

Vacuum

Series 88

CF COMPONENT
ULTRA-HIGH VACUUM FITTINGS
SIZES 1 1/3" TO 10"

W W W . M K S I N S T . C O M
Technology



Bulletin 02/08 - Series 88 CF Components

Due to continuous development, specifications and prices are subject to change without notice.

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Introduction

Manufactured by MKS to industry standards, Series 88 components are a full line of metal-sealed stainless steel CF flanges and fittings that are interchangeable with ultrahigh vacuum equipment made by other manufacturers.

MKS offers a complete system of interfacing components including valves, which allows rapid assembly without welding, brazing, or soldering. Most sizes and types of fittings are available for immediate shipment from MKS' distribution centers located throughout North America, Asia, and Europe.

Applications

Series 88 CF flanges are suitable for applications requiring a very clean environment, ultrahigh vacuum conditions, high temperature, or where critical or dangerous materials must be contained or excluded. These include:

1. Difficult applications with corrosive, radioactive, toxic or air sensitive materials.
2. Materials creation and processing such as molecular beam epitaxy.
3. Analytical instrumentation including Auger electron spectrometers, mass spectrometers, and electron microscopes.
4. High energy physics installation such as accelerators and fusion devices.

Description

Series 88 is a line of CF-style fittings that are the standard for ultrahigh vacuum applications. They use a flat gasket placed between two knife edges to provide a vacuum tight seal. Mating flanges have identical profiles, i.e., they are sex-less, eliminating the need to store two types or worry about compatibility.

Made with very high purity stainless steel and meticulous cleaning procedures, Series 88 CF components are suitable for use in the ultrahigh vacuum applications to below 10^{-13} Torr and in temperatures from -196° to 500°C . The material characteristics of the flanges, seals, screws, and nuts are selected to provide high performance throughout a wide temperature range. Rotatable and nonrotatable flanges in sizes from mini 1-1/3 to 10 inches (34 to 254 mm) are available with several bore sizes to fit a range of tube diameters.

MKS uses the latest automated equipment to provide the highest quality and consistency. Very high purity type 304 stainless steel is selected to have few inclusions. Combined with MKS' surface treatment and cleaning procedures, this minimizes outgassing, permeability, and leakage. Proper hardness is maintained to prevent the knife edge from deteriorating.

Installation

CF components are assembled by inserting a gasket between the two flange faces, then securing the assembly with bolts. (See figure 1.) Bolts should be tightened diagonally, versus sequentially around the circumference, for a secure

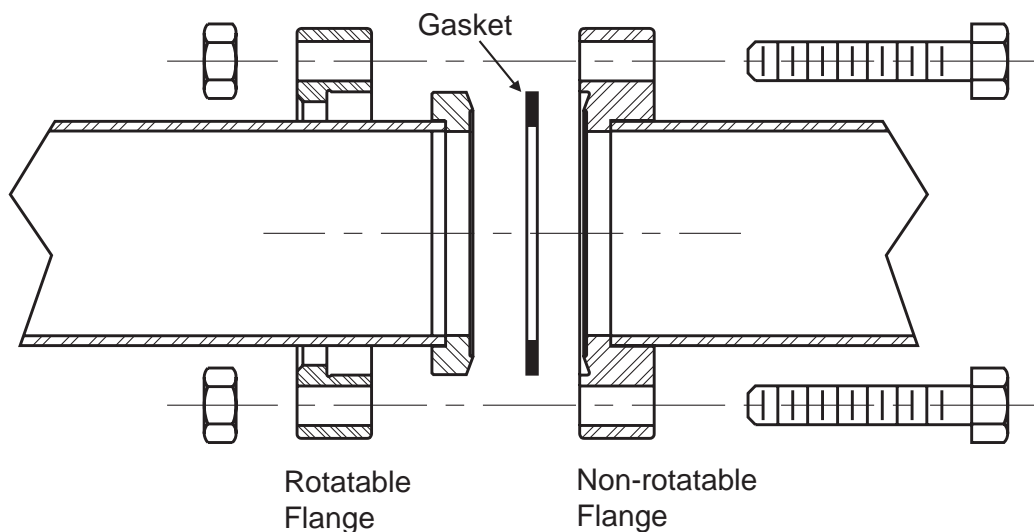


Figure 1 - CF Flange Installation

vacuum seal. Assembly is cost effective through reuse of components and inch dimensional stubs, sockets, and tubes. The foolproof design provides leak tight joints consistently.

A variety of sealing hardware is available, such as plate nuts, dodecagon (12 point head) bolts, Viton® seals, and individually wrapped copper, silver-plated copper and nickel gaskets protected from corrosion and mechanical damage.

Plate nuts furnish the fastest, most convenient method to close flanges, reduce required clearance, assemble with one wrench, and are especially good in limited accessibility. Assembly time reduces greatly, because bolts are easier to start and tighten. The clearance needed is half that of regular nuts. They eliminate the need and cost for tapped flanges.

MKS is one of very few CF manufacturers who offer silver plated bolts, including the convenient dodecagon (12 point head) style, which greatly reduce the risk of seizure or breakage.

Copper gaskets make these flanges self-centering and the standard leak grooves simplify troubleshooting and gasket removal. MKS guarantees its CF flanges and fittings to be leak free. OFHC copper gaskets are cleaned, insured to be scratch free, individually sealed, and ready for use. Individual packaging protects flange seal surfaces.

Silver-plated copper gaskets are available for systems that require frequent high-temperature bakeout. This prevents oxides from forming during the bakeout, which could contaminate the system.

The Viton® CF gasket offered by MKS Instruments has a unique notching in the design, allowing less outgassing than most elastomer seals.

CF flanges remain leak tight even after repeated cycling of the temperature over a wide range. Series 88 fittings are welded this way and every part is fully leak tested with a helium mass spectrometer leak detector. The availability of both tapped and clearance bolt holes gives great flexibility.

Type 304 stainless steel is suited for assembly by tungsten inert gas (TIG) welding; simple fusion welding without filler metal is preferred. Users may braze components to the CF flanges if desired. CF flanges seal properly when the faces of mating flanges contact each other.

The rotatable versions simplify alignment with the bolt holes of other system components and give infinitely rotatable joints. All fittings have at least one rotatable flange for easy alignment. Nonrotatable flanges provide better knife edge protection. The precise tolerances to which MKS fabricates its CF flanges insure an exact fit every time.

Standard size inch tubing provides easy and economical connection to the user's equipment. Series 88 components include double-sided flanges to allow the addition of ports through their circumference with least cost and space. Zero length reducers permit maximum design flexibility, while minimizing the need for custom made components, conductance loss, and surface area. In these, knife edge profiles of various sizes are machined onto the opposite sides of a flange.

Full and half nipples, adapters to a variety of other connection elements, wide angle viewing windows for visual or photographic observation in all metal vacuum systems, tees, elbows, crosses, and flexible metal hoses for vibration isolation and movement give the line added versatility.

With its extensive engineering capabilities, MKS provides custom designed and manufactured shapes and sizes of components. Custom vacuum chambers can be fabricated as well as unique space and time saving fittings and adapters.

Table 1 - Gaskets and Torque

Size	Metal Gasket Dimensions in/(mm)		Maximum Torque for Sealing ft./lbs (Newton-meters)
	Outer Diameter	Inner Diameter	
1 1/8"	0.84/(21)	0.64/(16)	5/(7)
2 1/8"	1.29/(33)	1.01/(26)	16/(22)
2 3/4"	1.90/(48)	1.45/(37)	16/(22)
3 3/8"	2.43/(62)	2.01/(51)	26/(35)
4 1/2"	3.24/(82)	2.51/(64)	26/(35)
4 5/8"	3.60/(91)	3.01/(76)	26/(35)
6"	4.74/(120)	4.01/(102)	26/(35)
8"	6.74/(171)	6.01/(153)	26/(35)
10"	8.74/(222)	8.01/(203)	26/(35)

Note: Metal gaskets are .08" thick.

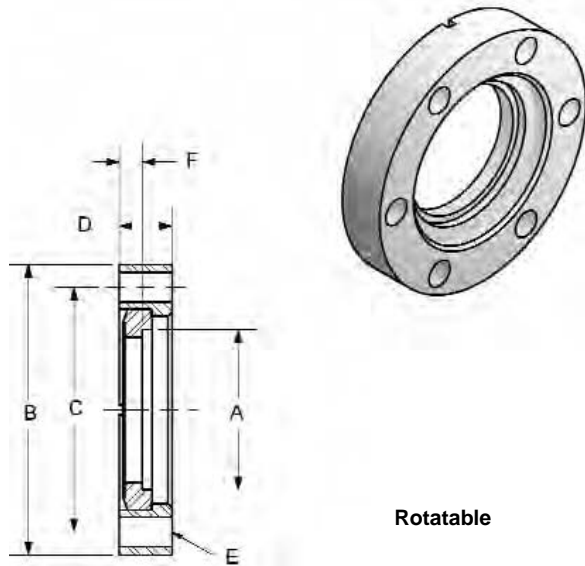
Specifications

Minimum Pressure (with metal seals)	10 ⁻¹³ Torr
Leak Check	< 10 ⁻⁹ std-cc/s
Materials	
Components	Type 304 Stainless Steel,
Gaskets	Copper, Silverplated Copper or Viton®
Bolts	Type 304 Stainless or Silver-Plated Stainless
Metal Gasket Thickness	.08" / (2.03 mm)

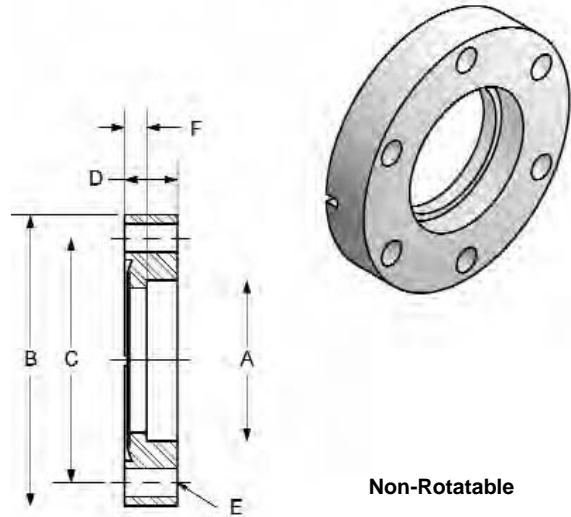


Figure 2. CF Flange Dimensions

in./ (mm)



Rotatable



Non-Rotatable

Flange Size	A Nominal Tube Diameter	B Flange Outside Diameter	C Bolt Circle Diameter	D Thickness	E Number of Holes	Tapped Holes Thread	Thru Holes Diameter	F Face to Counter Bore
1 1/8	.75 (19)	1.33 (34)	1.06 (27)	.30 (8)	6	8-32	.172 (4.3)	.18 (4.6)
2 1/8	1.00 (25)	2.12 (54)	1.62 (41)	.50 (13)	4	1/4-28	.265 (6.7)	.17 (4.3)
2 3/4	1.50 (38)	2.75 (70)	2.31 (59)	.50 (13)	6	1/4-28	.265 (6.7)	.21 (5.3)
3 3/8	2.00 (51)	3.38 (86)	2.85 (72)	.69 (18)	8	5/16-24	.332 (8.4)	.22 (5.6)
4 1/2	2.50 (64)	4.50 (114)	3.63 (92)	.69 (18)	8	5/16-24	.332 (8.4)	.38 (9.6)
4 5/8	3.01 (76)	4.61 (118)	4.03 (102)	.75 (19)	10	5/16-24	.332 (8.4)	.38 (9.6)
6	4.00 (102)	6.00 (152)	5.13 (130)	.78 (20)	16	5/16-24	.332 (8.4)	.43 (10.9)
8	6.00 (152)	8.00 (203)	7.13 (181)	.88 (22)	20	5/16-24	.332 (8.4)	.50 (12.7)
10	8.00 (203)	10.00 (254)	9.13 (232)	.97 (25)	24	5/16-24	.332 (8.4)	.50 (12.7)



