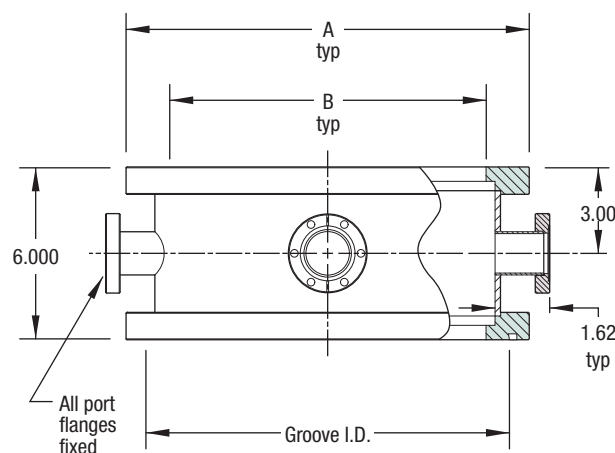
Standard MDC Feedthrough Collars add four, eight, or eighteen convenient feedthrough ports to bell jar vacuum systems. These ports accept a variety of feedthrough devices and other components mounted on mating Del-Seal™ CF 2-3/4" flanges or ISO NW40 Kwik-Flange™ KF ports.

Installation of a feedthrough collar is made by positioning it between a bell jar and a baseplate. The lower collar-to-baseplate seal is made with either a FKM / FPM fluoroelastomer L-gasket or O-ring, depending on which collar model is used. With Stainless Steel Bell Jars, a FKM / FPM fluoroelastomer O-ring in the jar's dovetail groove makes the seal.

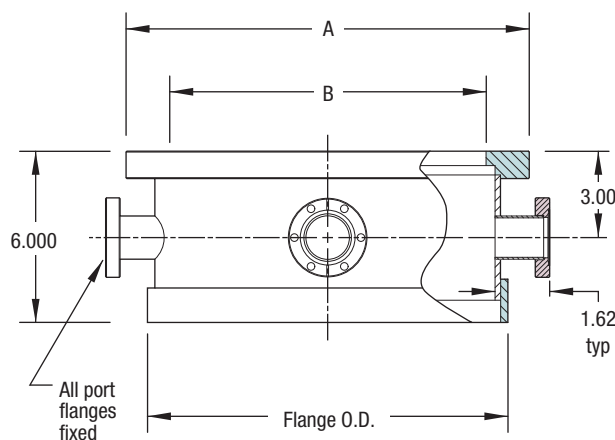
One O-ring or L-gasket is included with each collar. Dimensions and reordering information are found on the next page.

HIGH VACUUM SERIES

O-ring sealed



L-gasket sealed



- Drawings show collars with four Del-Seal™ CF ports.
- All collar walls are nominally 3/16" thick.



O-ring sealed



NOM. SIZE	NO. PORTS	PORT FLANGE O.D.	ISO REF.	A	B	O-RING GROOVE I.D.	WT LB	REFERENCE	PART NUMBER
DEL-SEAL™ CF PORTS									
12	4	2.73	-	14	11	12.50	65	FTCO-12	523002
18	8	2.73	-	20	16	18.50	150	FTCO-18	523003
24	18	2.73	-	26	23	25.00	230	FTCO-24	523004

KWIK-FLANGE™ KF PORTS									
12	4	2.16	NW40	14	11	12.50	50	FTCO-K150-12	523022
18	8	2.16	NW40	20	16	18.50	85	FTCO-K150-18	523025
24	18	2.16	NW40	26	23	25.00	130	FTCO-K150-24	523028

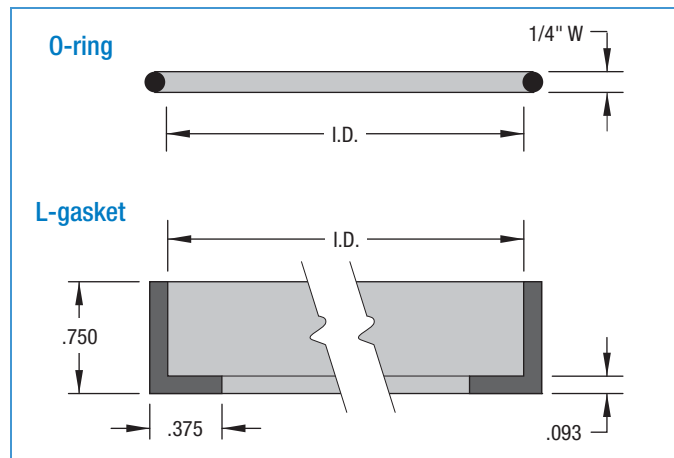
L-gasket sealed



NOM. SIZE	NO. PORTS	PORT FLANGE O.D.	ISO REF.	A	B	FLANGE O.D.	WT LB	REFERENCE	PART NUMBER
DEL-SEAL™ CF PORTS									
12	4	2.73	-	14	11	12.5	35	FTC-12	523000
18	8	2.73	-	20	16	18.5	65	FTC-18	523001

KWIK-FLANGE™ KF PORTS									
12	4	2.16	NW40	14	11	12.5	35	FTC-K150-12	523031
18	8	2.16	NW40	20	16	18.5	60	FTC-K150-18	523034

Seals



- FKM / FPM fluoroelastomer material
- Three standard sizes for each type seal

NOMINAL SIZE	NOMINAL I.D.	WT LB	REFERENCE	PART NUMBER
O-RING				
10	12-1/2	1/8	OR-12	521003
12	18-1/2	1/8	OR-18	521004
18	25	1/8	OR-24	521005

L-GASKET				
10	9-1/4	1/4	GVL-10	521000
12	11-1/2	1/4	GVL-12	521001
18	17-1/4	1/4	GVL-18	521002



Baseplate and Base Well

Features

- 2-3/4" Del-Seal™ CF flange or Kwik-Flange™ KF NW 40 port connections on Base Wells
- Standard ASA pump port flange, with optional Del-Seal™ CF or ISO Large-Flange™ LF port
- All type 304 stainless steel construction
- Elastomer seal surface

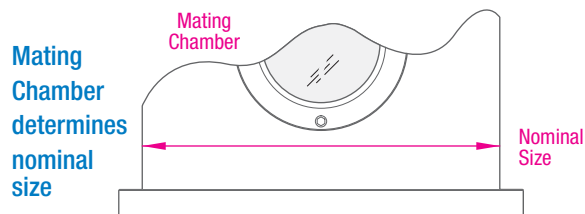
Description

Installation of a Baseplate is made by positioning a Bell Jar or Feedthrough Collar directly on top of it. The bell jar-to-baseplate seal is made with either a FKM / FPM fluoroelastomer L-gasket or O-ring, depending on which Bell Jar or Feedthrough model is used.

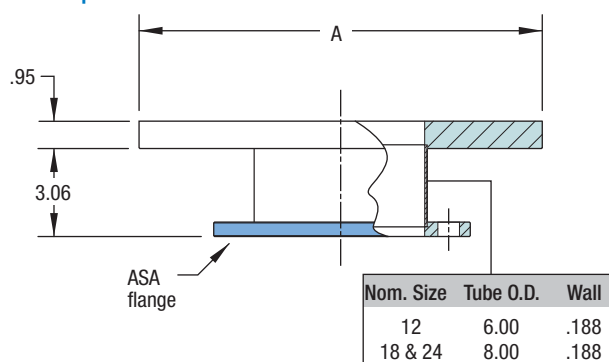
Standard MDC Base Wells are the integral combination of a Feedthrough Collar and a Baseplate, and eliminate one vacuum seal with a weld. Base Wells add four, eight, or eighteen convenient feedthrough ports to bell jar vacuum systems. These ports accept a variety of feedthrough devices and other components mounted on mating Del-Seal™ CF 2-3/4" flanges or Kwik-Flange™ KF NW40 sizes. If access ports are not required, Bell Jars can be mounted directly on Baseplates. Both Baseplates and Base Wells connect to the vacuum pumping system with a choice of standard smooth face ASA ANSI flange, or optional Del-Seal™ CF metal seal flange or Large-Flange™ LF bolt-style.

Seals for any flanges or ports are not included with Baseplates or Base Wells. For pump port flange or side port flanges, refer to individual flange specifications in Section 1.

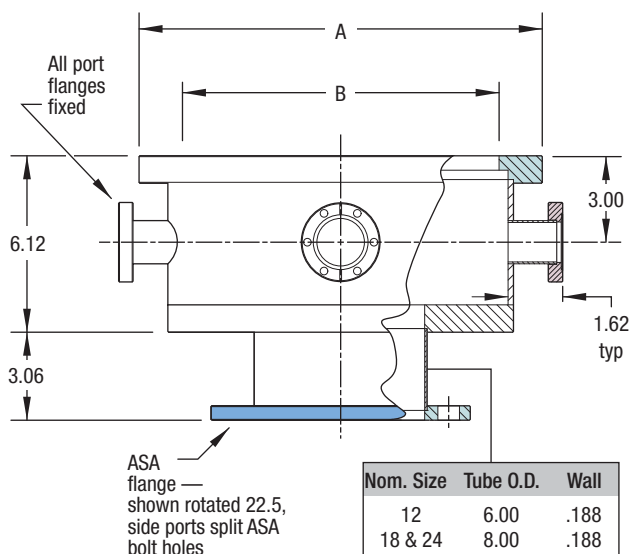
HIGH VACUUM SERIES



Baseplate



Base Well



ASA Pump Port Flange

NOMINAL SIZE	ANSI REF.	ASA DIA.	ASA THK.	NO. HOLES	HOLE DIA.	BOLT CIRCLE
12	4	9.00	.50	8	.75	7.50
18 & 24	6	11.00	.75	8	.81	9.50

- ASA flanges are nonrotatable with a smooth face.
- O-ring grooves may be added as a special configuration.
- Base and port seals not included.

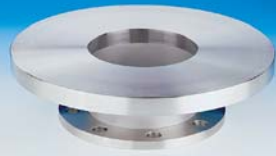
Chambers

Baseplates & Base Wells

Section 9.2



Baseplate



NOMINAL SIZE	PUMP PORT	ASA O.D.	A	WT LB	REFERENCE	PART NUMBER
12	ANSI-4	9.00	14	55	BP-12	523008
18	ANSI-6	11.00	20	110	BP-18	523009
24	ANSI-6	11.00	26	185	BP-24	523010

Base Well

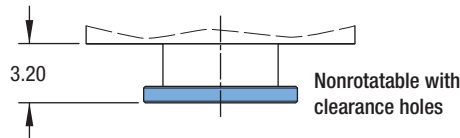


NOMINAL SIZE	PUMP PORT	NO. PORTS	PORT FLG. O.D.	ISO REF.	A	B	WT LB	REFERENCE	PART NUMBER
DEL-SEAL™ CF SIDE PORTS									
12	ANSI-4	4	2.73	-	14	11	80	BW-12	523005
18	ANSI-6	8	2.73	-	20	16	160	BW-18	523006
24	ANSI-6	18	2.73	-	26	23	250	BW-24	523007

KWIK-FLANGE™ KF SIDE PORTS									
12	ANSI-4	4	2.16	NW40	14	11	77	BW-K150-12	523050
18	ANSI-6	8	2.16	NW40	20	16	154	BW-K150-18	523053
24	ANSI-6	18	2.16	NW40	26	23	237	BW-K150-24	523056

Pump Port Options

Del-Seal™ CF

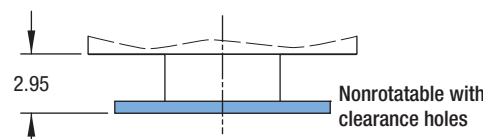


NOMINAL SIZE	MDC REF.	FLANGE DIA.	FLANGE THK.	NO. HOLES	HOLE DIA.	BOLT CIRCLE
12	F800600	7.97	.880	20	.332	7.128
18 & 24	F1000800	9.97	.970	24	.332	9.128

CHAMBER NOM. SIZE	OPTION NUMBER
12	-01
18 & 24	-03

Provides mating flange to metal-sealed port on vacuum pump. Optional elastomer seals available. See Section 1.1 for flange specifications and sealing methods. Add option number to standard part number. Example: 523008-01

Large-Flange™ LF



NOMINAL SIZE	ISO REF.	FLANGE DIA.	FLANGE THK.	NO. HOLES	HOLE DIA.	BOLT CIRCLE
12	NW160	8.86	.63	8	.43	7.87
18 & 24	NW200	11.22	.63	12	.43	10.24

CHAMBER NOM. SIZE	OPTION NUMBER
12	-02
18 & 24	-04

Provides mating flange to standard ISO port on vacuum pump. See Section 1.2 for flange specifications and sealing methods. Add option number to standard part number. Example: 523008-02



UHV Surface science chamber

Features

- UHV surface analysis chamber
- Eighteen access ports
- Three focal points
- Laser aligned ports
- Del-Seal™ CF port flanges
- Type 304 stainless steel construction

Surface Science Analysis Chambers

MDC SSAC-12 and -12D are versatile general purpose surface science analysis chambers which have proven to be suitable for a wide range of analytical studies or experimentation

MDC surface science chambers are constructed of type 304 stainless steel and with a total of 18 access ports. In addition to a vacuum pump port at the base, the chamber includes three 8", two 6", three 4-1/2" and nine 2-3/4 inch Del-Seal™ CF metal seal flanges with tube diameters of 6", 4", 2-1/2" and 1-3/4 inch, respectively. The chamber access ports accommodate a variety of experimental devices, analytical instruments, viewports, electrical and motion feedthroughs, vacuum measurement gauge tubes and other accessories.

The SSAC-12 chamber has a 14-5/8 inch female wire seal flange on the pump port while the SSAC-12D is supplied with a 14 inch Del-Seal™ CF metal seal flange. As previously noted, all 2-3/4 inch Del-Seal™ CF flanged ports are constructed with an oversized 1-3/4 inch outside diameter tubing to provide maximum apertures and allow the installation of larger devices. Access ports are precision aligned with a helium-neon laser during construction. Each port is directed at one of three internal reference or focal points A, B and C, or a vertical centerline. Angles and distances to these points are listed in a table alongside the diagram of the chamber.

Fastening and sealing hardware, including copper gaskets and bolt sets, are found under the individual size flange in the Flanges & Fittings section of this catalog. MDC employs advanced tungsten inert gas (TIG) welding techniques with high purity Argon as the inert gas medium. Manual as

well as automated orbital welding machines are at the heart of all welding operations. MDC adheres to stringent UHV welding standards and practices including that of nonfiller metal, all internal fusion weld joints. External weld joints are not used unless required for structural reinforcement and then, limited to skip or span weld configurations. In the event that a weld joint can not be made internally, a one hundred percent full penetration external weld will be used. All weld joints are leak tested using a mass spectrometer leak detector with a minimum Helium sensitivity of 2×10^{-10} standard cc/sec.

Chamber Surface Finishes

Vacuum chamber finishes include internal and external glass bead blasting of all body and port tube surfaces. Flanges and machined components have a standard 64 micro-inch surface finish. Seal surfaces are machined with a 32 micro-inch concentric finish suitable for standard metal seals. All internal surfaces are electrochemically polished.

The electropolishing process is the reverse of electroplating where the work piece is made the anode and dissolves or gives up material in the electrolytic process. The electropolishing operating conditions are controlled so that atomic oxygen forms and reacts with the metal work piece surface. According to one theory, the high points of the metal surface are most readily oxidized and this oxidized material is thereupon dissolved in the electrolyte and otherwise removed. Selective solution of the high points of a surface tends to give a very smooth finish comparable or superior to a mechanically buffed surface. In contrast to mechanical polishing, electropolishing produces a strain free surface.



Surface science chamber front view

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Surface science chamber rear view

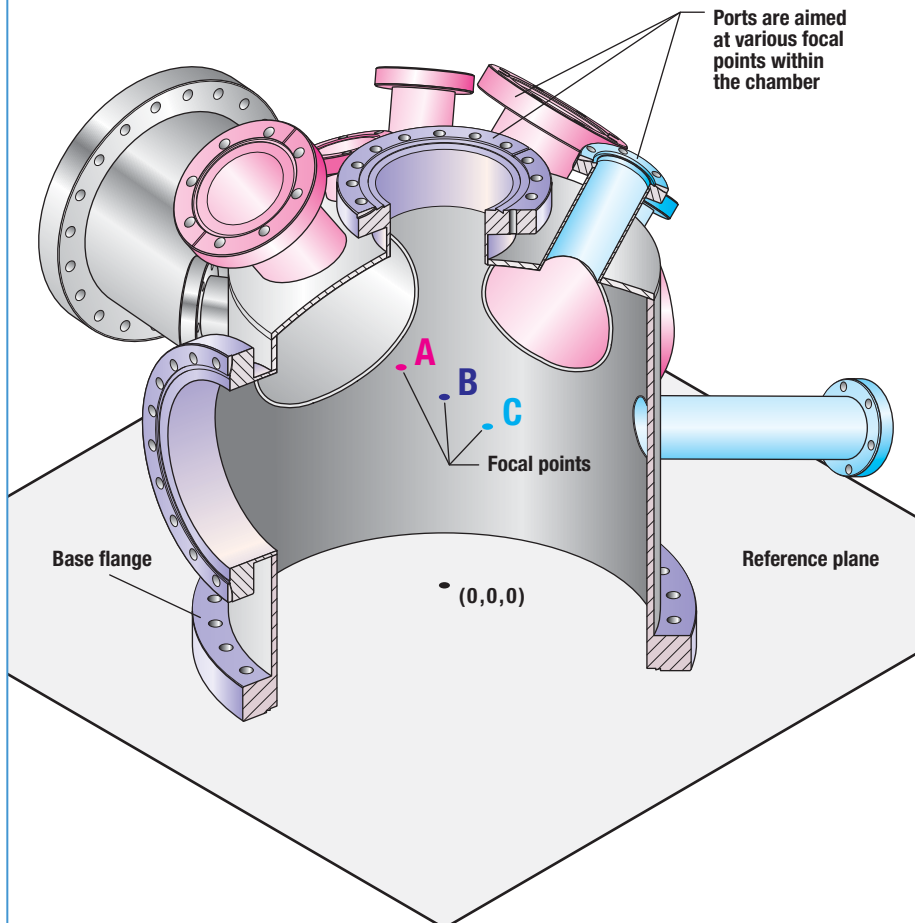
page 482



Leak Testing

MDC Precision is dedicated to providing high and ultrahigh vacuum components of the highest quality and performance. To this end all vacuum rated components manufactured by MDC and its divisions are leak tested repeatedly, as required, throughout the manufacturing process to insure these goals are met. All weld joints and flange seals are leak tested using a mass spectrometer leak detectors with a minimum Helium sensitivity of 2×10^{-10} standard cc/sec.

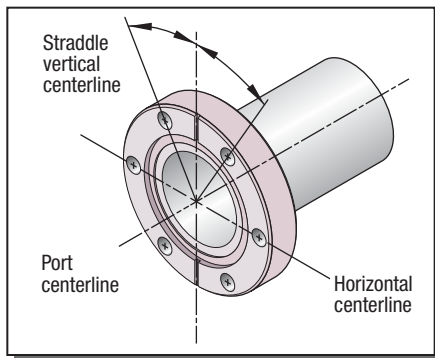
Surface Science Chamber Cross Section



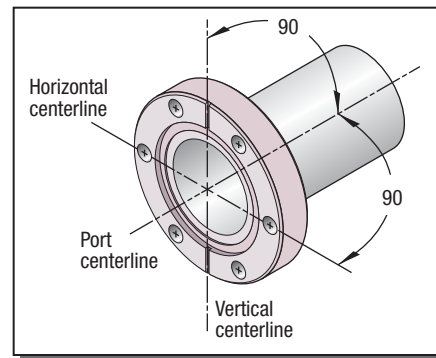
- In general, the central reference point is an arbitrary point on a reference plane.
- A base flange, reference plane and the zero point are selected for symmetry and simplicity
- The central reference point, or zero point, is given XYZ coordinates of (0,0,0)
- All focal point dimensions are measured from the zero point
- Port lengths and angles are measured from focal points



Surface science chamber base view page 482



Port flange bolt hole orientation



Port flange seal plane position



Surface Science Analysis Chamber

Description

The SSAC-12 is a versatile, general purpose surface science analysis chamber. It has proven to be suitable for a wide range of studies and experiment. Standardization of the chamber design has enabled MDC to offer the SSAC-12 at this price.

The chamber has a total of 18 access ports. In addition to the pump port in the base, there are three 8", two 6", three 4-1/2" and nine 2-3/4" ports with Del-Seal™ CF metal seal flanges. The SSAC-12 has a 14-5/8" female wire seal flange on the pump port; the SSAC-12D is supplied with a 14" Del-Seal™ CF flange.

The chamber access ports accommodate a variety of experimental devices, analytical instruments, viewports, feedthroughs and other accessories. Note that the 2-3/4" flanges connect to the chamber with oversize 1.75" O.D. tubing to accommodate larger devices.

Access ports are precision aligned with a helium-neon laser during construction. Each is oriented toward one of three internal reference points A, B and C, or a vertical centerline. Angles and distances to these points are listed in the table.

Chamber construction is of type 304 stainless steel. All flange and tube connections are TIG fusion welds. All internal surfaces are electropolished to ultrahigh vacuum standards. Connection hardware, including copper gaskets and bolt sets, are found under the individual size flange in Section 1.1.

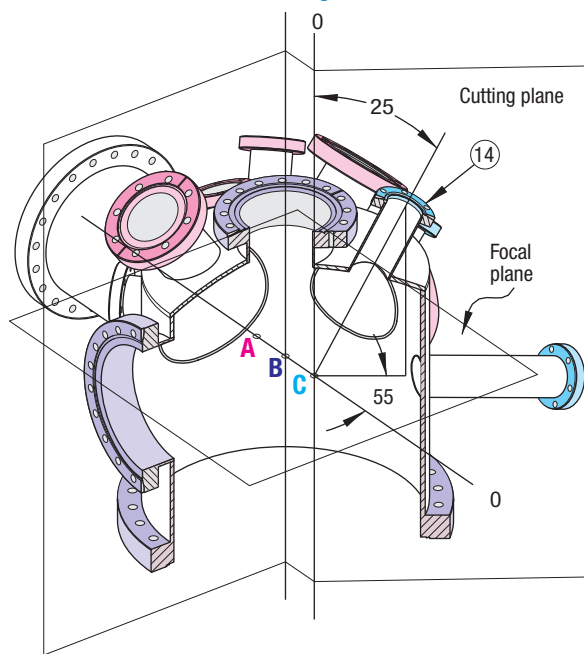
Ports with colored flanges are unique to a single focal point. Ports to focal point A are shown in magenta; ports to focal point B are shown in purple; and ports to focal point C are shown in cyan. Ports which have more than one focal point or no listed focal point are shown without color. Focal length dimensions for ports with more than one focal point are given to the first focal point intersection.