CF Flanges					in./(mm)
Flange Size	For Tubing OD	Rotatable / Non-Rotatable	Bolt Holes	Part Number	Price
1 1/8	Blank	Rotatable	Thru	100881014	
1 1/8	Blank	Rotatable	Tapped	100881021	
1 1/8	Blank	Non-Rotatable	Thru	100881000	
1 1/8	Blank	Non-Rotatable	Tapped	100881007	
1 1/8	.75 (19)	Rotatable	Thru	100881018	
1 1/8	.75 (19)	Rotatable	Tapped	100881025	
1 1/8	.75 (19)	Non-Rotatable	Thru	100881004	
1 1/8	.75 (19)	Non-Rotatable	Tapped	100881011	
2 1/8	Blank	Rotatable	Thru	100882010	
2 1/8	Blank	Rotatable	Tapped	100882015	
2 1/8	Blank	Non-Rotatable	Thru	100882000	
2 1/8	Blank	Non-Rotatable	Tapped	100882005	
2 1/8	.25 (6)	Rotatable	Thru	100882011	
2 1/8	.25 (6)	Rotatable	Tapped	100882016	
2 1/8	.25 (6)	Non-Rotatable	Thru	100882001	
2 1/8	.25 (6)	Non-Rotatable	Tapped	100882006	
2 1/8	.50 (13)	Rotatable	Thru	100882012	
2 1/8	.50 (13)	Rotatable	Tapped	100882017	
2 1/8	.50 (13)	Non-Rotatable	Thru	100882002	
2 1/8	.50 (13)	Non-Rotatable	Tapped	100882007	
2 1/8	.75 (19)	Rotatable	Thru	100882013	
2 1/8	.75 (19)	Rotatable	Tapped	100882018	
2 1/8	.75 (19)	Non-Rotatable	Thru	100882003	
2 1/8	.75 (19)	Non-Rotatable	Tapped	100882008	
2 1/8	1.00 (25)	Rotatable	Thru	100882014	
2 1/8	1.00 (25)	Rotatable	Tapped	100882019	
2 1/8	1.00 (25)	Non-Rotatable	Thru	100882004	
2 1/8	1.00 (25)	Non-Rotatable	Tapped	100882009	



CF Flanges**in./ (mm)**

Flange Size	For Tubing OD	Rotatable / Non-Rotatable	Bolt Holes	Part Number	Price
2 3/4	Blank	Rotatable	Thru	100883014	
2 3/4	Blank	Rotatable	Tapped	100883021	
2 3/4	Blank	Non-Rotatable	Thru	100883000	
2 3/4	Blank	Non-Rotatable	Tapped	100883007	
2 3/4	.25 (6)	Rotatable	Thru	100883015	
2 3/4	.25 (6)	Rotatable	Tapped	100883022	
2 3/4	.25 (6)	Non-Rotatable	Thru	100883001	
2 3/4	.25 (6)	Non-Rotatable	Tapped	100883008	
2 3/4	.50 (13)	Rotatable	Thru	100883016	
2 3/4	.50 (13)	Rotatable	Tapped	100883023	
2 3/4	.50 (13)	Non-Rotatable	Thru	100883002	
2 3/4	.50 (13)	Non-Rotatable	Tapped	100883009	
2 3/4	.75 (19)	Rotatable	Thru	100883017	
2 3/4	.75 (19)	Rotatable	Tapped	100883024	
2 3/4	.75 (19)	Non-Rotatable	Thru	100883003	
2 3/4	.75 (19)	Non-Rotatable	Tapped	100883010	
2 3/4	1.00 (25)	Rotatable	Thru	100883018	
2 3/4	1.00 (25)	Rotatable	Tapped	100883025	
2 3/4	1.00 (25)	Non-Rotatable	Thru	100883004	
2 3/4	1.00 (25)	Non-Rotatable	Tapped	100883011	
2 3/4	1.25 (32)	Rotatable	Thru	100883019	
2 3/4	1.25 (32)	Rotatable	Tapped	100883026	
2 3/4	1.25 (32)	Non-Rotatable	Thru	100883005	
2 3/4	1.25 (32)	Non-Rotatable	Tapped	100883012	
2 3/4	1.50 (38)	Rotatable	Thru	100883020	
2 3/4	1.50 (38)	Rotatable	Tapped	100883027	
2 3/4	1.50 (38)	Non-Rotatable	Thru	100883006	
2 3/4	1.50 (38)	Non-Rotatable	Tapped	100883013	
2 3/4	1.75 (45)	Rotatable	Thru	100883065	
2 3/4	1.75 (45)	Rotatable	Tapped	100883067	
2 3/4	1.75 (45)	Non-Rotatable	Thru	100883064	
2 3/4	1.75 (45)	Non-Rotatable	Tapped	100883066	

CF Flanges					in./ (mm)
Flange Size	For Tubing OD	Rotatable / Non-Rotatable	Bolt Holes	Part Number	Price
3 3/8	Blank	Rotatable	Thru	100884006	
3 3/8	Blank	Rotatable	Tapped	100884009	
3 3/8	Blank	Non-Rotatable	Thru	100884000	
3 3/8	Blank	Non-Rotatable	Tapped	100884003	
3 3/8	1.50 (38)	Rotatable	Thru	100884007	
3 3/8	1.50 (38)	Rotatable	Tapped	100884010	
3 3/8	1.50 (38)	Non-Rotatable	Thru	100884001	
3 3/8	1.50 (38)	Non-Rotatable	Tapped	100884004	
3 3/8	2.00 (51)	Rotatable	Thru	100884008	
3 3/8	2.00 (51)	Rotatable	Tapped	100884011	
3 3/8	2.00 (51)	Non-Rotatable	Thru	100884002	
3 3/8	2.00 (51)	Non-Rotatable	Tapped	100884005	
4 1/2	Blank	Rotatable	Thru	100885008	
4 1/2	Blank	Rotatable	Tapped	100885012	
4 1/2	Blank	Non-Rotatable	Thru	100885000	
4 1/2	Blank	Non-Rotatable	Tapped	100885004	
4 1/2	1.50 (38)	Rotatable	Thru	100885009	
4 1/2	1.50 (38)	Rotatable	Tapped	100885013	
4 1/2	1.50 (38)	Non-Rotatable	Thru	100885001	
4 1/2	1.50 (38)	Non-Rotatable	Tapped	100885005	
4 1/2	2.00 (51)	Rotatable	Thru	100885010	
4 1/2	2.00 (51)	Rotatable	Tapped	100885014	
4 1/2	2.00 (51)	Non-Rotatable	Thru	100885002	
4 1/2	2.00 (51)	Non-Rotatable	Tapped	100885006	
4 1/2	2.50 (64)	Rotatable	Thru	100885011	
4 1/2	2.50 (64)	Rotatable	Tapped	100885015	
4 1/2	2.50 (64)	Non-Rotatable	Thru	100885003	
4 1/2	2.50 (64)	Non-Rotatable	Tapped	100885007	
4 5/8	Blank	Rotatable	Thru	100885504	
4 5/8	Blank	Rotatable	Tapped	100885506	
4 5/8	Blank	Non-Rotatable	Thru	100885500	

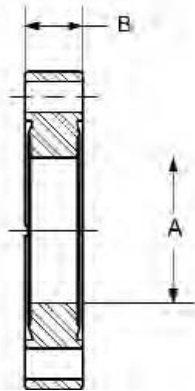


CF Flanges**in./ (mm)**

Flange Size	For Tubing OD	Rotatable / Non-Rotatable	Bolt Holes	Part Number	Price
4 5/8	Blank	Non-Rotatable	Tapped	100885502	
4 5/8	3.00 (76)	Rotatable	Thru	100885505	
4 5/8	3.00 (76)	Rotatable	Tapped	100885507	
4 5/8	3.00 (76)	Non-Rotatable	Thru	100885501	
4 5/8	3.00 (76)	Non-Rotatable	Tapped	100885503	
6	Blank	Rotatable	Thru	100886004	
6	Blank	Rotatable	Tapped	100886006	
6	Blank	Non-Rotatable	Thru	100886000	
6	Blank	Non-Rotatable	Tapped	100886002	
6	4.00 (102)	Rotatable	Thru	100886005	
6	4.00 (102)	Rotatable	Tapped	100886007	
6	4.00 (102)	Non-Rotatable	Thru	100886001	
6	4.00 (102)	Non-Rotatable	Tapped	100886003	
8	Blank	Rotatable	Thru	100887004	
8	Blank	Rotatable	Tapped	100887006	
8	Blank	Non-Rotatable	Thru	100887000	
8	Blank	Non-Rotatable	Tapped	100887002	
8	6.00 (152)	Rotatable	Thru	100887005	
8	6.00 (152)	Rotatable	Tapped	100887007	
8	6.00 (152)	Non-Rotatable	Thru	100887001	
8	6.00 (152)	Non-Rotatable	Tapped	100887003	
10	Blank	Rotatable	Thru	100888004	
10	Blank	Rotatable	Tapped	100888006	
10	Blank	Non-Rotatable	Thru	100888000	
10	Blank	Non-Rotatable	Tapped	100888002	
10	8.00 (203)	Rotatable	Thru	100888005	
10	8.00 (203)	Rotatable	Tapped	100888007	
10	8.00 (203)	Non-Rotatable	Thru	100888001	
10	8.00 (203)	Non-Rotatable	Tapped	100888003	

CF Double-Sided Flanges

in./(mm)



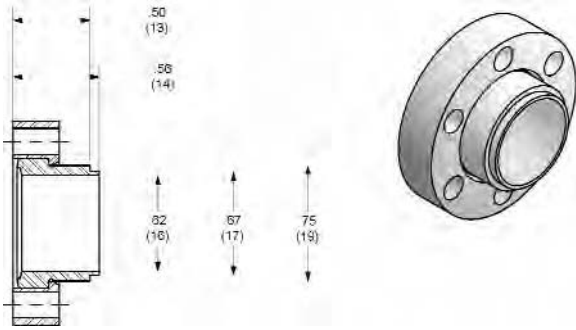
- Designed to be inserted between two flanges of the same size
- Requires double sided flange hardware
- Can be easily modified to accommodate side ports for such things as gas inlets, gauges, valves, etc.

Flange Size	A Bore	B Thickness	Part Number	Price
1 1/8	Blank	.30 (8)	100881038	
1 1/8	.26 (7)	.30 (8)	100881039	
1 1/8	.38 (10)	.30 (8)	100881040	
1 1/8	.51 (13)	.30 (8)	100881041	
1 1/8	.63 (16)	.30 (8)	100881042	
1 1/8	Blank	.50 (13)	100881043	
1 1/8	.63 (16)	.50 (13)	100881044	
2 1/8	Blank	.50 (13)	100882026	
2 1/8	1.01 (26)	.50 (13)	100882027	
2 3/4	Blank	.50 (13)	100883038	
2 3/4	.26 (7)	.50 (13)	100883039	
2 3/4	.51 (13)	.50 (13)	100883040	
2 3/4	.76 (19)	.50 (13)	100883041	
2 3/4	1.01 (26)	.50 (13)	100883042	
2 3/4	1.26 (32)	.50 (13)	100883043	
2 3/4	1.51 (38)	.50 (13)	100883044	
2 3/4	Blank	.75 (19)	100883045	
2 3/4	1.51 (38)	.75 (19)	100883046	
3 3/8	Blank	.69 (18)	100884022	
3 3/8	1.51 (38)	.69 (18)	100884023	
3 3/8	2.01 (51)	.69 (18)	100884024	
4 1/2	Blank	.69 (18)	100885026	
4 1/2	1.51 (38)	.69 (18)	100885027	
4 1/2	2.01 (51)	.69 (18)	100885028	
4 1/2	2.51 (64)	.69 (18)	100885029	
4 5/8	Blank	.81 (21)	100885508	
4 5/8	3.00 (76)	.81 (21)	100885509	
6	Blank	.78 (20)	100886017	
6	4.10 (102)	.78 (20)	100886018	
8	Blank	.88 (22)	100887014	
8	6.02 (153)	.88 (22)	100887015	
10	Blank	.97 (25)	100888014	
10	8.02 (204)	.97 (25)	100888015	

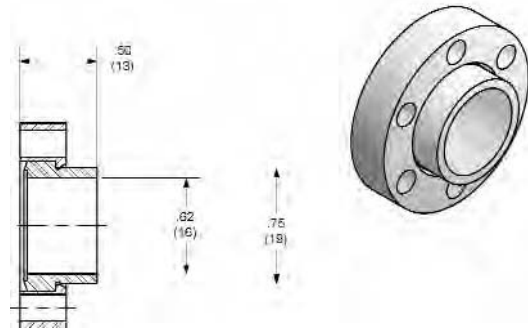


Mini 1 1/3" CF Weld Stubs

in./ (mm)