ULTRAHIGH VACUUM SERIES

Features

- Proven design
- 18 Access Ports
- Del-Seal™ CF metal seal flanges
- Precision component alignment
- All type 304 stainless steel construction
- Bakeable to 450°C
- UHV compatible to 1×10^{-11} Torr

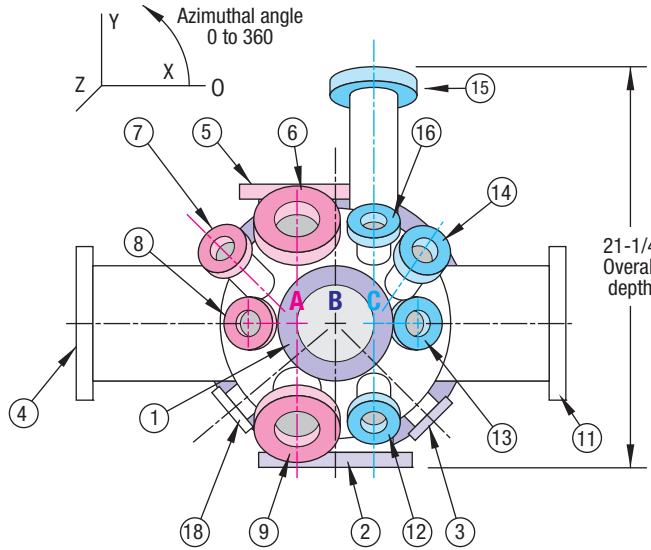
Port Angles



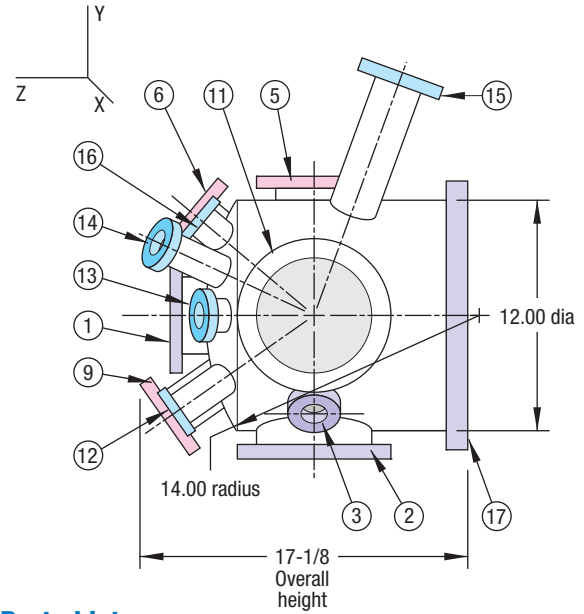
- The **polar angle** of a port is measured in a vertical plane that includes the focal point of the port and the centerline of the port
- The **azimuthal angle** of a port is measured as a projection of the port centerline onto a horizontal plane that includes the focal point of the port
- Example: Port 14 is aimed at focal point C
 - The cutting plane is vertical and passes through C
 - The cutting plane is rotated about a vertical line through C to include the centerline of Port 14
 - The **polar angle** of 25° is measured in the cutting plane
 - The **azimuthal angle** of 55° is measured in the focal plane



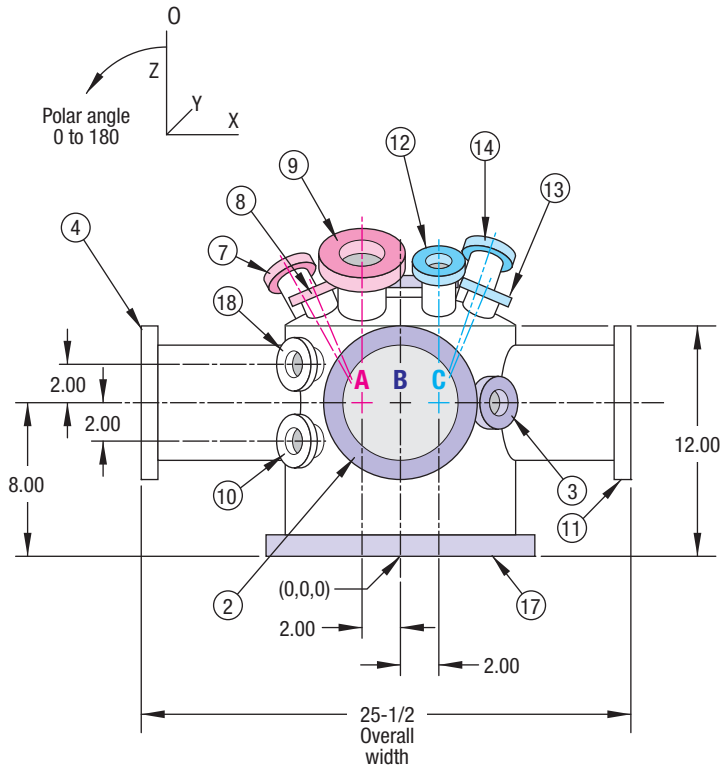
Top View



Side View



Front View



Ports List

PORT NO.	FLANGE SIZE	TUBE O.D.	FOCAL POINT	FOCAL LENGTH	AZIMUTHAL ANGLE	POLAR ANGLE
1	6	4.00	B	7.50	0	0
2	8	6.00	B	7.50	270	90
3	2-3/4	1.75	B	7.25	315	90
4	8	6.00	A	11.50	180	90
5	6	4.00	A	7.25	90	90
6	4-1/2	2.50	A	8.50	90	40
7	2-3/4	1.75	A	8.25	135	35
8	2-3/4	1.75	A	6.50	180	23
9	4-1/2	2.50	A	9.50	270	35
10	2-3/4	1.75	B1	7.25	220	90
11	8	6.00	C	10.00	0	90
12	2-3/4	1.75	C	9.00	270	35
13	2-3/4	1.75	C	6.50	0	23
14	2-3/4	1.75	C	9.00	55	25
15	4-1/2	2.50	C	13.75	90	110
16	2-3/4	1.75	C	7.75	90	40
17 ¹	14	12.00	B	8.00	0	180
18	2-3/4	1.75	B2	7.25	220	90

Focal Points (x,y,z)

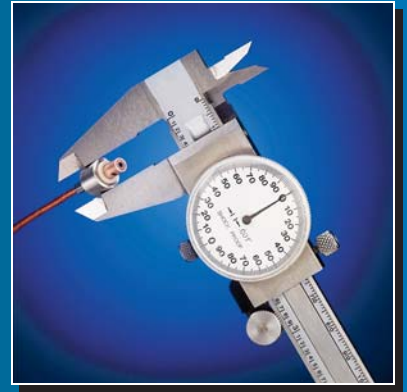
A	-2.00, 0.00, 8.00	B1	0.00, 0.00, 6.00
B	0.00, 0.00, 8.00	B2	0.00, 0.00, 10.00
C	2.00, 0.00, 8.00	(Note: B1 & B2 not shown)	

¹ Also available with 14-5/8" O.D. Female Wire Seal Flange.

DESCRIPTION	WT LB	REFERENCE	PART NUMBER
SURFACE SCIENCE ANALYSIS CHAMBER WITH 14-5/8" FEMALE WIRE SEAL FLANGE ON PORT 17	80	SSAC-12	200000
SURFACE SCIENCE ANALYSIS CHAMBER WITH 14" DEL-SEAL FLANGE ON PORT 17	80	SSAC-12D	200001

10

Custom Engineering



Section 10

<u>Chamber Geometry</u>	486
<u>Vacuum Components Made to Order</u>	488
<u>Modifications to Standard Parts</u>	490



Typical MDC custom chamber

- Chamber geometry
- Focal point
- Focal plane
- Focal length
- Polar angle

Drawings provided for custom fabrication must include accurate, complete data. View angles and lengths do not provide complete information — true angles and port lengths must be specified for fabrication. Descriptions of focal length, polar and azimuthal angles are given on these pages.

MDC Precision is equipped to build custom vacuum chambers of virtually any complexity. Vacuum vessels can be built to your exact specifications from a rough hand-sketch, detailed engineering drawings or anything in-between. MDC's engineering department uses the latest AutoCAD® software and can accept drawings as electronic files in either DWG or DXF file formats. For a nominal fee MDC can supply a complete engineering documentation package on those projects for which drawings were not provided by the customer.

Unless specified otherwise the main body of custom chambers less than or equal to 10 inches in diameter will be fabricated from standard tubing. Nonstandard sizes under 10 inches and all sizes over 10 inches in diameter shall be fabricated from rolled stainless steel sheet metal. The chart below provides nominal wall thicknesses for most MDC chambers.

The accurate positioning of ports on MDC Precision vacuum chamber is made possible with the use of sophisticated laser aligned fixtures. Five basic geometric parameters are required to define a chamber's port positions. These spherical coordinate system parameters include a port's focal point, focal plane, focal length, polar angle and azimuthal angle, figures 3 through 6 on facing page.

For the purpose of this discussion all vacuum chambers shall have a base port located on a horizontal XY base plane which is perpendicular to the chamber's vertical Z axis, figure 3 on facing page. Whenever bolt style flanges are used, bolt patterns shall straddle vertical centerline. In the case of Del-Seal™ CF metal seal flanges fitted with leak test grooves, the grooves shall be oriented vertically, figure 1 below.

Furthermore, all port flange seal faces shall be considered perpendicular with their mating tube axes, figure 2 below.

The focal point of a port, also referred to as a ports target point, is usually a position anywhere inside a vacuum chamber where an application task is to be performed. Its location is typically defined by the vertex or convergence point of one or more ports and other chamber features. Focal points can be thought of as sphere centers from which radial ports project. Even though focal points are inside a vacuum chamber they are not necessarily at the chamber's center. Chambers can contain multiple focal points as required by an application. All focal points are located on focal planes which are parallel to the chamber's main base plane. A port's focal length is defined as an axial and perpendicular distance measured from a port's focal point to the center of its mounting flange seal face. Minimum focal lengths require the use of tapped flanges. Clearance hole flanges require a minimum 1-1/2 inch tube extension in order to fit fastening hardware.

Polar angle is a port's angular displacement about a horizontal axis. This horizontal axis of rotation intersects the port's focal point and lays on the focal plane which is in turn perpendicular to the chamber's main Z axis. Polar angles are measured in a north to south direction on a 180° scale between the focal point's vertical axis and the port's center line, figures 4, 5 and 6 on facing page. The north position is 0° and the south position is 180°. A port is said to have a 90° polar angle when the port centerline lays on the focal plane, figure 4.

Azimuthal angles discussed herein shall be measured in a counterclockwise direction with a 0° starting point and a full 360°

Chamber Wall Thickness

Chamber Diameter	Wall Thickness
≤ 10.00	.120
> 10.00 but < 24.00	.188
≥ 24.00	.250

Please note that these wall thicknesses are given as reference only. Actual thicknesses may vary according to a chambers overall design including the size and quantity of ports being fitted. Contact MDC's technical sales engineers for more details.

Figure 1

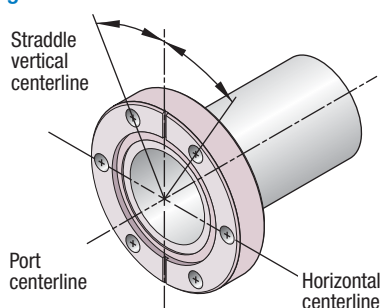
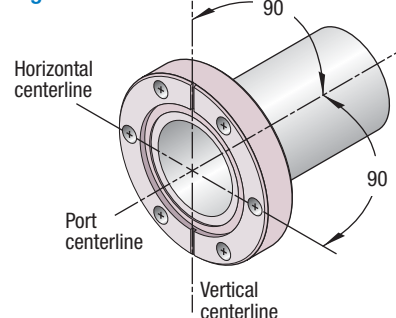


Figure 2



scale. Azimuthal angle is a port's angular displacement about a vertical axis. This vertical axis intersects the port's focal point and is always parallel to the chamber's main Z axis. The azimuthal angle is projected onto the port's horizontal focal plane and measured in a counterclockwise direction beginning at the 0° or three o'clock position and ending at the port center line or center line projection. If a port has a polar angle equal to 90°, figure 4, the port's center line will lay on the focal plane. If the polar angle is less than or greater than 90°, figures 5 and 6, the port's centerline will be above or below the focal plane and must be projected onto it for a final azimuthal angle measurement.

Custom engineered chambers are designed and manufactured using state of

the art metal machining equipment as well as conventional machining and welding tools. Unless specified otherwise the typical dimensional tolerances applied to all chamber fabrications shall be as follows...

Chamber fabrication tolerances have been optimized for cost-effectiveness and reproducibility. Chambers 24 inches in length or shorter will carry a ± 0.02 inch linear tolerance. Chambers longer than 24 inches but shorter than 72 inches will carry a ± 0.06 inch linear tolerance. All chambers will carry a minimum $\pm 0.50^\circ$ angular tolerance. Deviations from these specifications must be discussed with the MDC technical sales engineers for feasibility and cost before they can be implemented.

Figure 3 Spherical Coordinate System

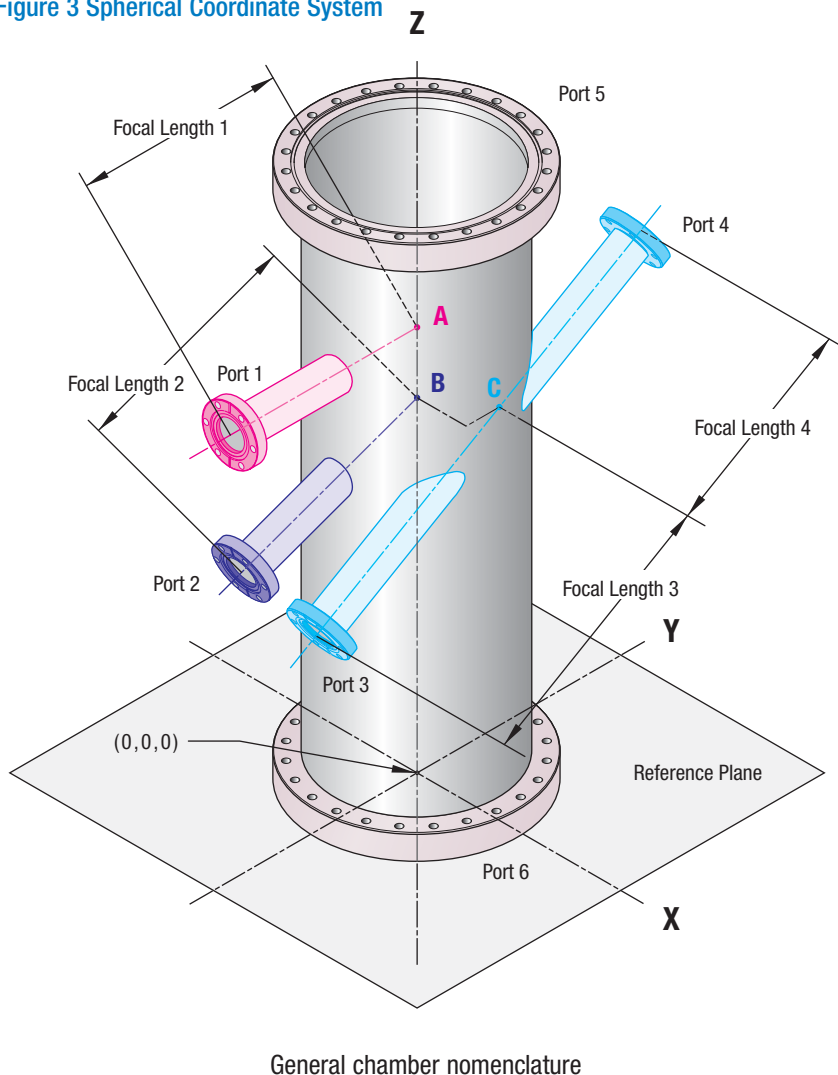


Figure 4

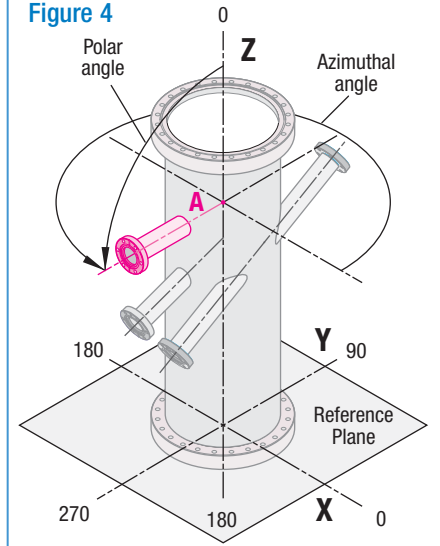


Figure 5

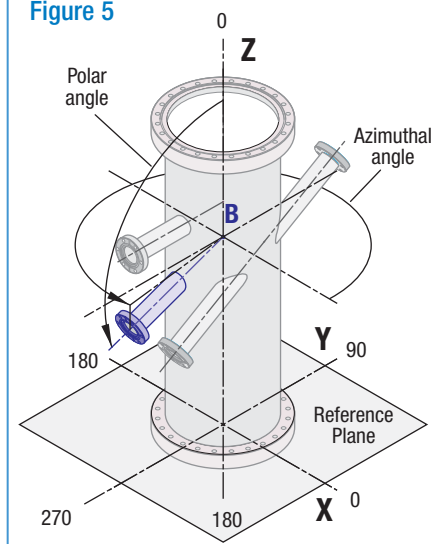
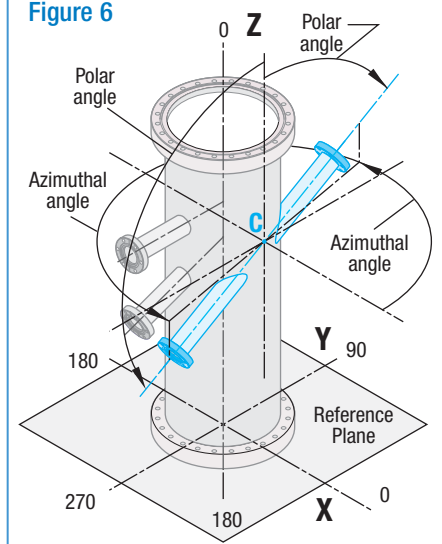


Figure 6





Custom 20-inch gate valve

- Materials
- Water cooling
- Welding
- Cleaning
- Leak testing
- Shipping

MDC Precision is equipped to build custom vacuum components of virtually any complexity. Vacuum vessels can be built to your exact specifications from a rough hand-sketch, detailed engineering drawings or anything in-between. MDC's engineering department uses the latest AutoCAD® software and can accept drawings electronically in either DWG or DXF file formats. For a nominal fee MDC can supply a complete engineering documentation package on those projects for which drawings were not provided by the customer.

Materials

Type 304 stainless steel is ideally suited for vacuum vessel construction because of its machining characteristics, excellent corrosion resistance and overall cost effectiveness. Unless otherwise specified all materials used in the fabrication of vacuum chambers will be type 304 stainless steel. MDC can quote the fabrication of chambers using other materials as required by a customer's application. Other materials used include 304L, 316 and 316L stainless steels. For more exotic stainless steel material types, consult with MDC's technical sales engineers. Low magnetic permeability materials such as mu-metal have also been used for the construction of magnetic shields used on conventional vacuum chambers. MDC specifies a magnetic permeability of less than or equal to 1.02μ when buying raw 304 stainless steel materials. Stresses induced during metal forming and welding operations will produce a change to this value in the proximity of an affected area, which may be significant to some applications. Distances between an application's process and the affected areas should be maximized for applications that are highly sensitive to this increase in the material's magnetic permeability.

Water Cooling

MDC can provide water cooling features on most any vacuum chamber geometry. Even though various water cooling methods for vacuum vessels have been adopted by the industry, one geometry stands out as the most efficient, reliable and cost-effective, this being the double-wall cooling method. We've been designing and fabricating watercooled vacuum chambers for over twenty years and the knowledge acquired over this period of time has lead us to recommend double-wall construction as the solution of choice for most watercooled vacuum chamber applications.

Typically, standard double-wall construction is limited to a chamber's main body and does not include any port extension tubes. Double wall cooling of port extension tubes is available on request, but significantly impacts a chamber's sale price. Double-wall chambers are fitted with water directing baffles between the walls to provide water flow over most chamber surfaces and thus minimize hot spots and water flow dead zones. Watercooled chambers are typically fitted with 1/4 inch NPT (7/16 inch nominal inside diameter) fittings. As a general point of reference, the water flow rate through a 1/4 inch NPT fitting with a total linear path of 50 inches, inlet water pressure of 60 PSI and an unrestricted outlet, will be a nominal 8-10 gallons per minute. Practical and safe water flow rates must be determined by the user by taking into account variables such as coolant path, temperature, pressure and a coolant's heat dissipating capacity.

Other less popular construction methods include tube-wrapping and half-channel geometries. Tube-wrap construction is a labor intensive hand-fitted process which provides reduced cooling capabilities. The



MDC custom spherical chamber



MDC custom chamber / system



half-channel construction comes closest to the cooling capabilities of a double-wall system, but it too is extremely labor intensive and thus not cost-effective. Of the three construction methods discussed double-wall construction also offers the most aesthetic solution, which is critical to most commercial process applications.

Customers requiring water cooling for their chamber should keep in mind that the water cooling features must be incorporated in the early stages of a chamber's design or construction. Water cooling of existing or partially constructed chambers is extremely difficult and may be cost prohibitive.

Welding

MDC employs advanced tungsten inert gas welding techniques (TIG) with high purity Argon as the inert gas medium. Manual as well as automated orbital welding machines are at the heart of all welding operations. MDC adheres to stringent UHV welding standards and practices including that of nonfiller metal, all internal fusion weld joints. External weld joints are not used unless required for structural reinforcement and then, limited to skip or span weld configurations. In the event that a weld joint can not be made internally, a one hundred percent full penetration external weld will be used. All weld joints are leak tested using a mass spectrometer leak detector with a minimum Helium sensitivity of 2×10^{-10} standard cc/sec.

Surface Finishes

Vacuum chamber finishes include internal and external glass bead blasting of all body and port tube surfaces. Flanges and machined components have a standard 63 micro-inch surface finish. Seal surfaces and

groove bottoms are machined with a 32 micro-inch concentric finish suitable for standard elastomer sealing. Optional electrochemical polishing of chambers is available at an added cost. The electropolishing process is the reverse of electroplating where the work piece is made the anode and dissolves or gives up material in the electrolytic process. The electro-polishing operating conditions are controlled so that atomic oxygen forms and reacts with the metal work piece surface. According to one theory, the high points of the metal surface are most readily oxidized and this oxidized material is thereupon dissolved in the electrolyte and otherwise removed. Selective solution of the high points of a surface tends to give a very smooth finish comparable or superior to a mechanically buffed surface. In contrast to mechanical polishing, electropolishing produces a strain free surface.

Leak Testing

MDC is dedicated to providing standard as well as custom high and ultrahigh vacuum components of the highest quality and performance. To this end all vacuum rated components manufactured by MDC and its divisions are leak tested repeatedly, as required, throughout the manufacturing process to insure these goals are met. All weld joints, braze joints and seals are leak tested using a mass spectrometer leak detectors with a minimum Helium sensitivity of 2×10^{-10} standard cc/sec.

Cleaning

Upon final machining, which uses water soluble non-sulfurous cutting oils, all components are washed in a high temperature detergent bath followed by multiple tap and deionized water rinses.

After the last rinse, parts are blown dry with dry nitrogen and packaged. Products are shipped clean and leak tested, ready for high vacuum installation and service.

Packaging & Shipping

Packaging includes the meticulous covering of all open ports with oil-free aluminum foil and the installation of protective plastic flange covers to prevent seal surface damage during transit. Where applicable components are heat-shrink skin packed, boxed or crated. For a fee MDC can ship chambers pumped and under vacuum with ports blanked-off and sealed. For this, chambers are evacuated to a rough vacuum level and sealed off by pinching a flange fitted copper roughing line. Note that this fee will include the purchase of all required port hardware including blank flanges, gaskets, fasteners and installation labor.

Pressure Rating

MDC vacuum chambers and components are constructed to maximize their high and ultrahigh vacuum capabilities. As such they are not designed for positive pressure applications with ratings above one atmosphere.