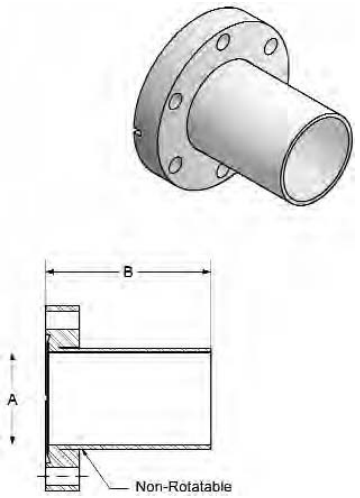
Long Weld Stub with Weld Prep

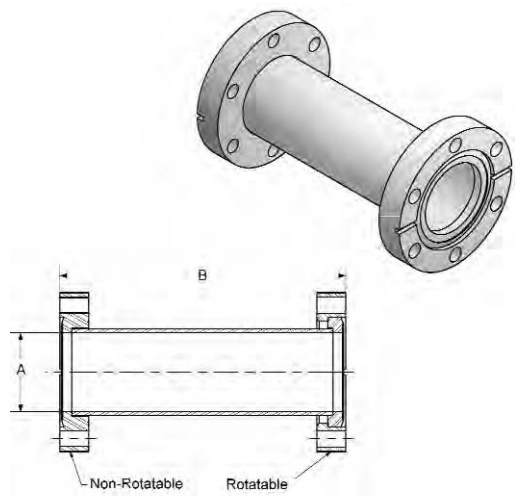


Long Weld Stub without Weld Prep

For Tubing OD/Wall	Rotatable/ Non-Rotatable	Bolt Holes	Weld Prep	Part Number	Price
Blank	Rotatable	Thru	Yes	100881015	
Blank	Rotatable	Tapped	Yes	100881022	
Blank	Non-Rotatable	Thru	Yes	100881001	
Blank	Non-Rotatable	Tapped	Yes	100881008	
.25/.035 (6.4/.89)	Rotatable	Thru	Yes	100881016	
.25/.035 (6.4/.89)	Rotatable	Tapped	Yes	100881023	
.25/.035 (6.4/.89)	Non-Rotatable	Thru	Yes	100881002	
.25/.035 (6.4/.89)	Non-Rotatable	Tapped	Yes	100881009	
.50/.035 (12.7/.89)	Rotatable	Thru	Yes	100881017	
.50/.035 (12.7/.89)	Rotatable	Tapped	Yes	100881024	
.50/.035 (12.7/.89)	Non-Rotatable	Thru	Yes	100881003	
.50/.035 (12.7/.89)	Non-Rotatable	Tapped	Yes	100881010	
.75/.035 (19.0/.89)	Rotatable	Thru	Yes	100881019	
.75/.035 (19.0/.89)	Rotatable	Tapped	Yes	100881026	
.75/.035 (19.0/.89)	Non-Rotatable	Thru	Yes	100881005	
.75/.035 (19.0/.89)	Non-Rotatable	Tapped	Yes	100881012	
.75/.065 (19.0/1.65)	Rotatable	Thru	No	100881020	
.75/.065 (19.0/1.65)	Rotatable	Tapped	No	100881027	
.75/.065 (19.0/1.65)	Non-Rotatable	Thru	No	100881006	
.75/.065 (19.0/1.65)	Non-Rotatable	Tapped	No	100881013	



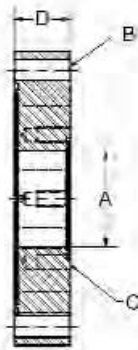
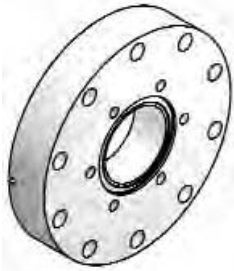
CF Half Nipple		in./ (mm)				
	Flange Size	For Tubing Size (OD)	A	B	Part Number	Price
	1 1/8	.75 (19)	.62 (16)	1.50 (38)	100881046	
	2 1/8	1.00 (25)	.87 (22)	2.05 (52)	100882040	
	2 3/4	1.50 (38)	1.37 (35)	2.43 (62)	100883049	
	3 3/8	2.00 (51)	1.87 (47)	3.21 (82)	100884027	
	4 1/2	2.50 (64)	2.37 (60)	4.13 (105)	100885032	
	4 5/8	3.00 (76)	2.87 (73)	4.93 (125)	100885531	
	6	4.00 (102)	3.87 (98)	5.31 (135)	100886020	
	8	6.00 (152)	5.84 (148)	6.56 (167)	100887016	
	10	8.00 (203)	7.76 (197)	8.00 (203)	100888016	
<ul style="list-style-type: none"> • Butt weld • For use with orbital welders • Thru holes 						

CF Full Nipple		in./ (mm)				
	Flange Size	For Tubing Size (OD)	A	B	Part Number	Price
	1 1/8	.75 (19)	.62 (16)	3.00 (76)	100881047	
	2 1/8	1.00 (25)	.87 (22)	4.10 (104)	100882041	
	2 3/4	1.50 (38)	1.37 (35)	4.92 (125)	100883050	
	2 3/4 *	1.50 (38)	1.37 (35)	4.00 (102)	100883069	
	3 3/8	2.00 (51)	1.87 (47)	6.42 (163)	100884028	
	4 1/2	2.50 (64)	2.37 (60)	8.26 (210)	100885033	
	4 5/8	3.00 (76)	2.87 (73)	9.88 (250)	100885532	
	6	4.00 (102)	3.87 (98)	10.62 (270)	100886021	
	8	6.00 (152)	5.84 (148)	13.12 (333)	100887017	
10	8.00 (203)	7.76 (197)	16.00 (406)	100888017		
<ul style="list-style-type: none"> • Special lengths to order • Thru holes * Includes 12 mesh screen, 1/2" in from rotatable port 						



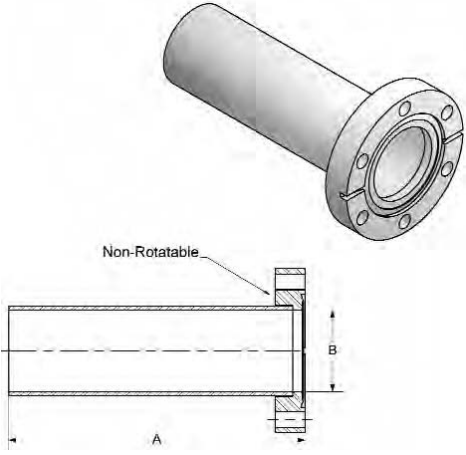
CF Zero Length Reducers

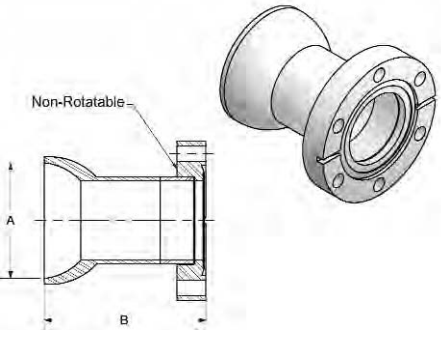
in./ (mm)

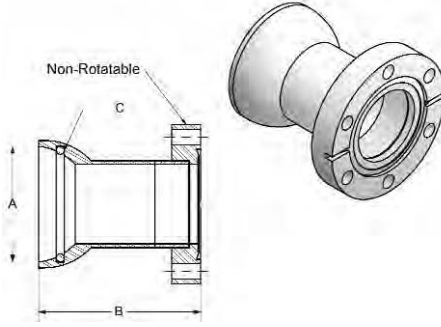


• Mates differing CF sizes

Flange Size	A	B	C	D Thickness	Part Number	Price
2 ¹ / ₈ to 1 ¹ / ₈	.63 (16)	1/4-28 Tapped	8-32 Tapped	.500 (12.7)	100882029	
2 ³ / ₄ to 1 ¹ / ₈	.63 (16)	.265 Thru	8-32 Tapped	.500 (12.7)	100883048	
2 ³ / ₄ to 2 ¹ / ₈	1.00 (25)	1/4-28 Tapped	1/4-28 Tapped	.500 (12.7)	100883149	
3 ³ / ₈ to 1 ¹ / ₈	.63 (16)	.332 Thru	8-32 Tapped	.875 (22.2)	100884124	
3 ³ / ₈ to 2 ¹ / ₈	1.00 (25)	.332 Thru	1/4-28 Tapped	.875 (22.2)	100884125	
3 ³ / ₈ to 2 ³ / ₄	1.52 (39)	5/16-24 Tapped	1/4-28 Tapped	.875 (22.2)	100884026	
4 ¹ / ₂ to 1 ¹ / ₈	.63 (16)	.332 Thru	8-32 Tapped	.875 (22.2)	100885132	
4 ¹ / ₂ to 2 ¹ / ₈	1.00 (25)	.332 Thru	1/4-28 Tapped	.875 (22.2)	100885133	
4 ¹ / ₂ to 2 ³ / ₄	1.52 (39)	.332 Thru	1/4-28 Tapped	.875 (22.2)	100885034	
4 ¹ / ₂ to 3 ³ / ₈	2.02 (51)	5/16-24 Tapped	5/16-24 Tapped	.875 (22.2)	100885031	
4 ⁵ / ₈ to 1 ¹ / ₈	.63 (16)	.332 Thru	8-32 Tapped	.875 (22.2)	100885510	
4 ⁵ / ₈ to 2 ¹ / ₈	1.00 (25)	.332 Thru	1/4-28 Tapped	.875 (22.2)	100885511	
4 ⁵ / ₈ to 2 ³ / ₄	1.50 (38)	.332 Thru	1/4-28 Tapped	.875 (22.2)	100885512	
4 ⁵ / ₈ to 3 ³ / ₈	2.00 (51)	.332 Thru	5/16-24 Tapped	.875 (22.2)	100885513	
6 to 1 ¹ / ₈	.63 (16)	.332 Thru	8-32 Tapped	.875 (22.2)	100886120	
6 to 2 ¹ / ₈	1.00 (25)	.332 Thru	1/4-28 Tapped	.875 (22.2)	100886121	
6 to 2 ³ / ₄	1.52 (39)	.332 Thru	1/4-28 Tapped	.875 (22.2)	100886022	
6 to 3 ³ / ₈	2.00 (51)	.332 Thru	5/16-24 Tapped	.875 (22.2)	100886123	
6 to 4 ¹ / ₂	2.50 (64)	.332 Thru	5/16-24 Tapped	.875 (22.2)	100886124	
6 to 4 ⁵ / ₈	3.00 (76)	.332 Thru	5/16-24 Tapped	.875 (22.2)	100886125	
8 to 1 ¹ / ₈	.63 (16)	.332 Thru	8-32 Tapped	.875 (22.2)	100887118	
8 to 2 ¹ / ₈	1.00 (25)	.332 Thru	1/4-28 Tapped	.875 (22.2)	100887119	
8 to 2 ³ / ₄	1.52 (39)	.332 Thru	1/4-28 Tapped	.875 (22.2)	100887020	
8 to 3 ³ / ₈	2.00 (51)	.332 Thru	5/16-24 Tapped	.875 (22.2)	100887121	
8 to 4 ¹ / ₂	2.50 (64)	.332 Thru	5/16-24 Tapped	.875 (22.2)	100887122	
8 to 4 ⁵ / ₈	3.00 (76)	.332 Thru	5/16-24 Tapped	.875 (22.2)	100887123	
8 to 6	4.00 (102)	.332 Thru	5/16-24 Tapped	.875 (22.2)	100887124	
10 to 1 ¹ / ₈	.63 (16)	.332 Thru	8-32 Tapped	.970 (24.6)	100888130	
10 to 2 ¹ / ₈	1.00 (25)	.332 Thru	1/4-28 Tapped	.970 (24.6)	100888131	
10 to 2 ³ / ₄	1.50 (38)	.332 Thru	1/4-28 Tapped	.970 (24.6)	100888132	
10 to 3 ³ / ₈	2.00 (51)	.332 Thru	5/16-24 Tapped	.970 (24.6)	100888133	
10 to 4 ¹ / ₂	2.50 (64)	.332 Thru	5/16-24 Tapped	.970 (24.6)	100888134	
10 to 4 ⁵ / ₈	3.00 (76)	.332 Thru	5/16-24 Tapped	.970 (24.6)	100888135	
10 to 6	4.00 (102)	.332 Thru	5/16-24 Tapped	.970 (24.6)	100888136	
10 to 8	6.00 (152)	.332 Thru	5/16-24 Tapped	.970 (24.6)	100888137	

Adapter, CF to Pyrex® Tube						in./(mm)	
	Flange Size	For Tubing Size (OD)	A	B	Part Number	Price	
	1 1/8	.75 (19)	5.25 (133)	.62 (16)	100881048		
	2 1/8	1.00 (25)	4.92 (126)	.87 (22)	100882030		
	2 3/4	1.50 (38)	4.96 (128)	1.37 (35)	100883053		
	3 3/8	2.00 (51)	5.48 (139)	1.87 (48)	100884031		
	4 1/2	2.50 (64)	5.63 (143)	2.37 (60)	100885035		
	6	4.00 (102)	6.84 (169)	3.87 (98)	100886023		
8	6.00 (152)	8.75 (222)	5.83 (148)	100887021			
<ul style="list-style-type: none"> • Pyrex® glass • Thru holes 							

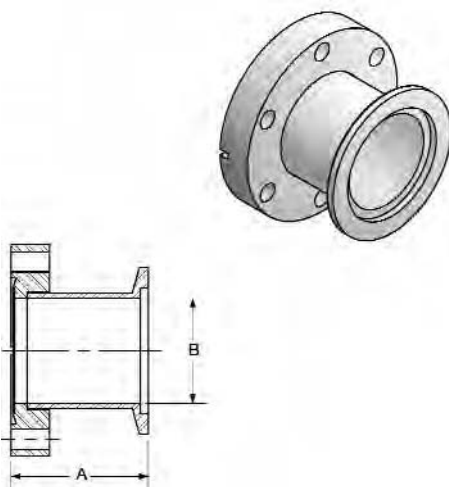
Adapter, CF to Ball Socket without O-Ring						in./(mm)	
	Flange Size	A	B	C	Part Number	Price	
	2 3/4 to 50/30	2.00 (51)	2.80 (71)	N/A	100883052		
	3 3/8 to 75/50	3.00 (76)	4.16 (106)	N/A	100884030		
<ul style="list-style-type: none"> • Without O-ring groove • Standard quartz ball coupling • Thru holes • Mating ball end needs O-ring 							

Adapter, CF to Ball Socket with O-Ring						in./(mm)	
	Flange Size	A	B	C	Part Number	Price	
	2 3/4 to 50/30	2.00 (51)	2.80 (71)	2-224 O-Ring	100883051		
	3 3/8 to 75/50	3.00 (76)	4.16 (106)	2-232 O-Ring	100884029		
<ul style="list-style-type: none"> • With O-ring groove and Viton® O-ring • Thru holes • Standard quartz ball coupling 							



Adapter, ISO-KF to CF

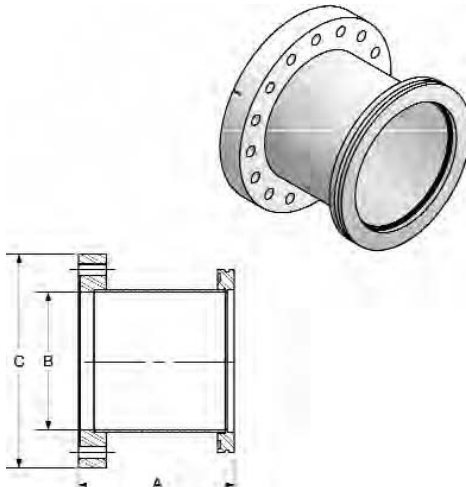
in./ (mm)

	Flange Size (KF)	Flange Size (CF)	A	B	Part Number	Price
	NW 16	Mini 1 1/8	2.08 (53)	0.62 (16)	100315601	
	NW 16	2 3/4	1.78 (45)	0.62 (16)	100315611	
	NW 25	2 1/8	1.89 (48)	0.87 (22)	100319812	
	NW 25	2 3/4	1.78 (45)	0.87 (22)	100315603	
	NW 40	2 3/4	1.78 (45)	1.33 (34)	100315605	
	NW 50	2 3/4	2.11 (54)	1.37 (35)	100319813	
	NW 50	4 1/2	1.95 (50)	1.83 (46)	100315606	

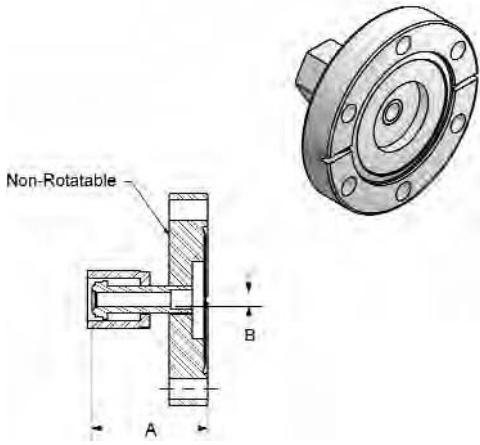
• Stainless steel type 304

Adapter, ISO-MF Flange to CF Flange

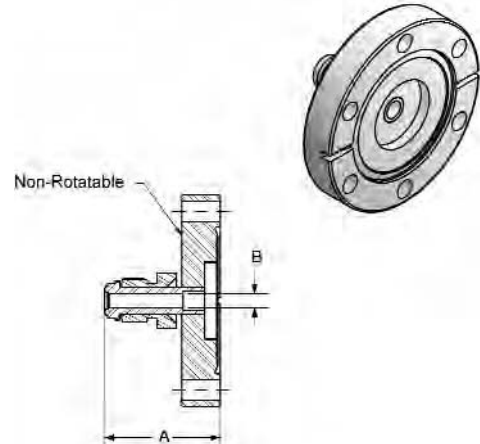
in./ (mm)

	Flange Sizes	A	B	C	Part Number	Price
	NW 63 to 4 1/2" CF	4.33 (110)	2.37 (60)	4.50 (114)	100762206	
	NW 80 to 6" CF	4.33 (110)	2.87 (73)	6.00 (152)	100762208	
	NW 100 to 6" CF	4.37 (111)	3.87 (98)	6.00 (152)	100762210	
	NW 160 to 8" CF	4.45 (113)	5.83 (148)	8.00 (203)	100762216	
	NW 200 to 10" CF	4.45 (113)	7.76 (197)	10.00 (254)	100762220	

• Stainless steel type 304
• Special adapters available upon request

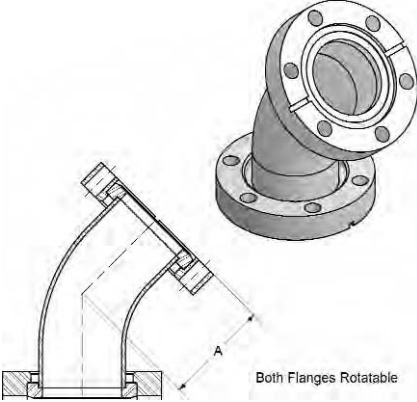
Adapter, CF to VCR® Female *						in./ (mm)	
		Flange Size	A	B	VCR Size	Part Number	Price
		1 1/8 to 4 VCR®	1.43 (36)	.19 (5)	1/4	100881049	
2 1/8 to 4 VCR®	1.50 (38)	.19 (5)	1/4	100882032			
2 1/8 to 8 VCR®	1.69 (43)	.41 (10)	1/2	100882033			
2 1/8 to 12 VCR®	2.19 (56)	.62 (16)	3/4	100882036			
2 3/4 to 4 VCR®	1.50 (38)	.19 (5)	1/4	100883054			
2 3/4 to 8 VCR®	1.69 (43)	.41 (10)	1/2	100883057			
2 3/4 to 12 VCR®	2.19 (56)	.62 (16)	3/4	100883058			
3 3/8 to 4 VCR®	1.80 (46)	.19 (5)	1/4	100884033			
3 3/8 to 8 VCR®	1.88 (48)	.41 (10)	1/2	100884035			
3 3/8 to 12 VCR®	2.38 (60)	.62 (16)	3/4	100884037			

- Thru holes
- VCR-compatible parts may be used

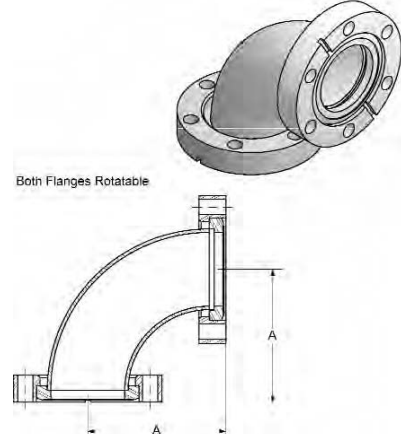
Adapter, CF to VCR® Male *						in./ (mm)	
		Flange Size	A	B	VCR Size	Part Number	Price
		1 1/8 to 4 VCR®	1.43 (36)	.19 (5)	1/4	100881050	
2 1/8 to 4 VCR®	1.50 (38)	.19 (5)	1/4	100882031			
2 1/8 to 8 VCR®	1.69 (43)	.41 (10)	1/2	100882034			
2 1/8 to 12 VCR®	2.19 (56)	.62 (16)	3/4	100882035			
2 3/4 to 4 VCR®	1.50 (38)	.19 (5)	1/4	100883055			
2 3/4 to 8 VCR®	1.69 (43)	.41 (10)	1/2	100883056			
2 3/4 to 12 VCR®	2.19 (56)	.62 (16)	3/4	100883059			
3 3/8 to 4 VCR®	1.80 (46)	.19 (5)	1/4	100884032			
3 3/8 to 8 VCR®	1.88 (48)	.41 (10)	1/2	100884034			
3 3/8 to 12 VCR®	2.38 (60)	.62 (16)	3/4	100884036			

- Thru holes
- VCR-compatible parts may be used

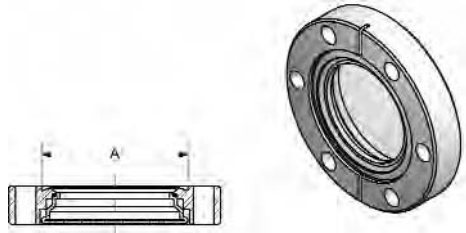


CF Elbow 45° Smooth Radius					in./ (mm)	
 <p>Both Flanges Rotatable</p>	Flange Size	For Tubing OD	A	Part Number	Price	
	1 1/8	.75 (19)	.81 (21)	100881052		
	2 1/8	1.00 (25)	1.35 (34)	100882038		
	2 3/4	1.50 (38)	1.82 (46)	100883061		
	3 3/8	2.00 (51)	2.53 (64)	100884039		
	4 1/2	2.50 (64)	3.37 (86)	100885037		
	4 5/8	3.00 (76)	4.05 (103)	100885528		
	6	4.00 (102)	5.24 (133)	100886025		
	8	6.00 (152)	5.76 (146)	100887023		
	10	8.00 (203)	6.95 (177)	100888020		

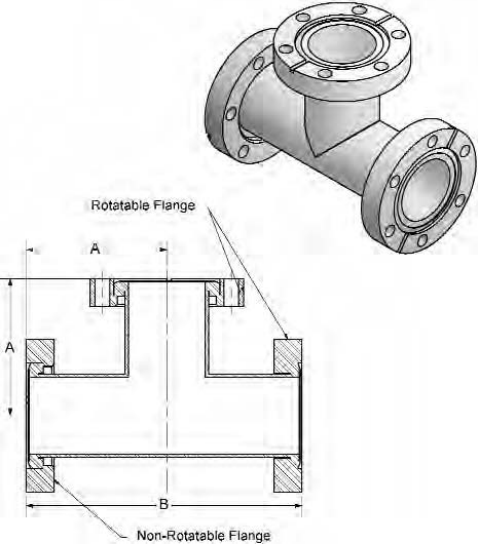
• Flanges same size on both sides

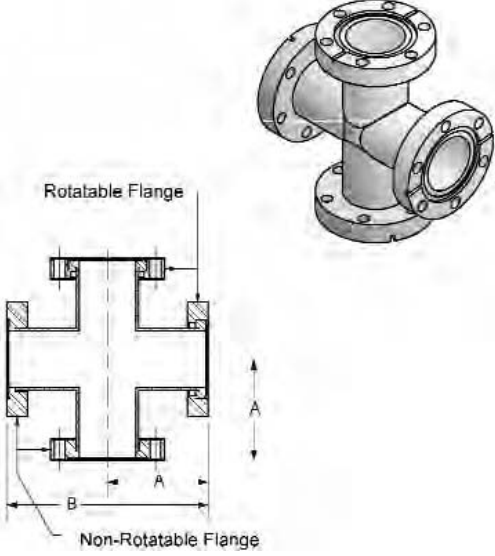
CF Elbow 90° Smooth Radius					in./ (mm)	
 <p>Both Flanges Rotatable</p>	Flange Size	For Tubing OD	A	Part Number	Price	
	1 1/8	.75 (19)	1.50 (38)	100881030		
	2 1/8	1.00 (25)	2.22 (56)	100882039		
	2 3/4	1.50 (38)	2.46 (63)	100883030		
	3 3/8	2.00 (51)	3.21 (82)	100884014		
	4 1/2	2.50 (64)	4.13 (105)	100885018		
	4 5/8	3.00 (76)	4.86 (123)	100885529		
	6	4.00 (102)	6.42 (163)	100886010		
	8	6.00 (152)	9.49 (241)	100887012		
	10	8.00 (203)	12.49 (317)	100888012		

• Flanges same size on both sides

CF Window, Viewing Port				in./ (mm)	
	Flange Size	A	Part Number	Price	
	1 1/8	.62 (16)	100881051		
	2 1/8	.62 (16)	100882037		
	2 3/4	1.40 (36)	100883060		
	3 3/8	1.40 (36)	100884038		
	4 1/2	2.69 (68)	100885036		
	4 5/8	2.69 (68)	100885530		
	6	3.88 (99)	100886024		
	8	5.38 (137)	100887022		
	10	5.38 (137)	100888039		

• Max temperature 400°C
 • Optical quality borosilicate glass
 • Standard flange thickness
 • Thru holes