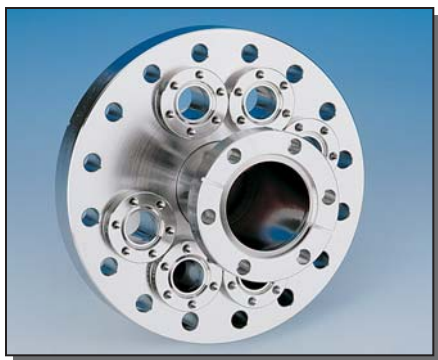
Custom multiport flanges and fittings



Custom gate valve filled with RF port shield



Custom e-Vap® electron beam source



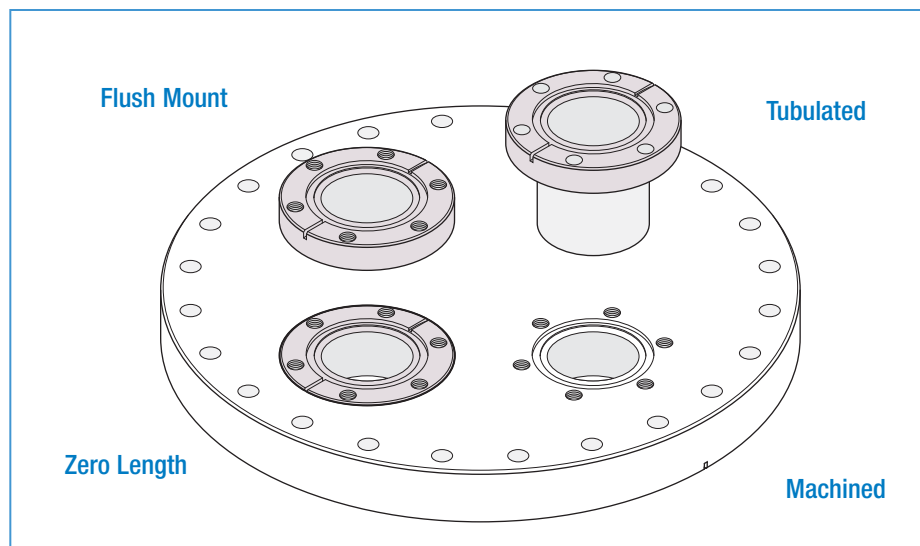
Typical MDC custom multiport flange assembly.
See page 74 for similar flanges.

MDC's technical sales engineers are available to discuss your requirements for any non-standard component. In the case where a catalog item may be close to your needs, but would benefit from a slight modification, the requirements could be easily noted using the existing catalog drawing. Locate the catalog page of the product to be modified. Provide the page number, a reference number if it's available, and a brief description of the modification requirements along with a marked up copy of the catalog drawing. Product specific drawings are available for most products depicted in this catalog and are usually presented with the table for those products.

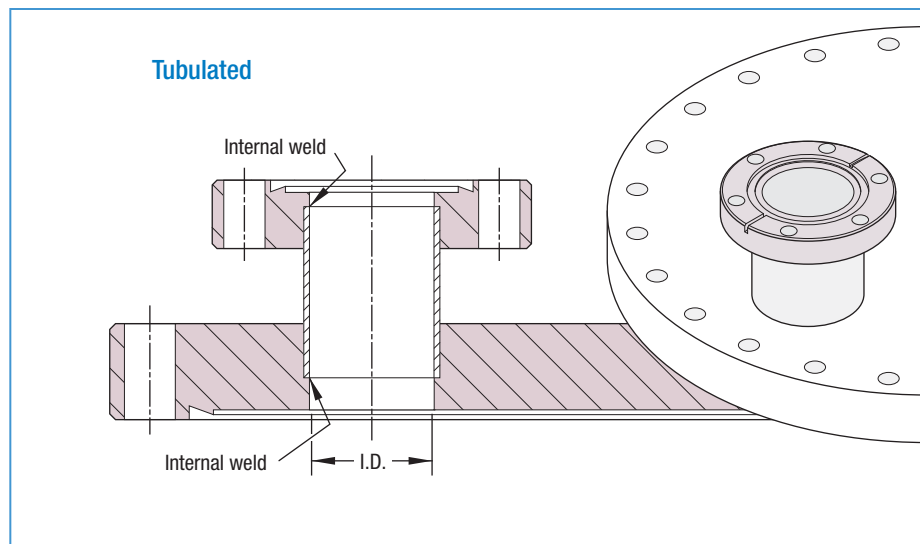
MDC is equipped to build custom vacuum components of virtually any complexity. In the case where there is no standard component close to your needs, it will be necessary to generate a drawing. Custom components can be built to your exact specifications from a rough hand-sketch, detailed computer-generated engineering drawings or anything in-between. MDC uses AutoCAD® software and can receive drawings electronically in either DWG or DXF file formats. For a nominal fee MDC can supply a complete engineering documentation package on those projects for which drawings were not provided by the customer.

One example of the multiple ways to specify a custom component

The flange assembly at right depicts four popular methods of installing flanges in to a larger flange or plate. Del-Seal™ CF metal seal flanges have been used for the purpose of this example. The methods described would apply to most any flange type and configuration. The four methods of construction are referred to as standard tubulated, top flush mounted, zero length recessed and single piece integrally machined. These are given as examples for commonly asked questions. Discussing your application with an MDC technical sales engineer will help determine the appropriate solution for your application.

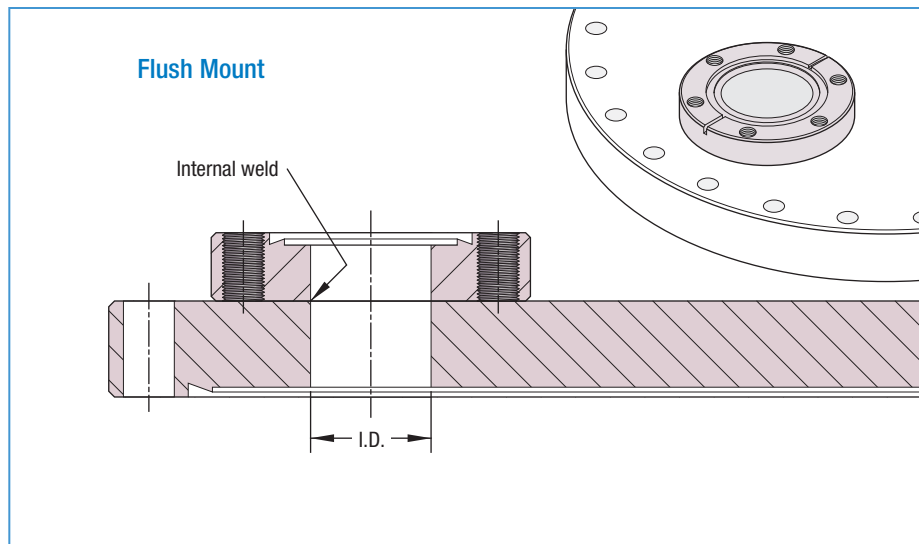


The tubulated method of construction would be one in which a standard or custom half-nipple is welded to the larger flange at the tube end. The larger flange or plate is counter-bored to match the tube's inside and outside diameters. The tube to flange transitions are welded in the same fashion along the bore's inside diameter. This method of construction allows the use of clearance hole, bolt and nut fasteners, and is the only configuration that would allow the use of a rotatable flange.

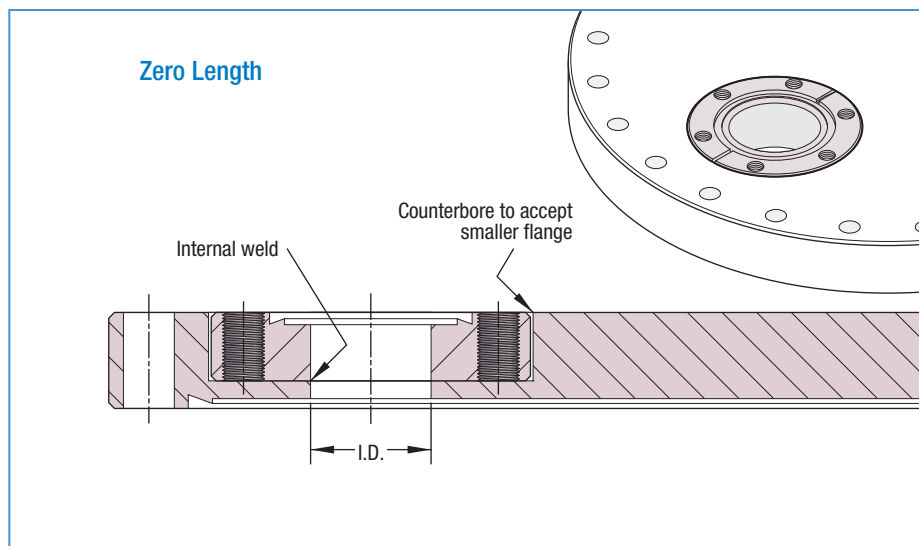




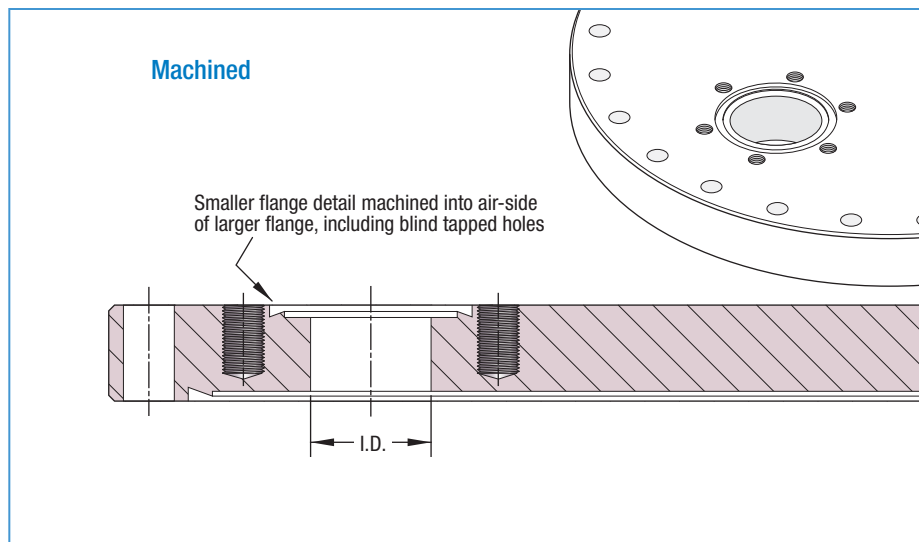
The most economical method of installing a flange would be to use standard off the shelf components requiring the minimum amount of modification and fabrication or in other words a top mounted method. In this method the larger flange or plate is bored to match the bore size of a smaller flange. Both are then joined by fusion welding internally along the interface between the two bored pieces. In some cases, external skip welds are provided for additional mechanical strength. This is the most economical method of construction.



The zero length method of installation is similar to the top mount method with one exception, the larger flange or plate is counter-bored to a depth that matches the thickness of the smaller flange. The counter-bore is used to reduce the overall thickness of the completed assembly and thus provides a zero length recessed profile. The flanges are welded in the same fashion along the bore inside diameter. This approach provides a more aesthetic look at a reasonable cost.



An integrally machined method eliminates all weld joints, but requires the most amount of machining. Special machining steps include the use of blind-tapping for all bolt holes and off-center turning of the knife-edge seal geometry as well as through bore operations. In some instances it may even be desirable to use helical thread inserts, since these would be easy to replace in the event a thread is damaged. Conventional threads would be very difficult to repair. This type of fabrication is the most aesthetic, but also the most expensive of the three choices.



11

Index & Reference



Section 11

Reference

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Alphabetical	514
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Converting from one unit to another

The following tables provide the most frequent conversions for use in vacuum applications. Text books or other reference manuals offer additional conversion factors.

In all of the tables below, the original units are listed in the left-hand column. Locate the conversion factor by intersecting the row of the original units with the column of the final units. Multiply the number of original units by the factor to obtain the number of final units.

Using the sample table at the right, gram weight is multiplied by 3.527E-02 to obtain ounce weight. For example, 281 grams would convert to ounces by: $281 \times .03527 = 9.911 \approx 10$ oz. Note that conversion factors are intended for reference use only.

Sample conversion: grams to ounces

Weight

	lb	oz	g
lb	1	1.600E+01	4.54E+02
oz	6.250E-02	1	2.84E+01
g	2.205E-03	3.527E-02	1
kg	2.205E+00	3.527E+01	1.00E+03

Diagram illustrating the conversion of grams to ounces. The value 3.527E-02 is circled, with an arrow pointing to it from the text "Multiplied by". Another arrow points from the "g" row to the "oz" column, labeled "equals".