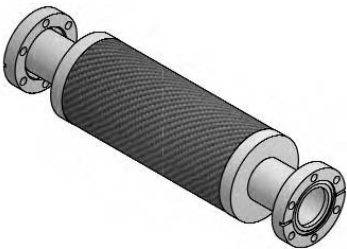
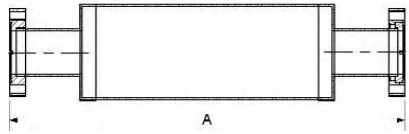
CF Tee		in./ (mm)				
	Flange Size	For Tubing OD	A	B	Part Number	Price
	1 1/8	.75 (19)	1.50 (38)	3.00 (76)	100881028	
	2 1/8	1.00 (25)	2.06 (52)	4.12 (105)	100882042	
	2 3/4	1.50 (38)	2.46 (63)	4.92 (125)	100883028	
	3 3/8	2.00 (51)	3.21 (82)	6.42 (166)	100884012	
	4 1/2	2.50 (64)	4.13 (105)	8.26 (210)	100885016	
	4 5/8	3.00 (76)	4.94 (126)	9.88 (251)	100885533	
	6	4.00 (102)	5.31 (135)	10.62 (270)	100886008	
	8	6.00 (152)	6.56 (167)	13.12 (333)	100887009	
	10	8.00 (203)	8.00 (203)	16.00 (406)	100888008	
<ul style="list-style-type: none"> Flanges same size on all sides 						

CF Cross		in./ (mm)				
	Flange Size	For Tubing OD	A	B	Part Number	Price
	1 1/8	.75 (19)	1.50 (38)	3.00 (76)	100881029	
	2 1/8	1.00 (25)	2.06 (52)	4.12 (105)	100882043	
	2 3/4	1.50 (38)	2.46 (63)	4.92 (125)	100883029	
	3 3/8	2.00 (51)	3.21 (82)	6.42 (166)	100884013	
	4 1/2	2.50 (64)	4.13 (105)	8.26 (210)	100885017	
	4 5/8	3.00 (76)	4.94 (126)	9.88 (251)	100885534	
	6	4.00 (102)	5.31 (135)	10.62 (270)	100886009	
	8	6.00 (152)	6.56 (167)	13.12 (333)	100887011	
	10	8.00 (203)	8.00 (203)	16.00 (406)	100888010	
<ul style="list-style-type: none"> Flanges same size on all sides 						



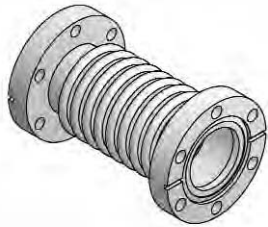
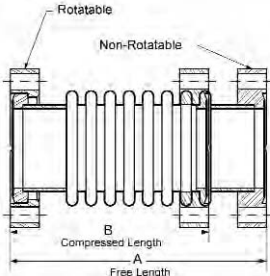
Braided Metal Hose

in./(mm)

 	Flange Size	Static Bend Radius	A	Part Number	Price
	<ul style="list-style-type: none"> Flexible, yet will not contract during rough pumping One rotatable and one non-rotatable flange 	1 1/8	2.5"	11.48 (292)	100881335
	1 1/8	2.5"	21.48 (546)	100881336	
	1 1/8	2.5"	41.48 (1054)	100881337	
	2 1/8	3.0"	12.31 (313)	100882323	
	2 1/8	3.0"	22.31 (567)	100882324	
	2 1/8	3.0"	42.31 (1075)	100882325	
	2 3/4	5.0"	12.40 (315)	100883335	
	2 3/4	5.0"	22.40 (569)	100883336	
	2 3/4	5.0"	42.40 (1077)	100883337	
	3 3/8	6.0"	12.68 (322)	100884319	
	3 3/8	6.0"	22.68 (576)	100884320	
	3 3/8	6.0"	42.68 (1084)	100884321	
	4 1/2	7.5"	13.98 (355)	100885323	
	4 1/2	7.5"	23.98 (609)	100885324	
	4 1/2	7.5"	43.98 (1117)	100885325	
	6	10.0"	23.31 (592)	100886315	
	6	10.0"	43.31 (1100)	100886316	

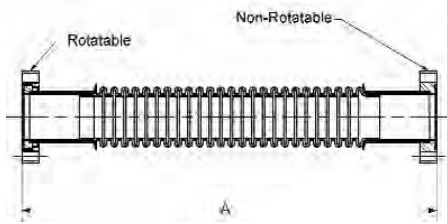
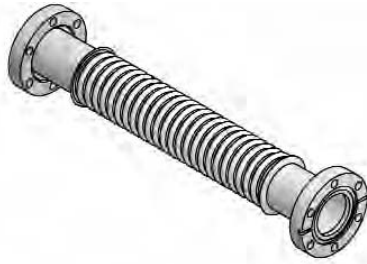
Bellows Section

in./(mm)

 	Flange Size	Static Bend Radius	A	B	Spring Rate (lb/in)	Part Number	Price
	<ul style="list-style-type: none"> Type 321 stainless steel Flexible coupling for vibrations and alignment Thru holes 	1 1/8	3.0 (76)	4.15 (105)	3.80 (97)	70	100881045
	2 1/8	4.0 (102)	3.41 (86)	3.20 (81)	58	100882028	
	2 3/4	5.5 (140)	4.15 (105)	3.20 (81)	61	100883047	
	3 3/8	8.0 (203)	4.29 (109)	3.20 (81)	58	100884025	
	4 1/2	13.0 (330)	6.12 (155)	4.90 (125)	66	100885030	
	4 5/8	13.0 (330)	5.92 (150)	4.90 (125)	66	100885536	
	6	21.0 (533)	6.24 (158)	4.90 (125)	80	100886019	
	8	24.0 (610)	8.25 (210)	7.25 (184)	168	100887037	
	10	38.0 (965)	10.25 (260)	9.25 (235)	282	100888040	

Thick Wall Metal Hose

in./ (mm)



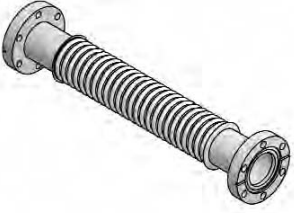
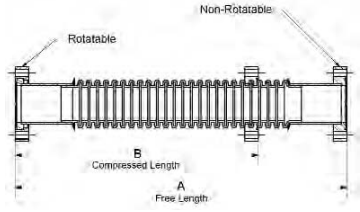
Flange Size	Static Bend Radius	A	Wall Thickness	Spring Rate (lb/in)	Part Number	Price
1 1/8	2.12 (54)	11.30 (287)	.015 (.381)	256	100881035	
1 1/8	2.12 (54)	21.20 (539)	.015 (.381)	128	100881036	
1 1/8	2.12 (54)	40.90 (1039)	.015 (.381)	64	100881037	
2 1/8	2.88 (73)	11.30 (287)	.015 (.381)	224	100882023	
2 1/8	2.88 (73)	22.10 (561)	.015 (.381)	112	100882024	
2 1/8	2.88 (73)	41.80 (1062)	.015 (.381)	56	100882025	
2 3/4	3.50 (89)	12.30 (312)	.015 (.381)	220	100883035	
2 3/4	3.50 (89)	22.20 (564)	.015 (.381)	110	100883036	
2 3/4	3.50 (89)	41.90 (1064)	.015 (.381)	55	100883037	
3 3/8	5.25 (133)	13.30 (378)	.015 (.381)	220	100884019	
3 3/8	5.25 (133)	23.20 (589)	.015 (.381)	110	100884020	
3 3/8	5.25 (133)	42.90 (1090)	.015 (.381)	55	100884021	
4 1/2	6.50 (165)	13.80 (350)	.018 (.457)	148	100885023	
4 1/2	6.50 (165)	23.70 (602)	.018 (.457)	74	100885024	
4 1/2	6.50 (165)	43.40 (1102)	.018 (.457)	37	100885025	
6	11.00 (280)	24.20 (615)	.018 (.457)	256	100886015	
6	11.00 (280)	43.90 (1115)	.018 (.457)	128	100886016	
8	17.00 (422)	24.20 (615)	.020 (.508)	352	100887018	
8	17.00 (422)	46.20 (1174)	.020 (.508)	176	100887019	
10	24.00 (610)	24.70 (627)	.018 (.457)	348	100888018	
10	24.00 (610)	44.40 (1128)	.018 (.457)	174	100888019	

- Type 321 stainless steel
- Flexible coupling for vibration and alignment
- Thru holes



Thin Wall Metal Hose

in./ (mm)

 	Flange Size	Static Bend Radius	A	B	Wall Thickness	Spring Rate (lb/in)	Part Number	Price
	<ul style="list-style-type: none"> Type 321 stainless steel Special lengths to order Both ends must be supported for the 4 1/2 and 6 inch sizes 	1 1/8	1.63 (41)	11.3 (287)	7.8 (198)	.006 (.152)	27	100881032
	1 1/8	1.63 (41)	21.2 (539)	13.8 (351)	.006 (.152)	12	100881033	
	1 1/8	1.63 (41)	40.9 (1039)	25.6 (650)	.006 (.152)	9	100881034	
	2 1/8	1.38 (35)	11.3 (287)	7.8 (198)	.006 (.152)	16	100882020	
	2 1/8	1.38 (35)	22.1 (561)	14.7 (373)	.006 (.152)	7	100882021	
	2 1/8	1.38 (35)	41.8 (1062)	26.5 (673)	.006 (.152)	3	100882022	
	2 3/4	2.50 (64)	12.3 (312)	8.7 (221)	.006 (.152)	9	100883032	
	2 3/4	2.50 (64)	22.1 (561)	14.1 (358)	.006 (.152)	4	100883033	
	2 3/4	2.50 (64)	41.9 (1064)	25.0 (635)	.006 (.152)	2	100883034	
	3 3/8	3.25 (83)	13.3 (338)	10.5 (267)	.006 (.152)	13	100884016	
	3 3/8	3.25 (83)	23.2 (589)	17.0 (432)	.006 (.152)	6	100884017	
	3 3/8	3.25 (83)	42.9 (1090)	29.8 (757)	.006 (.152)	3	100884018	
	4 1/2	6.75 (172)	13.8 (351)	9.1 (231)	.006 (.152)	15	100885020	
	4 1/2	6.75 (172)	23.7 (602)	16.2 (412)	.006 (.152)	7	100885021	
	4 1/2	6.75 (172)	43.4 (1102)	30.3 (770)	.006 (.152)	3	100885022	
	6	20.00 (508)	14.3 (363)	10.0 (254)	.008 (.203)	30	100886012	
	6	20.00 (508)	24.2 (615)	17.8 (452)	.008 (.203)	15	100886013	

Flange Protector Caps

Flange Size	Description	Part Number	Price
1 1/8	Flange protector cap, plastic	100003050	
2 1/8	Flange protector cap, plastic	100005285	
2 3/4	Flange protector cap, plastic	100003049	
3 3/8	Flange protector cap, plastic	100003048	

CF Hardware				
Flange Size	Description	Quantity	Part Number	Price
1 1/8	Bolt Set, Tapped, 8-32 x 0.56	25	100889029	
1 1/8	Bolt Set, Tapped, 8-32 x 0.62	25	100889030	
1 1/8	Bolt Set, Tapped, 8-32 x 0.75	25	100889031	
1 1/8	Bolt Set, Tapped, 8-32 x 0.50	25	100889032	
2 1/8, 2 3/4	Bolt Set, Tapped, 1/4-28 x 1.00	25	100889033	
3 3/8, 4 1/2, 4 5/8, 6	Bolt Set, Tapped, 5/16-24 x 1.25	25	100889035	
8, 10	Bolt Set, Tapped, 5/16-24 x 1.75	25	100889037	
1 1/8	Bolt/Nut Set, Thru, 8-32 x 0.75	25	100889047	
1 1/8	Bolt/Nut Set, Thru, 8-32 x 0.87	25	100889147	
1 1/8	Bolt/Nut Set, Thru, 8-32 x 0.75, Ag	25	100889048	
1 1/8	Bolt/Nut Set, Thru, 8-32 x 0.87, Ag	25	100889148	
2 1/8, 2 3/4	Bolt/Nut Set, Thru, 1/4-28 x 1.25	25	100889049	
2 1/8, 2 3/4	Bolt/Nut Set, Thru, 1/4-28 x 1.38	25	100889150	
3 3/8	Bolt/Nut Set, Thru, 5/16-24 x 1.75	25	100889051	
4 1/2	Bolt/Nut Set, Thru, 5/16-24 x 2.00	25	100889053	
4 5/8, 6, 8	Bolt/Nut Set, Thru, 5/16-24 x 2.25	25	100889055	
10	Bolt/Nut Set, Thru, 5/16-24 x 2.50	25	100889057	
1 1/8	Bolt/Nut Set, Double-Sided, 8-32 x 1.25	25	100889123	
1 1/8	Bolt/Nut Set, Double-Sided, 8-32 x 1.25, Ag	25	100889124	
2 1/8, 2 3/4	Bolt/Nut Set, Double-Sided, 1/4-28 x 1.75	25	100889125	
2 3/4	Bolt/Nut Set, Double-Sided, 1/4-28 x 2.00	25	100889126	
2 3/4	Bolt/Nut Set, Double-Sided, 1/4-28 x 2.50	25	100889153	
3 3/8	Bolt/Nut Set, Double-Sided, 5/16-24 x 2.50	25	100889130	
4 1/2	Bolt/Nut Set, Double-Sided, 5/16-24 x 2.75	25	100889127	
4 5/8, 6, 8	Bolt/Nut Set, Double-Sided, 5/16-24 x 3.00	25	100889128	
10	Bolt/Nut Set, Double-Sided, 5/16-24 x 3.50	25	100889129	
1 1/8	Viton Seal, Beveled Edge	5	100889020	
2 1/8	Viton Seal, Beveled Edge	5	100889021	
2 3/4	Viton Seal, Beveled Edge	5	100889022	
3 3/8	Viton Seal, Beveled Edge	5	100889023	
4 1/2	Viton Seal, Beveled Edge	5	100889024	
4 5/8	Viton Seal, Beveled Edge	5	100889025	
6	Viton Seal, Beveled Edge	5	100889026	
8	Viton Seal, Beveled Edge	5	100889027	
10	Viton Seal, Beveled Edge	5	100889028	



CF Hardware

Flange Size	Description	Quantity	Part Number	Price
1 1/8	Silver-Plated Copper Gasket	1	100889181	
2 1/8	Silver-Plated Copper Gasket	1	100889182	
2 3/4	Silver-Plated Copper Gasket	1	100889183	
3 3/8	Silver-Plated Copper Gasket	1	100889184	
4 1/2	Silver-Plated Copper Gasket	1	100889185	
4 5/8	Silver-Plated Copper Gasket	1	100889186	
6	Silver-Plated Copper Gasket	1	100889187	
8	Silver-Plated Copper Gasket	1	100889189	
10	Silver-Plated Copper Gasket	1	100889190	
1 1/8	Copper Gasket, Etched, Individually Sealed	10	100889103	
2 1/8	Copper Gasket, Etched, Individually Sealed	10	100889104	
2 3/4	Copper Gasket, Etched, Individually Sealed	10	100889105	
3 3/8	Copper Gasket, Etched, Individually Sealed	10	100889106	
4 1/2	Copper Gasket, Etched, Individually Sealed	10	100889107	
4 5/8	Copper Gasket, Etched, Individually Sealed	10	100889108	
6	Copper Gasket, Etched, Individually Sealed	10	100889109	
8	Copper Gasket, Etched, Individually Sealed	10	100889111	
10	Copper Gasket, Etched, Individually Sealed	10	100889112	

Plate Nut Sets

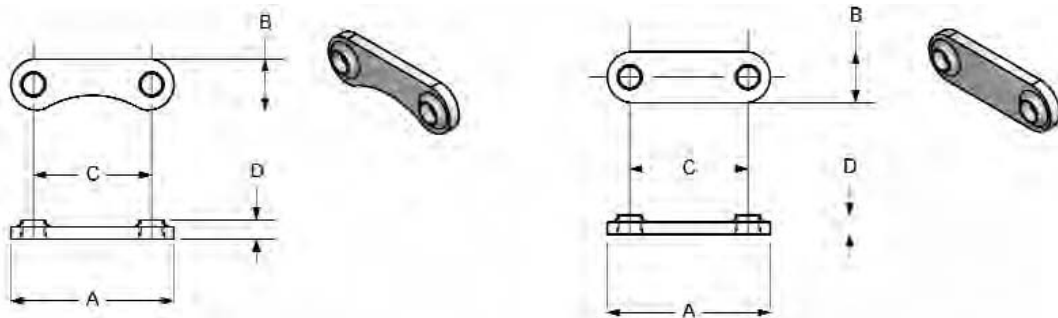


Plate Nuts (24 per package)

Flange Size	Thread Size	A	B	C	D	Part Number	Price
1 1/8	8-32	.80"	.30"	.53"	.15"	100889071	
2 3/4	1/4-28	1.41"	.50"	1.16"	.18"	100889072	
3 3/8	5/16 - 24	1.75"	.50"	1.09"	.22"	100889073	
4 1/2	5/16 - 24	2.03"	.50"	1.39"	.22"	100889074	
6	5/16 - 24	1.64"	.50"	1.00"	.22"	100889075	
8	5/16 - 24	1.75"	.50"	1.12"	.22"	100889076	

Plate Nut and Bolt Sets			
Flange Size	Description	Part Number	Price
1 1/3	Plate Nut/Bolt Set: 12 Plate Nuts, 24 Bolts/Washers, 8-32 x 0.75	100889077	
2 3/4	Plate Nut/Bolt Set: 12 Plate Nuts, 24 Bolts/Washers, 1/4-28 x 1.25	100889079	
3 3/8	Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24 x 1.75	100889081	
4 1/2	Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24 x 2.00	100889083	
6	Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24 x 2.25	100889085	
8	Plate Nut/Bolt Set: 20 Plate Nuts, 40 Bolts/Washers, 5/16-24 x 2.25	100889087	

Plate Nut and Dodecagon (12 pt) Silver Plated Bolt Sets			
Flange Size	Description	Part Number	Price
1 1/3	Dodecagon Plate Nut/Bolt Set: 12 Plate Nuts, 24 Bolts/Washers, 8-32 x 0.75	100889090	
2 3/4	Dodecagon Plate Nut/Bolt Set: 12 Plate Nuts, 24 Bolts/Washers, 1/4-28 x 1.25	100889092	
3 3/8	Dodecagon Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24 x 1.75	100889094	
4 1/2	Dodecagon Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24 x 2.00	100889096	
6	Dodecagon Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24 x 2.25	100889098	
8	Dodecagon Plate Nut/Bolt Set: 20 Plate Nuts, 40 Bolts/Washers, 5/16-24 x 2.25	100889100	

Dodecagon (12 pt) Bolts with Nuts and Washers			
Flange Sizes	Description	Part Number	Price
2 1/8, 2 3/4	Dodecagon Bolt/Nut/Washer Set, Silver Plated, Tapped, 1/4-28 x 1.00	100889042	
2 1/8, 2 3/4	Dodecagon Bolt/Nut/Washer Set, Silver Plated, Thru, 1/4-28 x 1.25	100889062	
2 1/8, 2 3/4	Dodecagon Bolt/Nut/Washer Set, Silver Plated, Thru, 1/4-28 x 1.38	100889151	
3 3/8, 4 1/2, 4 5/8, 6	Dodecagon Bolt/Nut/Washer Set, Silver Plated, Tapped, 5/16-24 x 1.25	100889044	
4 1/2	Dodecagon Bolt/Nut/Washer Set, Silver Plated, Thru, 5/16-24 x 2.00	100889066	
3 3/8	Dodecagon Bolt/Nut/Washer Set, Silver Plated, Thru, 5/16-24 x 1.75	100889064	
4 5/8, 6, 8	Dodecagon Bolt/Nut/Washer Set, Silver Plated, Thru, 5/16-24 x 2.25	100889068	
8, 10	Dodecagon Bolt/Nut/Washer Set, Silver Plated, Tapped, 5/16-24 x 1.75	100889046	
10	Dodecagon Bolt/Nut/Washer Set, Silver Plated, Thru, 5/16-24 x 2.50	100889070	



Numerical Listing

100003048	Flange Protector Cap, 3 3/8"	100881035	Thick Wall Metal Hose, 11.30", 1 1/3"
100003049	Flange Protector Cap, 2 3/4"	100881036	Thick Wall Metal Hose, 21.20", 1 1/3"
100003050	Flange Protector Cap, 1 1/3"	100881037	Thick Wall Metal Hose, 40.90", 1 1/3"
100005285	Flange Protector Cap, 2 1/8"		
		100881038	Double Sided Flange, 1 1/3", Blank
100315601	Adapter, ISO-KF to CF, NW 16 to 1-1/3" CF	100881039	Double Sided Flange, 1 1/3", 0.26"
100315603	Adapter, ISO-KF to CF, NW 25 to 2-3/4" CF	100881040	Double Sided Flange, 1 1/3", 0.38"
100315605	Adapter, ISO-KF to CF, NW 40 to 2-3/4" CF	100881041	Double Sided Flange, 1 1/3", 0.51"
100315606	Adapter, ISO-KF to CF, NW 50 to 4-1/2" CF	100881042	Double Sided Flange, 1 1/3", 0.6"
100315611	Adapter, ISO-KF to CF, NW 16 to 2-3/4" CF	100881043	Double Sided Flange, 1 1/3", Blank
100319812	Adapter, ISO-KF to CF, NW 25 to 2 1/8" CF	100881044	Double Sided Flange, 1 1/3", 0.63"
100319813	Adapter, ISO-KF to CF, NW 50 to 2 3/4" CF		
		100881045	Bellows Section, 1 1/3"
100762206	Adapter, MF to CF, NW 63 to 4.5" CF	100881046	Half Nipple, 1 1/3", .75"
100762208	Adapter, MF to CF, NW 80 to 6" CF	100881047	Full Nipple, 1 1/3", 0.75"
100762210	Adapter, MF to CF, NW 100 to 6" CF		
100762216	Adapter, MF to CF, NW 160 to 8" CF	100881048	Adapter, CF to Pyrex, 1 1/3"
100762220	Adapter, MF to CF, NW 200 to 10" CF	100881049	Adapter, 1 1/3" to 4 VCR®-F
		100881050	Adapter, 1 1/3" to 4 VCR®-M
100881000	Flange, 1 1/3", Blank, Nonrotatable		
100881001	Weld Stub, 1 1/3", w/ wp, Blank, Nonrotatable, Thru	100881051	Viewing Port, 1 1/3"
100881002	Weld Stub, 1 1/3", w/ wp, .25", Nonrotatable, Thru	100881052	45° Elbow, 1 1/3"
100881003	Weld Stub, 1 1/3", w/ wp, .50", Nonrotatable, Thru		
100881004	Flange, 1 1/3", 0.75", Nonrotatable, Thru	100881335	Braided Metal Hose, 11.48", 1 1/3"
100881005	Weld Stub, 1 1/3", w/ wp, .75", Nonrotatable, Thru	100881336	Braided Metal Hose, 21.48", 1 1/3"
100881006	Weld Stub, 1 1/3", w/o wp, .75", Nonrotatable, Thru	100881337	Braided Metal Hose, 41.48", 1 1/3"
100881007	Flange, 1 1/3", Blank, Nonrotatable, Tapped		
100881008	Weld Stub, 1 1/3", w/ wp, Blank, Nonrotatable, Tapped	100882000	Flange, 2 1/8", Blank, Nonrotatable, Thru
100881009	Weld Stub, 1 1/3", w/ wp, .25", Nonrotatable, Tapped	100882001	Flange, 2 1/8", 0.25", Nonrotatable, Thru
100881010	Weld Stub, 1 1/3", w/ wp, .50", Nonrotatable, Tapped	100882002	Flange, 2 1/8", 0.50", Nonrotatable, Thru
100881011	Flange, 1 1/3", 0.75", Nonrotatable, Tapped	100882003	Flange, 2 1/8", 0.75", Nonrotatable, Thru
100881012	Weld Stub, 1 1/3", w/ wp, .75", Nonrotatable, Tapped	100882004	Flange, 2 1/8", 1.00", Nonrotatable, Thru
100881013	Weld Stub, 1 1/3", w/o wp, .75", Nonrotatable, Tapped	100882005	Flange, 2 1/8", Blank, Nonrotatable, Tapped
		100882006	Flange, 2 1/8", 0.25", Nonrotatable, Tapped
100881014	Flange, 1 1/3", Blank, Rotatable, Thru	100882007	Flange, 2 1/8", 0.50", Nonrotatable, Tapped
100881015	Weld Stub, 1 1/3", w/ wp, Blank, Rotatable, Thru	100882008	Flange, 2 1/8", 0.75", Nonrotatable, Tapped
100881016	Weld Stub, 1 1/3", w/ wp, .25", Rotatable, Thru	100882009	Flange, 2 1/8", 1.00", Nonrotatable, Tapped
100881017	Weld Stub, 1 1/3", w/ wp, .50", Rotatable, Thru	100882010	Flange, 2 1/8", Blank, Rotatable, Thru
100881018	Flange, 1 1/3", 0.75", Rotatable, Thru	100882011	Flange, 2 1/8", 0.25", Rotatable, Thru
100881019	Weld Stub, 1 1/3", w/ wp, .75", Rotatable, Thru	100882012	Flange, 2 1/8", 0.50", Rotatable, Thru
100881020	Weld Stub, 1 1/3", w/o wp, .75", Rotatable, Thru	100882013	Flange, 2 1/8", 0.75", Rotatable, Thru
100881021	Flange, 1 1/3", Blank, Rotatable, Tapped	100882014	Flange, 2 1/8", 1.00", Rotatable, Thru
100881022	Weld Stub, 1 1/3", w/ wp, Blank, Rotatable, Tapped	100882015	Flange, 2 1/8", Blank, Rotatable, Tapped
100881023	Weld Stub, 1 1/3", w/ wp, .25", Rotatable, Tapped	100882016	Flange, 2 1/8", 0.25", Rotatable, Tapped
100881024	Weld Stub, 1 1/3", w/ wp, .50", Rotatable, Tapped	100882017	Flange, 2 1/8", 0.50", Rotatable, Tapped
100881025	Flange, 1 1/3", 0.75", Rotatable, Tapped	100882018	Flange, 2 1/8", 0.75", Rotatable, Tapped
100881026	Weld Stub, 1 1/3", w/ wp, .75", Rotatable, Tapped	100882019	Flange, 2 1/8", 1.00", Rotatable, Tapped
100881027	Weld Stub, 1 1/3", w/o wp, .75", Rotatable, Tapped		
		100882020	Thin Wall Metal Hose, 1.38", 2 1/8"
100881028	Tee, 1 1/3"	100882021	Thin Wall Metal Hose, 1.38", 2 1/8"
100881029	Cross, 1 1/3"	100882022	Thin Wall Metal Hose, 1.38", 2 1/8"
100881030	90° Elbow, 1 1/3"		
		100882023	Thick Wall Metal Hose, 40.90", 2 1/8"
100881032	Thin Wall Metal Hose, 1.63", 1 1/3"	100882024	Thick Wall Metal Hose, 22.10", 2 1/8"
100881033	Thin Wall Metal Hose, 1.63", 1 1/3"	100882025	Thick Wall Metal Hose, 41.80", 2 1/8"
100881034	Thin Wall Metal Hose, 1.63", 1 1/3"		