Pressure

	Pa N·m ⁻²	mbar millibar	Torr mm Hg	micron mTorr	atm atmos	kg _f ·cm ⁻²	psi lb _f ·in ⁻²
Pa	1	1.00E-02	7.50E-03	7.50E+00	9.87E-06	1.02E-05	1.45E-04
mbar	1.00E+02	1	7.50E-01	7.50E+02	9.87E-04	1.02E-03	1.45E-02
Torr	1.33E+02	1.33E+00	1	1.00E+03	1.32E-03	1.36E-03	1.93E-02
micron	1.33E-01	1.33E-03	1.00E-03	1	1.32E-06	1.36E-06	1.93E-05
atm	1.01E+05	1.01E+03	7.60E+02	7.60E+05	1	1.03E+00	1.47E+01
kg _f ·cm ⁻²	9.80E+04	9.80E+02	7.36E+02	7.36E+05	9.68E-01	1	1.42E+01
psi	6.89E+03	6.89E+01	5.17E+01	5.17E+04	6.81E-02	7.03E-02	1

Example:

2.00E-05 Torr	2.66E-03	2.66E-05	2.00E-05	2.00E-02	2.64E-08	2.72E-08	3.86E-07
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Leak Rate

	Pa·s ⁻¹	mbar·s ⁻¹	Torr·s ⁻¹	std cc·s ⁻¹
Pa·s ⁻¹	1	1.00E-02	7.50E-03	9.87E-03
mbar·s ⁻¹	1.00E+02	1	7.50E-01	9.87E-01
Torr·s ⁻¹	1.33E+02	1.33E+00	1	1.32E+00
std cc·s ⁻¹	1.01E+02	1.01E+00	7.60E-01	1

Example:

1.00E-07 mbar·s ⁻¹	1.00E-05	1.00E-07	7.50E-08	9.87E-08
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Flow Rate

	gpm	gps	l·m ⁻¹	l·s ⁻¹
gpm	1	1.67E-02	3.79E+00	6.31E-02
gps	6.00E+01	1	2.27E+02	3.79E+00
l·m ⁻¹	2.64E-01	4.40E-03	1	1.67E-02
l·s ⁻¹	1.59E+01	2.64E-01	6.00E+01	1

Example:

2.5 gpm	2.50E+00	4.17E-02	9.46E+00	1.58E-01
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Length

	foot ft	inch in	meter m	centimeter cm	millimeter mm	micron μ m	Angstrom Å
foot	1	1.20E+01	3.05E-01	3.05E+01	3.05E+02	3.05E+05	3.05E+09
inch	8.33E-02	1	2.54E-02	2.54E+00	2.54E+01	2.54E+04	2.54E+08
meter	3.28E+00	3.94E+01	1	1.00E+02	1.00E+03	1.00E+06	1.00E+10
centimeter	3.28E-02	3.94E-01	1.00E-02	1	1.00E+01	1.00E+04	1.00E+08
millimeter	3.28E-03	3.94E-02	1.00E-03	1.00E-01	1	1.00E+03	1.00E+07
micron	3.28E-06	3.94E-05	1.00E-06	1.00E-04	1.00E-03	1	1.00E+04
Angstrom	3.28E-10	3.94E-09	1.00E-10	1.00E-08	1.00E-07	1.00E-04	1

Example:

24 inch	2.00E+00	2.40E+01	6.10E-01	6.10E+01	6.10E+02	6.10E+05	6.10E+09
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Weight

	lb	oz	g	kg
lb	1	1.600E+01	4.54E+02	4.54E-01
oz	6.250E-02	1	2.84E+01	2.84E-02
g	2.205E-03	3.527E-02	1	1.00E-03
kg	2.205E+00	3.527E+01	1.00E+03	1

Example:

10 kg	2.21E+01	3.53E+02	1.00E+04	1.00E+01
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Force

	lb _f	oz _f	N	kg _f
lb _f	1	1.60E+01	4.45E+00	4.54E-01
oz _f	6.25E-02	1	2.78E-01	2.83E-02
N	2.25E-01	3.60E+00	1	1.02E-01
kg _f	2.21E+00	3.53E+01	9.81E+00	1

Example:

5 lb	5.00E+00	8.00E+01	2.22E+01	2.27E+00
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Torque

	lb _f -ft	oz _f -in	N-m	kg _f -m
lb _f -ft	1	1.92E+02	1.36E+00	1.38E-01
oz _f -in	5.21E-03	1	7.09E-03	7.25E-04
N-m	7.38E-01	1.41E+02	1	1.02E-01
kg _f -m	7.23E+00	1.38E+03	9.81E+00	1

Example:

15 lb-ft	1.5E+01	2.88E+03	2.03E+01	2.07E+00
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Note: The “_f” for “force” is frequently omitted in tables or text when the meaning is clear from the context.



18-8 ss A grade of stainless steel including 18% chromium and 8% nickel; typically used on bolts, screws and nuts

300 Series ss Generic reference to any stainless steel grade in the numerical 300 series family

304 ss Vacuum grade stainless steel; can be easily machined and welded; very low outgassing properties

304L ss Very low-carbon stainless steel

316 ss Vacuum grade stainless steel; low magnetic permeability

A or Amp Ampere; unit of electric current

Å Angstrom; unit of length; $1 \text{ Å} = 10^{-10} \text{ m}$

Abbe Error Linear off-axis error introduced through amplification of tilt and wobble with a long moment arm. This type of error occurs when the point under measurement is at a relatively long distance from the axis of motion, typically greater than 12"

AC Alternating current

Accuracy The maximum expected difference between the actual and a desired position for a given input. Highly dependent on method of actual position measurement

Accuracy, Absolute The output of a system versus the commanded or ideal input

Accuracy, On-Axis The uncertainty of position after all sources of linear error are eliminated. Some linear errors: cosine error, leadscrew pitch error, abbe error and thermal expansion effects

Actuator A portion of a device that provides motion to the internal parts of the device; typically manual or electropneumatic

Adapter Provides a transition from one method of sealing to a different method of sealing, such as metal seal to elastomer seal

AKA The abbreviation for "also known as"

AL or Al Aluminum

Aluminum 6061-T6 Vacuum grade aluminum

AM-350 A precipitation hardened stainless steel used in welded bellows; similar to 304L with a longer life in cycling

Amp or amps Ampere; unit of electric current

ANSI American National Standards Institute

ASA American Standards Association, replaced by ANSI

ASME American Society of Mechanical Engineers

ASTM American Society for Testing and Materials

Atm or atmos Atmosphere; used in pressure measurement reference

Austenitic stainless steels Iron-chromium-nickel alloys, provides good corrosion resistance, machining and welding properties; 304ss and 316ss are examples

AVS American Vacuum Society

AWG American Wire Gage; corresponds with the number of operations of drawing a wire, thus a larger number, which represents more operations, results in a smaller diameter wire; AKA Brown & Sharpe gage; there are many wire gage methods

BA Bayard-Alpert (gauge); method of vacuum measurement

Backlash The maximum magnitude of an input that produces no measurable output upon reversing direction. Typically the result of poor meshing between drivetrain components as in lead screw threads

Bar A unit of pressure measurement; in vacuum applications, used as millibar

BC Bolt circle; the center to center distance of two bolt holes on the same diameter; generally may be used in specifying any centerline to centerline distance of elements on the same diameter; sometimes used in place of the connector circle (CC) for pins on an electrical connector

Best way A method of shipment to be selected by MDC which would be appropriate for the type of product to be shipped; see Ordering Information section

Blind hole A drilled hole that does not break through the metal; maintains the vacuum integrity of the drilled piece

Blind tapped A tapped blind hole; female threads inside a hole that does not break through the metal; maintains the vacuum integrity of the drilled and tapped piece

BNC Bayonet Naval Connector; a specific type of electrical connector that attaches without threads; used in 50 ohm and 75 ohm coaxial low power instrumentation transmission lines

Bolt length The portion of a bolt excluding the head; may be threaded completely or have a shank with partial threading

Bonnet The flanged connection of two parts of a valve; the flanges between the actuator and body of a valve

Buna-N® A DuPont Dow Elastomers registered trademark brand name of a type of elastomer seal; butyl material which has excellent resistance to gas permeation; an early vacuum seal, generally displaced by FKM / FPM fluoroelastomer

Capture groove A counterbore in a flange that a gasket seats into; keeps a gasket from moving outside its range of correct positioning

Carriage The movable parts in a gate valve, including wheels, pins, springs, supports, etc.; the back side of the flat O-ring sealed gate in a gate valve

cc Cubic centimeter; metric unit of volume measurement

CC Connector circle; the center to center distance of two pins on the same diameter of an electrical connector

CCW Counterclockwise

CE Compliance European safety standard; similar to UL listing in the USA

CERN Centre Européenne pour la Recherche Nucléaire (French); European Organization for Nuclear Research; specifications standard limited to France

CF flange Del-Seal™ CF metal seal flange; originally developed by

Varian Corporation under the Conflat® Flange brand name; requires metal gasket for UHV seal, usually copper material

CIF Carriage and Insurance paid to customer's delivery address

Clearance holes Holes that are drilled completely through a metal piece without threads; also called through holes or thru holes

Counterbore A straight bore partially through a metal piece; sometimes concentric with a smaller bore

CSA Canadian Standards Association; comparable to United Laboratories approval in the USA

CSR Customer Service Representative

CVD Chemical vapor deposition; a method of depositing material on a substrate using a chemical reaction

CW Clockwise

DC Direct current

Del-Seal™ The MDC trademark name for a metal seal UHV flanges; also written Del-Seal™ CF; compatible with Conflat® flanges

DIA or dia Diameter

Dicronite A dry film lubricant used on linear and ball bearings; modified tungsten disulfide in lamellar form; inert, corrosion resistant, non-magnetic and UHV compatible throughout a wide temperature range

DIN Deutsche Industrie Norm (German); German industry standard

Display Resolution The smallest motion detectable by a motion device's precision rule, micrometer or motor controls

DN Diamètre Nominal (French); nominal diameter, usually referring to vacuum tubing internal diameter

DWDM Dense Wavelength Division Multiplexing; the process of splitting or multiplexing the light traveling through fiber (optics) into different wavelengths

EB, E-B, e-beam or other variations Electron beam

Eccentricity Sometimes called concentricity; eccentricity in a rotary device is the deviation of the center of rotation from its mean position as the device turns

Elastomer A flexible material for completing a vacuum seal between two flat surfaces, usually ISO flanges; colloquially "rubber"

Electropneumatic Method of actuating a device using a compressed gas which is controlled by an electrical solenoid valve

Electropolish Removes a small amount of surface metal from any shape of stainless steel; provides an attractive high-luster finish plus deburring

Error The difference between an obtained performance parameter and the ideal or desired result. Errors fall into two primary categories, on-axis and off-axis errors

Fixed flange Nonrotatable; composed of a single machined piece; when welded to tubing or a chamber, the bolt holes cannot be rotated to align with bolt holes of another flange

FKM / FPM fluoroelastomer Fluorocarbon-based fluoroelastomer (FKM / FPM)

Flush mount One flange is welded directly to the back of either another larger flange or a flat surface; typically the total thickness is the sum of the two individual thicknesses

FOB Freight on board; the point at which transfer of ownership of a product occurs

FPT Commonly used abbreviation for female pipe thread

Friction Friction is defined as the resistance to motion between surfaces in contact. Friction can be constant or it can vary with speed. Elements contributing to overall friction may be in the form of drag, sliding friction, system wear or lubricant viscosity

Friction, Static The friction that must be overcome to impart motion to a body at rest. Since static friction is higher than sliding friction, the force which must be applied to impart motion is greater than the force required to keep the body in motion. As a result, when a force is initially applied, the body will begin to move with a jump in some unpredictable and unrepeatable manner, producing non-linear, non-repeatable motion

FT or ft Foot; unit of length measurement

F/T or f/t Abbreviation for feedthrough

Gasket Any material between two sealing surfaces; either metal or elastomer material; typically rectangular in cross-section but may also be circular in cross-section

Gate The flat plate in a gate valve that makes a seal between the two sides of a valve; includes a groove to hold an elastomer O-ring that completes the seal

Gear Ratio, Drive Train A motion instrument's drive train gear ratio is the relationship between received input motion and the delivered output motion. Ratios are expressed in the numerical notation a:b, where "a" represents the received motion or device input in revolutions or some other unit, and "b" represents the delivered or resulting output motion in revolutions for rotary devices or 1" of travel in linear motion instruments

gpm Gallons per minute; unit of liquid volume flow

gps Gallons per second; unit of liquid volume flow

Graded seal The portion of a glass component that changes from one material to another; typically the transition from Pyrex® to quartz tubing

HF High frequency; the range of frequencies in the radio spectrum between 3 and 30 megahertz