100882026	Double Sided Flange, 2 1/8", Blank	100883029	Cross, 2 3/4"
100882027	Double Sided Flange, 2 1/8", 1.01"	100883030	90° Elbow, 2 3/4"
100882028	Bellows Section, 2 1/8"	100883032	Thin Wall Metal Hose, 2.50", 2 3/4"
100882029	Reducer, 2 1/8" to 1 1/3"	100883033	Thin Wall Metal Hose, 2.50", 2 3/4"
100882030	Adapter, CF to Pyrex, 2 1/8"	100883034	Thin Wall Metal Hose, 2.50", 2 3/4"
100882031	Adapter, 2 1/8" to 4 VCR®-M	100883035	Thick Wall Metal Hose, 12.30", 2 3/4"
100882032	Adapter, 2 1/8" to 4 VCR®-F	100883036	Thick Wall Metal Hose, 22.20", 2 3/4"
100882033	Adapter, 2 1/8" to 8 VCR®-F	100883037	Thick Wall Metal Hose, 41.90", 2 3/4"
100882034	Adapter, 2 1/8" to 8 VCR®-M	100883038	Double Sided Flange, 2 3/4", Blank
100882035	Adapter, 2 1/8" to 12 VCR®-M	100883039	Double Sided Flange, 2 3/4", 0.26"
100882036	Adapter, 2 1/8" to 12 VCR®-F	100883040	Double Sided Flange, 2 3/4", 0.51"
100882037	Viewing Port, 2 1/8"	100883041	Double Sided Flange, 2 3/4", 0.76"
100882038	45° Elbow, 2 1/8"	100883042	Double Sided Flange, 2 3/4", 1.01"
100882039	90° Elbow, 2 1/8"	100883043	Double Sided Flange, 2 3/4", 1.26"
100882040	Half Nipple, 2 1/8", 1.00"	100883044	Double Sided Flange, 2 3/4", 1.51"
100882041	Full Nipple, 2 1/8", 1.00"	100883045	Double Sided Flange, 2 3/4", Blank
100882042	Tee, 2 1/8"	100883046	Double Sided Flange, 2 3/4", 1.51"
100882043	Cross, 2 1/8"	100883047	Bellows Section, 2 3/4"
100882323	Braided Metal Hose, 12.31", 2 1/8"	100883048	Reducer, 2 3/4" to 1 1/3"
100882324	Braided Metal Hose, 22.31", 2 1/8"	100883049	Half Nipple, 2 3/4", 1.50"
100882325	Braided Metal Hose, 42.31", 2 1/8"	100883050	Full Nipple, 2 3/4", 1.50"
100883000	Flange, 2 3/4", Blank, Nonrotatable, Thru	100883051	Adapter, Ball Socket w/ O-ring groove
100883001	Flange, 2 3/4", 0.25", Nonrotatable, Thru	100883052	Adapter, Ball Socket w/o O-ring groove
100883002	Flange, 2 3/4", 0.50", Nonrotatable, Thru	100883053	Adapter, CF to Pyrex, 2 3/4"
100883003	Flange, 2 3/4", 0.75", Nonrotatable, Thru	100883054	Adapter, 2 3/4" to 4 VCR®-F
100883004	Flange, 2 3/4", 1.00", Nonrotatable, Thru	100883055	Adapter, 2 3/4" to 4 VCR®-M
100883005	Flange, 2 3/4", 1.25", Nonrotatable, Thru	100883056	Adapter, 2 3/4" to 8 VCR®-M
100883006	Flange, 2 3/4", 1.50", Nonrotatable, Thru	100883057	Adapter, 2 3/4" to 8 VCR®-F
100883007	Flange, 2 3/4", Blank, Nonrotatable, Tapped	100883058	Adapter, 2 3/4" to 12 VCR®-F
100883008	Flange, 2 3/4", 0.25", Nonrotatable, Tapped	100883059	Adapter, 2 3/4" to 12 VCR®-M
100883009	Flange, 2 3/4", 0.50", Nonrotatable, Tapped	100883060	Viewing Port, 2 3/4"
100883010	Flange, 2 3/4", 0.75", Nonrotatable, Tapped	100883061	45° Elbow, 2 3/4"
100883011	Flange, 2 3/4", 1.00", Nonrotatable, Tapped	100883064	Flange, 2 3/4", 1.75", Nonrotatable, Thru
100883012	Flange, 2 3/4", 1.25", Nonrotatable, Tapped	100883065	Flange, 2 3/4", 1.75", Rotatable, Thru
100883013	Flange, 2 3/4", 1.50", Nonrotatable, Tapped	100883066	Flange, 2 3/4", 1.75", Nonrotatable, Tapped
100883014	Flange, 2 3/4", Blank, Rotatable, Thru	100883067	Flange, 2 3/4", 1.75", Rotatable, Tapped
100883015	Flange, 2 3/4", 0.25", Rotatable, Thru	100883069	Full Nipple w/ Screen, 2 3/4", 1.50"
100883016	Flange, 2 3/4", 0.50", Rotatable, Thru	100883149	Reducer, 2 3/4" to 2 1/8"
100883017	Flange, 2 3/4", 0.75", Rotatable, Thru	100883335	Braided Metal Hose, 12.40", 2 3/4"
100883018	Flange, 2 3/4", 1.00", Rotatable, Thru	100883336	Braided Metal Hose, 22.40", 2 3/4"
100883019	Flange, 2 3/4", 1.25", Rotatable, Thru	100883337	Braided Metal Hose, 42.40", 2 3/4"
100883020	Flange, 2 3/4", 1.50", Rotatable, Thru	100884000	Flange, 3 3/8", Blank, Nonrotatable, Thru
100883021	Flange, 2 3/4", Blank, Rotatable, Tapped	100884001	Flange, 3 3/8", 1.50", Nonrotatable, Thru
100883022	Flange, 2 3/4", 0.25", Rotatable, Tapped	100884002	Flange, 3 3/8", 2.00", Nonrotatable, Thru
100883023	Flange, 2 3/4", 0.50", Rotatable, Tapped	100884003	Flange, 3 3/8", Blank, Nonrotatable, Tapped
100883024	Flange, 2 3/4", 0.75", Rotatable, Tapped	100884004	Flange, 3 3/8", 1.50", Nonrotatable, Tapped
100883025	Flange, 2 3/4", 1.00", Rotatable, Tapped	100884005	Flange, 3 3/8", 2.00", Nonrotatable, Tapped
100883026	Flange, 2 3/4", 1.25", Rotatable, Tapped	100884006	Flange, 3 3/8", Blank, Rotatable, Thru
100883027	Flange, 2 3/4", 1.50", Rotatable, Tapped		
100883028	Tee, 2 3/4"		



100884007	Flange, 3 3/8", 1.50", Rotatable, Thru	100885011	Flange, 4 1/2", 2.50", Rotatable, Thru
100884008	Flange, 3 3/8", 2.00", Rotatable, Thru	100885012	Flange, 4 1/2", Blank, Rotatable, Tapped
100884009	Flange, 3 3/8", Blank, Rotatable, Tapped	100885013	Flange, 4 1/2", 1.50", Rotatable, Tapped
100884010	Flange, 3 3/8", 1.50", Rotatable, Tapped	100885014	Flange, 4 1/2", 2.00", Rotatable, Tapped
100884011	Flange, 3 3/8", 2.00", Rotatable, Tapped	100885015	Flange, 4 1/2", 2.50", Rotatable, Tapped
100884012	Tee, 3 3/8"	100885016	Tee, 4 1/2"
100884013	Cross, 3 3/8"	100885017	Cross, 4 1/2"
100884014	90° Elbow, 3 3/8"	100885018	90° Elbow, 4 1/2"
100884016	Thin Wall Metal Hose, 3.25", 3 3/8"	100885020	Thin Wall Metal Hose, 6.75", 4 1/2"
100884017	Thin Wall Metal Hose, 3.25", 3 3/8"	100885021	Thin Wall Metal Hose, 6.75", 4 1/2"
100884018	Thin Wall Metal Hose, 3.25", 3 3/8"	100885022	Thin Wall Metal Hose, 6.75", 4 1/2"
100884019	Thick Wall Metal Hose, 13.30", 3 3/8"	100885023	Thick Wall Metal Hose, 13.80", 4 1/2"
100884020	Thick Wall Metal Hose, 23.20", 3 3/8"	100885024	Thick Wall Metal Hose, 23.70", 4 1/2"
100884021	Thick Wall Metal Hose, 42.90", 3 3/8"	100885025	Thick Wall Metal Hose, 43.40", 4 1/2"
100884022	Double Sided Flange, 3 3/8", Blank	100885026	Double Sided Flange, 4 1/2", Blank
100884023	Double Sided Flange, 3 3/8", 1.51"	100885027	Double Sided Flange, 4 1/2", 1.51"
100884024	Double Sided Flange, 3 3/8", 2.00"	100885028	Double Sided Flange, 4 1/2", 2.00"
100884025	Bellows Section, 3 3/8"	100885029	Double Sided Flange, 4 1/2", 2.51"
100884026	Reducer, 3 3/8" to 2 3/4"	100885030	Bellows Section, 4 1/2"
100884027	Half Nipple, 3 3/8", 2.00"	100885031	Reducer, 4 1/2" to 3 3/8"
100884028	Full Nipple, 3 3/8", 2.00"	100885032	Half Nipple, 4 1/2", 2.50"
100884029	Adapter, Ball Socket w/ O-ring groove	100885033	Full Nipple, 4 1/2", 2.50"
100884030	Adapter, Ball Socket w/o O-ring groove	100885034	Reducer, 4 1/2" to 2 3/4"
100884031	Adapter, CF to Pyrex, 3 3/8"	100885035	Adapter, CF to Pyrex, 4 1/2"
100884032	Adapter, 3 3/8" to 4 VCR [®] -M	100885036	Viewing Port, 4 1/2"
100884033	Adapter, 3 3/8" to 4 VCR [®] -F	100885037	45° Elbow, 4 1/2"
100884034	Adapter, 3 3/8" to 8 VCR [®] -M	100885132	Reducer, 4 1/2" to 1 1/3"
100884035	Adapter, 3 3/8" to 8 VCR [®] -F	100885133	Reducer, 4 1/2" to 2 1/8"
100884036	Adapter, 3 3/8" to 12 VCR [®] -M	100885323	Braided Metal Hose, 13.98", 4 1/2"
100884037	Adapter, 3 3/8" to 12 VCR [®] -F	100885324	Braided Metal Hose, 23.98", 4 1/2"
100884038	Viewing Port, 3 3/8"	100885325	Braided Metal Hose, 43.98", 4 1/2"
100884039	45° Elbow, 3 3/8"	100885500	Flange, 4 5/8", Blank, Nonrotatable, Thru
100884124	Reducer, 3 3/8" to 1 1/3"	100885501	Flange, 4 5/8", 3.00", Nonrotatable, Thru
100884125	Reducer, 3 3/8" to 2 1/8"	100885502	Flange, 4 5/8", Blank, Nonrotatable, Tapped
100884319	Braided Metal Hose, 12.68", 3 3/8"	100885503	Flange, 4 5/8", 3.00", Nonrotatable, Tapped
100884320	Braided Metal Hose, 22.68", 3 3/8"	100885504	Flange, 4 5/8", Blank, Rotatable, Thru
100884321	Braided Metal Hose, 42.68", 3 3/8"	100885505	Flange, 4 5/8", 3.00", Rotatable, Thru
100885000	Flange, 4 1/2", Blank, Nonrotatable, Thru	100885506	Flange, 4 5/8", Blank, Rotatable, Tapped
100885001	Flange, 4 1/2", 1.50", Nonrotatable, Thru	100885507	Flange, 4 5/8", 3.00", Rotatable, Tapped
100885002	Flange, 4 1/2", 2.00", Nonrotatable, Thru	100885508	Double Sided Flange, 4 5/8", Blank
100885003	Flange, 4 1/2", 2.50", Nonrotatable, Thru	100885509	Double Sided Flange, 4 5/8", 3.00"
100885004	Flange, 4 1/2", Blank, Nonrotatable, Tapped	100885510	Reducer, 4 5/8" to 1 1/3"
100885005	Flange, 4 1/2", 1.50", Nonrotatable, Tapped	100885511	Reducer, 4 5/8" to 2 1/8"
100885006	Flange, 4 1/2", 2.00", Nonrotatable, Tapped	100885512	Reducer, 4 5/8" to 2 3/4"
100885007	Flange, 4 1/2", 2.50", Nonrotatable, Tapped	100885513	Reducer, 4 5/8" to 3 3/8"
100885008	Flange, 4 1/2", Blank, Rotatable, Thru	100885528	45° Elbow, 4 5/8"
100885009	Flange, 4 1/2", 1.50", Rotatable, Thru		
100885010	Flange, 4 1/2", 2.00", Rotatable, Thru		