HV High vacuum; typically between 10^{-3} to 10^{-8} Torr

Hybrid A combination of two different methods of sealing, such as metal seal to elastomer seal; an adapter

Hysteresis The difference in the absolute position of an object for a given commanded input when approached from opposite directions. It is due to elastic forces accumulated in various drivetrain components, leadscrew wind-up, for instance. Often confused with backlash

Hz Hertz; cycles per second



ID Internal diameter or inner dimension; usually of tubing or a hollow bore through a metal piece

IEEE Institute of Electrical and Electronics Engineers

IGT Ionization gauge tube; used with a gauge to measure pressure

J or Joule The SI unit of work or energy; newton-meter

Insert Part of a rotatable flange; the smaller part of a rotatable flange that is welded to a tube; includes the sealing knife-edge; requires a receiver to complete a vacuum seal

ISO International Standards Organization

Kalrez® 4079 A perfluoroelastomer useful in corrosive or high temperature applications

Kapton® The DuPont Dow Elastomers registered trademark brand name of a UHV compatible polyimide film typically used for wire insulation; provides an extremely tough abrasion resistant and tenacious insulator

KF flange The smaller ISO flanges; originally Klein Flange developed in Germany, "Klein" meaning small; Kwik-Flange™ is the MDC trademark name for the smaller components of a complete ISO flange family

Knife-edge The sealing detail on a metal seal flange; the portion of a metal seal flange that bites into a gasket between two identical size flanges

Kovar® - Alloy 29-17 The Carpenter Technology registered trademark brand name of a highly magnetic nickel-iron alloy; provides a transition between stainless steel and glass materials in viewports or other components; has a phase shift at -80°C and therefore not suitable for cryogenic applications

kV Kilovolts; measurement of electrical voltage

kW Kilowatts; measurement of electrical power

LB or lb Pound; unit of weight measurement

LB_f or lb_f Pound; unit of force measurement; frequently the "f" is omitted when the context is clear

lb-ft Pound-foot; unit of torque measurement; sometimes written lb_f-ft

LCD Liquid crystal display; typically used on instrumentation

Leak check grooves Narrow radial grooves machined into a metal seal flange between the outer surface and the capture groove for a gasket; typically not on flanges larger than 10" OD

LF flange The larger ISO flanges; Large-Flange™ is the MDC trademark name for the larger components of a complete ISO flange family

Live length The portion of a bellows that can provide motion; the convoluted portion of a formed bellows

LN₂ or LN Liquid nitrogen

Load Capacity, Stage The maximum centered load that can be placed directly on an XYZ motion stage and is typically limited by the load capacity of the bearings

Load Capacity, Lateral or Moment Also called side or bending

load capacity, it is the maximum load that can be applied perpendicular to a shaft's axis of motion

Load Capacity, Axial The maximum centered and balanced compressive or tensile load that can be applied to a stage's or shaft's longitudinal or parallel axis of motion.

Load-Lock A method of introducing product into a vacuum chamber via an intermediate chamber; allows sample manipulation without significantly affecting the vacuum of the main chamber

LV Low vacuum; typically between atmosphere and 10⁻³ Torr

Matte finish A bead blast finish on standard tubing

MAX or max Maximum

MESA Modular Equipment Standards Architecture; replaced by MESC

MESC Modular Equipment Standards Committee

MHV Miniature high voltage; used in medium power applications; similar to BNC series, but do not intermate with BNC

micron unit of length equal to .000001 meter

mil unit of length equal to .001 inch

min Minimum or minute, depending on context

Minimum Incremental Motion The smallest motion a device is capable of delivering reliably, not the smallest display resolution increment

MPI Mechanical position indicator; available on most electro-pneumatic valves; utilizes mechanical microswitches to provide open/closed circuits which may be used for position indication, interlock circuitry, etc.; requires customer wiring

MPT Commonly used abbreviation for male pipe thread

Mu-metal A composite of rare earth metals used to provide a magnetic shield around sensitive instrumentation

NEMA National Electrical Manufacturers Association

NIST National Institute of Standards and Technology

Nominal The approximate or rounded-off dimension used to designate the size of an object, such as a flange or tube; abbreviated "Nom." or "nom."

Nonrotatable A flange machined from a single piece of material; once welded to tubing or a chamber, the bolt holes are no longer rotatable for alignment purposes

NPT National Pipe Taper; a specific taper to a threaded hole which provides a pressure seal between male and female threads; sometimes referred to as National Pipe Thread

NW Nenn Weite (German); nominal diameter, usually referring to vacuum tubing internal diameter

OD Outside diameter or outer dimension; usually of tubing or any circular or spherical piece, but can also apply to any shape

OEM Original equipment manufacturer

OFE copper Oxygen free electronic grade copper; also called oxy-

gen free electrolytic or simply oxygen free; replaces OFHC

OFHC copper Oxygen free, high conductivity; a trade name for vacuum compatible copper that is no longer being manufactured; replaced by OFE copper

O-ring An elastomer vacuum seal available in various materials; torus or doughnut shaped, typically circular in cross-section; may be a dynamic or static seal

oz Ounce; unit of weight measurement

ozf Ounce; unit of force measurement; frequently the “f” is omitted when the context is clear

oz-in Ounce-inch; unit of torque measurement

PEEK Polyether-etherketone; a high-temperature resistant thermoplastic that is vacuum compatible; suitable for wire coating, injection molding, film and advanced composite fabrication

pf Picofarad; unit of electrical capacitance measurement

PI Position indicator; available on most valves; utilizes stationary magnetic Reed switches and a moveable magnet

Pitch The spacing of threads on a shaft; related to threads per inch

Play Uncontrolled movement due to looseness of mechanical parts. Usually increases with the components age. Play is a contributor to backlash

Poppet The movable portion of an angle valve; includes a groove to hold an elastomer O-ring which completes the seal

Position Stability The ability to maintain a constant position over time. Variation from stable position is called drift. Contributors to drift include worn parts, migration of lubricant, and thermal variation

Precision Also known as repeatability, it is the range of deviations in output position that will occur for 95% of the motion excursions from the same error-free input. Accuracy and precision are not the same

PSI Pounds per square inch; unit of pressure measurement

PSIA Pounds per square inch absolute; pressure measured with respect to zero pressure

PSIG Pounds per square inch gauge; pressure measured with respect to that of the atmosphere

PTFE Polytetrafluorethylene; self-lubricating, non-compressible, inert and low outgassing material for dynamic seals

PVC Polyvinyl chloride; typically used in low vacuum applications such as roughing lines

PVD Physical vapor deposition; a method of depositing material on a substrate using evaporation

QMS Quadrupole mass spectrometer

Quad-Ring An elastomer used in dynamic seals; typically “U” shaped in cross-section

Receiver Part of a rotatable flange; the larger outer part of a rotatable flange that includes bolt holes; may be rotated to align bolt holes prior to completing a vacuum seal

Reducer A fitting that changes diameter from one size to another within a single method of sealing, such as metal seal to metal seal; contrasted with Adapter

Repeatability The ability of a motion instrument to reliably achieve a commanded position over many attempts regardless of the direction from which the position is approached

RF Radio frequency

RGA Residual gas analyzer

RMS Root-mean-square; a calculation to determine an average of fluctuating values; electrical or surface finish measurement

Roll-up A cylindrical shaped section of stainless steel that is welded internally for vacuum integrity and stitch welded externally for strength; for vacuum chambers or “tubing” greater than 10 inches in outer diameter

Rotatable flange Composed of two machined pieces: an insert and a receiver; used for bolt hole alignment only; the insert is welded to tubing and the receiver slides over the insert; the receiver bolt holes can be rotated to align with bolt holes of another flange, once bolts are inserted the receiver cannot be rotated

RPM or rpm Revolutions per minute; measurement of rotational speed

Runout The linear, not angular, portion of off-axis error. It is the deviation between ideal straight line motion and actual measured motion in a translation stage. Runout has two orthogonal components, straightness, a measure of in-plane deviation, and flatness, the out-of-plane deviation

SAE Society of Automotive Engineers

SEMI Semiconductor Equipment and Materials International

Sensitivity The minimum input required to produce output motion or the ratio between output motion and input drive; applicable particularly to manually actuated motion devices

Setback The distance from the sealing face of a flange to the tubing counterbore

SHV Safe high voltage; similar to MHV series, except SHV cable connector center contacts do not protrude from connector ends which makes them safer in a disconnected condition

SI Système International d’Unités (French); unified system of measurement including the metric system, electrical units such as Amperes, Volts, etc.

Spring rate The amount of force required to compress a guided bellows one linear inch; given in pounds per inch (lbs/in)

Squirm Arbitrary lateral movement of a bellows

SS, SST, ss or sst Abbreviation for Stainless Steel, any grade

Stainless steel In general, an iron-chromium alloy; corrosion resistance is enhanced by the addition of nickel

Static bend radius The minimum radius a bellows can be curved without encountering permanent deformation

Std Atm cc/sec He Leak rate measurement



Swagelok® The Swagelok Company registered trademark brand name tube fitting providing UHV compatible connections on fractional inch tube sizes; uses a compressible ferrule; requires clean tube end only

Tangents Lengths of straight tubing added to elbows so that centerlines of straight sections are tangent to curved centerline

Tapped holes Drilled holes that have female threads cut into them; also called threaded holes

TC Thermocouple; method of measuring heat and therefore indirectly measuring vacuum pressure

Temp or temp Abbreviation for temperature

Threaded holes Drilled holes that have female threads cut into them; also called tapped holes

Through or Thru holes Drilled holes that are smooth and completely through the material; also called clearance holes

TIG Tungsten inert gas; a method of welding which keeps the weld shielded from corrosive atmosphere by bathing the area with an inert gas during the process

Tilt The angular portion of off-axis error. It is the deviation between ideal straight line motion and actual measured motion in a translation stage. Tilt and wobble have three orthogonal components commonly referred to as roll, pitch, and yaw

Torr A unit of pressure measurement; one atmosphere equals 760 Torr; sometimes written torr

TSE Technical Sales Engineer

Typ or typ Typical; applies to all occurrences of a feature

Type-D Subminiature feedthrough Based on MIL-C-24308 specifications for pin arrangements; identified by a "D" or key-stone shape

Type N feedthrough Low instrumentation voltage feedthrough for matched 50 ohm impedance rating applications

UHV Ultrahigh vacuum; defined by the American Vacuum Society as the pressure range between 7.5×10^{-10} to 7.5×10^{-13} Torr; British and German standards define UHV as 10^{-8} Torr or better

UL Underwriter's Laboratories; typically a stamp of approval for acceptable electrical safety standards in the USA

UNC Unified National Coarse; referring to bolt threads

UNF Unified National Fine; referring to bolt threads

UNS Unified Numbering System

UPS United Parcel Service; see Ordering Information section

UTA A common abbreviation for Up-to-Air

V Volt; unit of electrical voltage

VAC Alternating current voltage

VCR® The Swagelok Company registered trademark brand name tube fitting providing UHV compatible connections on fractional inch tube sizes; uses a replaceable metal gasket; requires mating connector installed on tubing

VDC Direct current voltage

VespeI® The DuPont Dow Elastomer registered trademark brand name of a high vacuum compatible polyimide material used for bearings; may be used without lubrication

WDM xxxxx

Wobble The angular deviation of the axis of rotation over one complete revolution

WT or wt Weight

WxHxD Rectangular dimensions

XHV Extreme high vacuum; defined by the American Vacuum Society as below 7.5×10^{-13} Torr

Yield point xxxx

Zero-length Any flanged device that has a total overall thickness equal to the thickness of the flange itself

& ampersand; the symbol for "and"

@ the symbol for "at"

°C degrees Centigrade or Celsius; unit of temperature

°F degrees Fahrenheit; unit of temperature

μ Mu; unit of magnetic permeability; also the symbol for micron as μin, micro-inch

the symbol for "number" or "pound" weight, depending on context

Ω Omega; ohm, unit of electrical resistance or impedance



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Size Ref's

Ref	Del-Seal™ flange
133	1-1/3" flange
218	2-1/8" flange
275	2-3/4" flange
338	3-3/8" flange
450	4-1/2" flange
458	4-5/8" flange
600	6" flange
675	6-3/4" flange
800	8" flange
1000	10" flange
1200	12" flange
1325	13-1/4" flange
1400	14" flange
1650	16-1/2" flange

Ref	Vacuum Tubing
025	1/4" O.D.
037	3/8" O.D.
050	1/2" O.D.
075	3/4" O.D.
100	1" O.D.
125	1-1/4" O.D.
150	1-1/2" O.D.
175	1-3/4" O.D.
200	2" O.D.
250	2-1/2" O.D.
300	3" O.D.
400	4" O.D.
600	6" O.D.
800	8" O.D.
1000	10" O.D.
1075	10-3/4" O.D.



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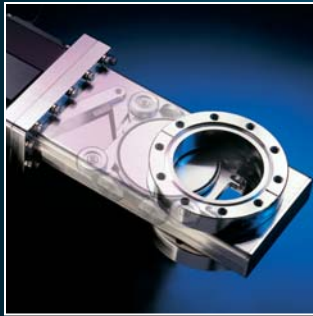
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refer to the
Products At A Glance
pages in the front of this catalog.

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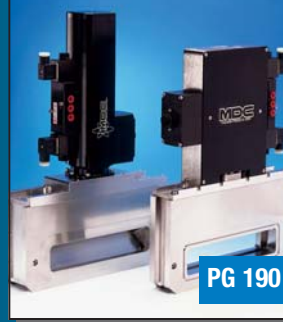
Valves

Circular Gate



PG 168

Rectangular Gate



PG 190

Angle



PG 200

Inline



PG 222

All-Metal



PG 236

Variable Leak



PG 238

Precision Leak



PG 239

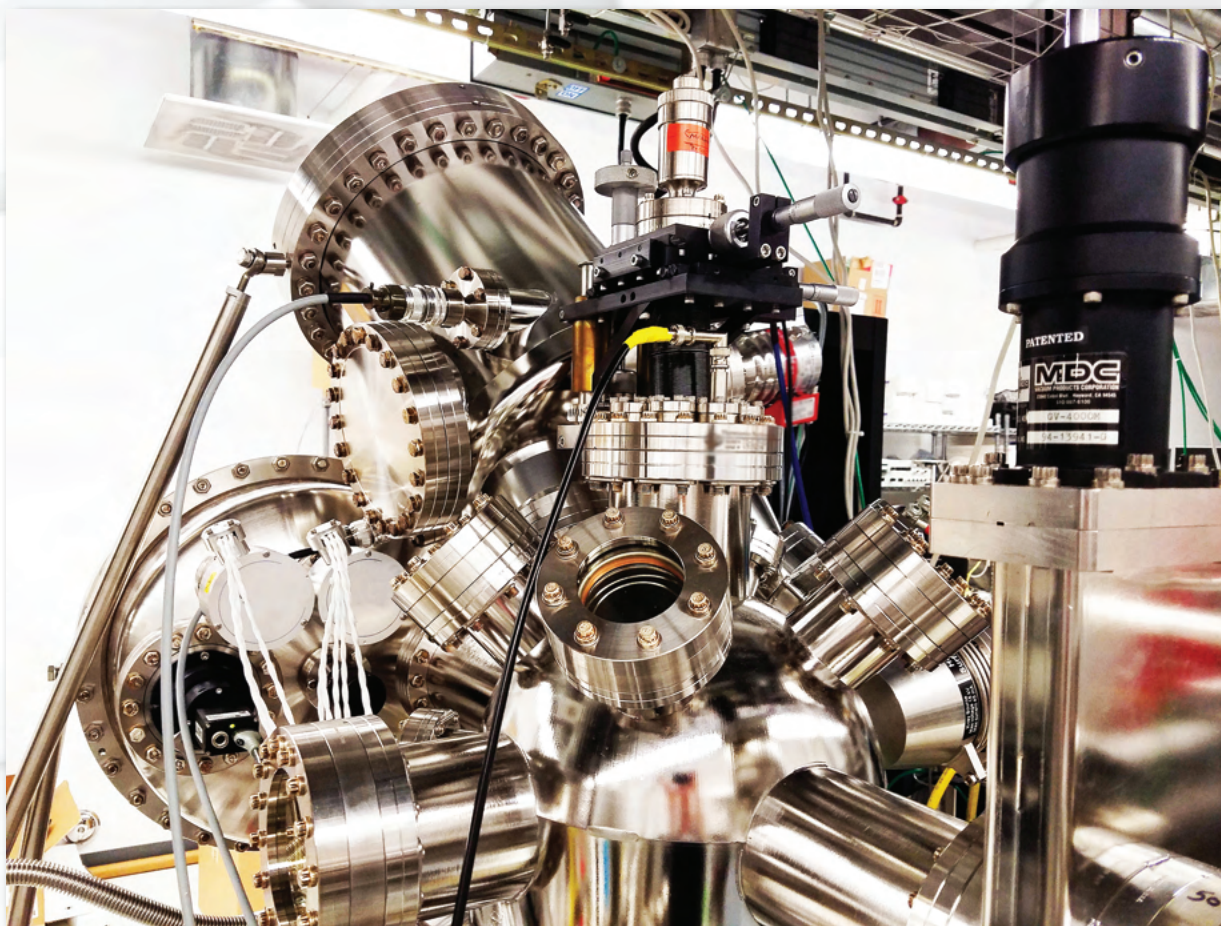
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Ordering Information

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Sales Representatives

Inside back cover

Oakland / Berkeley

- South on Interstate 880
- Exit 25 for Industrial Parkway
- Turn left onto Industrial Pkwy W.
- Turn right onto Huntwood Ave
- Turn left onto Santana St

Livermore / Central Valley

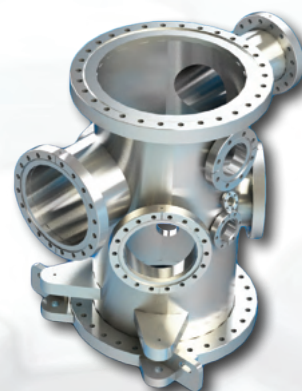
- West on Interstate 580
- Merge onto Interstate 580 W
- Merge onto Interstate 880 S
- Exit 25 for Industrial Parkway
- Turn left onto Industrial Pkwy W.
- Turn right onto Huntwood Ave
- Turn left onto Santana St

San Jose

- North on Interstate 880
- Exit 24 for Whipple Rd
- Turn right onto Whipple Rd
- Turn left onto Wiegman Rd
- Turn right onto Zephyr Ave
- Turn left onto Santana St

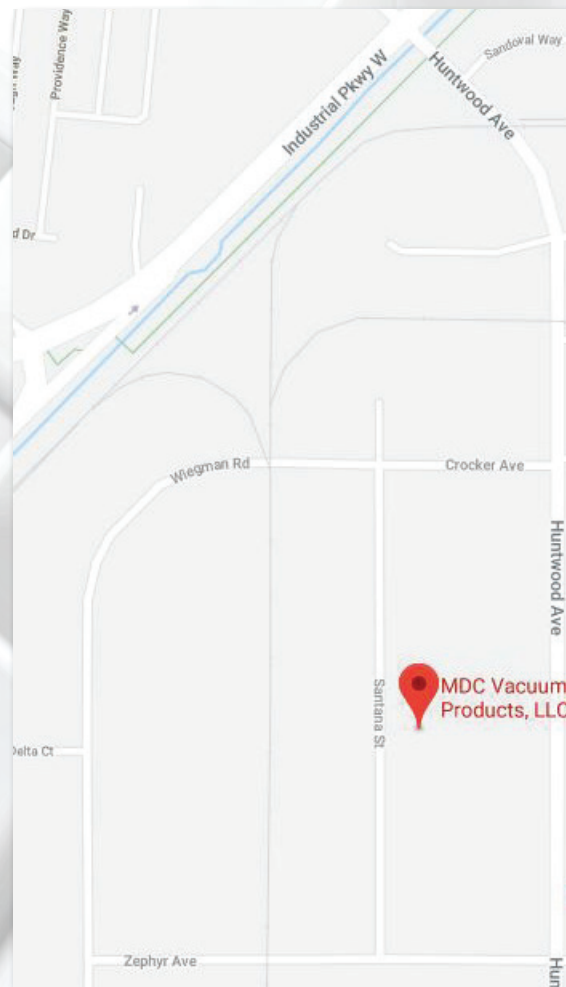
San Francisco International Airport

- South on Highway 101 Merge
- Exit Highway 92 East
- Continue onto Interstate 880 S
- Exit 25 for Industrial Parkway
- Turn left onto Industrial Pkwy W
- Turn right onto Huntwood Ave
- Turn left onto Santana St



MDC's Hayward, California Manufacturing Facility

MDC Precision
30962 Santana Street
Hayward, CA 94544
USA



Shipping Method

All standard shipments are made by the following methods unless otherwise specified:

- All product shipments from MDC will be delivered FCA, MDC's shipping location
- Prepare and added to invoice (PPA)
- Shipped via the best way as determined by MDC.

Nonstandard shipments must be specified by the customer.

General notes include the following:

- Orders may be specified to ship collect
- Charges for nonstandard methods of shipping are determined by the specified carrier
- In some cases, oversized items may be charged at a "dimensional weight" rate which is substantially higher than surface rates

MDC recommends in all cases that an alternative carrier be named at the time of order.

Weights stated online are for reference only. Exact shipping weights are determined at the time of shipment.

Payment Terms

Prices and specifications are subject to change without notice.

Delivery

Every effort will be made to ship within three (3) days of receipt of an order. In the event of a back-order, a firm delivery date will be established and quoted.

Warranty

MDC warrants that all Products will be free from substantial defects in materials and workmanship under normal use for 12 months (90 calendar days for Expendables, defined below) from the date of delivery. MDC warrants, for 90 calendar days from the date of Services delivery that the Services will be performed in a workmanlike manner in conformity with the professional standards for comparable services in the industry. "Expendables" are (a) Products consisting entirely of expendable items, such as gaskets, bellows, bearings, lubricants, etc., and (b) the expendable item portions of any Product. MDC's complete Warranty Policy can be seen on the MDC website: www.mdcprecision.com

Return Policy

Custom Products, including Services deliverables, may not be returned by Buyer. Other Products may be returned to MDC at Buyer's expense within 30 calendar days of delivery, subject to MDC's approval and a 25% restocking fee. Buyer must obtain from MDC a RMA number before returning any such Product and otherwise comply with MDC's RMA procedures. All such returned Products must be unused, 100% complete and contain all original packing materials. No Products may be returned after 30 calendar days from delivery to Buyer. Following such a return, MDC will issue to Buyer a credit for the amount paid for such Product less the restocking fee. Such credit may only be applied against future purchases from MDC and will expire 1 year after issuance. No cash refund will be issued by MDC. MDC's complete Return Policy can be seen on the MDC website: www.mdcprecision.com

Trademark Ownership

American Express®	American Express Co.
MasterCard®	Mastercard International Inc.
VISA®	VISA International Service Association
Alumel®	Hoskins Manufacturing Co.
Apiezon®	Avo Biddle Instruments
AutoCad®	Autodesk Corporation
Conflat®, Fel-Pro®	Varian Associates Inc.
Corning®, Pyrex®	Corning Inc.
Dicronite®	Rotary Components, Inc.
Kovar®	Carpenter Technology
Mazak®	Yamazaki Mazak Corp.
Slo-Syn®	Superior Electric Co.
Suprasil™	Heraeus Amersil Inc.
Swagelok®, VCR®	Swagelok Co.
Teflon®	E.I. DuPont de Nemours & Co., Inc.
VacOptix®	Insulator Seal
Buna®, Kapton®, Kalrez®, Krytox®,	
Vespel®, Delrin®	DuPont Dow Elastomers
Cab-Fast®	MDC Precision, LLC
Del-Seal™, Del-Base™, Del-Weld™, Kwik-Flange™, Large-Flange™,	
Mini-Scaffold™, Auto-Dock™, C-Loc®,	
Uni-Loc™, V-Plane®, Re-Vap™, e-Vap®	

MDC Precision, LLC

*All dimensions in this catalog are given in inches unless specified otherwise.
See our current Terms & Conditions of Sale on the MDC Website: www.mdcprecision.com*