100885529	90° Elbow, 4 5/8"	100887011	Cross, 8"
100885530	Viewing Port, 4 5/8"	100887012	90° Elbow, 8"
100885531	Half Nipple, 4 5/8", 3.00"	100887014	Double Sided Flange, 8", Blank
100885532	Full Nipple 4 5/8", 3.00"	100887015	Double Sided Flange, 8", 6.02"
100885533	Tee, 4 5/8"	100887016	Half Nipple, 8", 6.00"
100885534	Cross, 4 5/8"	100887017	Full Nipple, 8", 6.00"
100885536	Bellows Section, 4 5/8"	100887018	Thick Wall Metal Hose, 24.20", 8"
100886000	Flange, 6", Blank, Nonrotatable, Thru	100887019	Thick Wall Metal Hose, 46.20", 8"
100886001	Flange, 6", 4.00", Nonrotatable, Thru	100887020	Reducer, 8" to 2 3/4"
100886002	Flange, 6", Blank, Nonrotatable, Tapped	100887021	Adapter, CF to Pyrex, 8"
100886003	Flange, 6", 4.00", Nonrotatable, Tapped	100887022	Viewing Port, 8"
100886004	Flange, 6", Blank, Rotatable, Thru	100887023	45° Elbow, 8"
100886005	Flange, 6", 4.00", Rotatable, Thru	100887037	Bellows Section, 8"
100886006	Flange, 6", Blank, Rotatable, Tapped	100887118	Reducer, 8" to 1 1/3"
100886007	Flange, 6", 4.00", Rotatable, Tapped	100887119	Reducer, 8" to 2 1/8"
100886008	Tee, 6"	100887121	Reducer, 8" to 3 3/8"
100886009	Cross, 6"	100887122	Reducer, 8" to 4 1/2"
100886010	90° Elbow, 6"	100887123	Reducer, 8" to 4 5/8"
100886012	Thin Wall Metal Hose, 20.00", 6"	100887124	Reducer, 8" to 6"
100886013	Thin Wall Metal Hose, 20.00", 6"	100888000	Flange, 10", Blank, Nonrotatable, Thru
100886015	Thick Wall Metal Hose, 24.20", 6"	100888001	Flange, 10", 8.00", Nonrotatable, Thru
100886016	Thick Wall Metal Hose, 43.90", 6"	100888002	Flange, 10", Blank, Nonrotatable, Tapped
100886017	Double Sided Flange, 6", Blank	100888003	Flange, 10", 8.00", Nonrotatable, Tapped
100886018	Double Sided Flange, 6", 4.10"	100888004	Flange, 10", Blank, Rotatable, Thru
100886019	Bellows Section, 6"	100888005	Flange, 10", 8.00", Rotatable, Thru
100886020	Half Nipple, 6", 4.00"	100888006	Flange, 10", Blank, Rotatable, Tapped
100886021	Full Nipple, 6", 4.00"	100888007	Flange, 10", 8.00", Rotatable, Tapped
100886022	Reducer, 6" to 2 3/4"	100888008	Tee, 10"
100886023	Adapter, CF to Pyrex, 6"	100888010	Cross, 10"
100886024	Viewing Port, 6"	100888012	90° Elbow, 10"
100886025	45° Elbow, 6"	100888014	Double Sided Flange, 10", Blank
100886120	Reducer, 6" to 1 1/3"	100888015	Double Sided Flange, 10", 8.00"
100886121	Reducer, 6" to 2 1/8"	100888016	Half Nipple, 10", 8.00"
100886123	Reducer, 6" to 3 3/8"	100888017	Full Nipple, 10", 8.00"
100886124	Reducer, 6" to 4 1/2"	100888018	Thick Wall Metal Hose, 24.70", 10"
100886125	Reducer, 6" to 4 5/8"	100888019	Thick Wall Metal Hose, 44.40", 10"
100886315	Braided Metal Hose, 43.31", 6"	100888020	45° Elbow, 10"
100886316	Braided Metal Hose, 23.31", 6"	100888039	Viewing Port, 10"
100887000	Flange, 8", Blank, Nonrotatable, Thru	100888040	Bellows Section, 10"
100887001	Flange, 8", 6.00", Nonrotatable, Thru	100888130	Reducer, 10" to 1 1/3"
100887002	Flange, 8", Blank, Nonrotatable, Tapped	100888131	Reducer, 10" to 2 1/8"
100887003	Flange, 8", 6.00", Nonrotatable, Tapped	100888132	Reducer, 10" to 2 3/4"
100887004	Flange, 8", Blank, Rotatable, Thru	100888133	Reducer, 10" to 3 3/8"
100887005	Flange, 8", 6.00", Rotatable, Thru	100888134	Reducer, 10 to 4 1/2"
100887006	Flange, 8", Blank, Rotatable, Tapped	100888135	Reducer, 10" to 4 5/8"
100887007	Flange, 8", 6.00", Rotatable, Tapped	100888136	Reducer, 10" to 6"
100887009	Tee, 8"	100888137	Reducer, 10" to 8"



100889020	Viton Seal, Beveled Edge (5), 1 1/3"	100889083	Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24x2.00, 4 1/2"
100889021	Viton Seal, Beveled Edge (5), 2 1/8"	100889085	Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24x2.25, 6"
100889022	Viton Seal, Beveled Edge (5), 2 3/4"	100889087	Plate Nut/Bolt Set: 20 Plate Nuts, 40 Bolts/Washers, 5/16-24x 2.25, 8"
100889023	Viton Seal, Beveled Edge (5), 3 3/8"	100889090	Dodecagon Plate Nut/Bolt Set: 12 Plate Nuts, 24 Bolts/Washers, 8-32x0.75, 1 1/3"
100889024	Viton Seal, Beveled Edge (5), 4 1/2"	100889092	Dodecagon Plate Nut/Bolt Set: 12 Plate Nuts, 24 Bolts/Washers, 1/4-28x1.25, 2 3/4"
100889025	Viton Seal, Beveled Edge (5), 4 5/8"	100889094	Dodecagon Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24x1.75, 3 3/8"
100889026	Viton Seal, Beveled Edge (5), 6"	100889096	Dodecagon Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24x2.00, 4 1/2"
100889027	Viton Seal, Beveled Edge (5), 8"	100889098	Dodecagon Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24x2.25, 6"
100889028	Viton Seal, Beveled Edge (5), 10"	100889100	Dodecagon Plate Nut/Bolt Set: 20 Plate Nuts, 40 Bolts/Washers, 5/16-24x2.25, 8"
100889029	Bolt Set, Tapped, 8-32x0.56, 1 1/3"	100889103	Copper Gasket, Etched, 1 1/3"
100889030	Bolt Set, Tapped, 8-32x0.62, 1 1/3"	100889104	Copper Gasket, Etched, 2 1/8"
100889031	Bolt Set, Tapped, 8-32x0.75, 1 1/3"	100889105	Copper Gasket, Etched, 2 3/4"
100889032	Bolt Set, Tapped, 8-32x0.50, 1 1/3"	100889106	Copper Gasket, Etched, 3 3/8"
100889033	Bolt Set, Tapped, 1/4-28x1.00, 2 1/8", 2 3/4"	100889107	Copper Gasket, Etched, 4 1/2"
100889035	Bolt Set, Tapped, 5/16-24x1.25, 3 3/8", 4 1/2", 4 5/8" 6"	100889108	Copper Gasket, Etched, 4 5/8"
100889037	Bolt Set, Tapped, 5/16-24x1.75, 8", 10"	100889109	Copper Gasket, Etched, 6"
100889042	Dodecagon Bolt/Nut/Washer Set, Tapped, 1/4-28x1.00, 2 1/8", 2 3/4"	100889111	Copper Gasket, Etched, 8"
100889044	Dodecagon Bolt/Nut/Washer Set, Tapped, 5/16-24x1.75, 3 3/8", 4 1/2", 4 5/8", 6"	100889112	Copper Gasket, Etched, 10"
100889046	Dodecagon Bolt/Nut/Washer Set, Tapped, 5/16-24x1.75, 8", 10"	100889123	Bolt/Nut Set, Double-Sided, 8-32x1.25, 1 1/3"
100889047	Bolt/Nut Set, Thru, 8-32x0.75, 1 1/3"	100889124	Bolt/Nut Set, Double-Sided, 8-32x1.25, 1 1/3"
100889048	Bolt/Nut Set, Thru, 8-32x0.75, 1 1/3"	100889125	Bolt/Nut Set, Double-Sided, 1/4-28x1.75, 2 1/8", 2 3/4"
100889049	Bolt/Nut Set, Thru, 1/4-28x1.25, 2 1/8", 2 3/4"	100889126	Bolt/Nut Set, Double-Sided, 1/4-28x2.00, 2 3/4"
100889051	Bolt/Nut Set, Thru, 5/16-24x1.75, 3 3/8"	100889127	Bolt/Nut Set, Double-Sided, 5/16-24x2.75, 4 1/2"
100889053	Bolt/Nut Set, Thru, 5/16-24x 2.00, 4 1/2"	100889128	Bolt/Nut Set, Double-Sided, 5/16-24x3.00, 4 5/8", 6", 8"
100889055	Bolt/Nut Set, Thru, 5/16-24x2.25, 4 5/8", 6", 8"	100889129	Bolt/Nut Set, Double-Sided, 5/16-24x3.50, 10"
100889057	Bolt/Nut Set, Thru, 5/16-24x2.50, 10"	100889130	Bolt/Nut Set, Double-Sided, 5/16-24x2.50, 3 3/8"
100889062	Dodecagon Bolt/Nut/Washer Set, Thru, 1/4-28x1.25, 2 1/8", 2 3/4"	100889147	Bolt/Nut Set, Thru, 8-32x0.87, 1 1/3"
100889064	Dodecagon Bolt/Nut/Washer Set, Thru, 5/16-24x1.75, 3 3/8"	100889148	Bolt/Nut Set, Thru, 8-32x0.87, 1 1/3"
100889066	Dodecagon Bolt/Nut/Washer Set, Thru, 5/16-24x2.00, 4 1/2"	100889150	Bolt/Nut Set, Thru, 1/4-28x1.38, 2 1/8", 2 3/4"
100889068	Dodecagon Bolt/Nut/Washer Set, Thru, 5/16-24x2.25, 4 5/8", 6", 8"	100889151	Dodecagon Bolt/Nut/Washer Set, Thru, 1/4-28x1.38, 2 1/8", 2 3/4"
100889070	Dodecagon Bolt/Nut/Washer Set, Thru, 5/16-24x2.50, 10"	100889153	Bolt/Nut Set, Double-Sided, 1/4-28x2.50, 2 3/4"
100889071	Plate Nut Set, 8-32, 1 1/3"	100889181	Silver-Plated Copper Gasket (1), 1 1/3"
100889072	Plate Nut Set, 1/4-28, 2 3/4"	100889182	Silver-Plated Copper Gasket (1), 2 1/8"
100889073	Plate Nut Set, 5/16-24, 3 3/8"	100889183	Silver-Plated Copper Gasket (1), 2 3/4"
100889074	Plate Nut Set, 5/16-24, 4 1/2"	100889184	Silver-Plated Copper Gasket (1), 3 3/8"
100889075	Plate Nut Set, 5/16-24, 6"	100889185	Silver-Plated Copper Gasket (1), 4 1/2"
100889076	Plate Nut Set, 5/16-24, 8"	100889186	Silver-Plated Copper Gasket (1), 4 5/8"
100889077	Plate Nut/Bolt Set: 12 Plate Nuts, 24 Bolts/Washers, 8-32x0.75, 1 1/3"	100889187	Silver-Plated Copper Gasket (1), 6"
100889079	Plate Nut/Bolt Set: 12 Plate Nuts, 24 Bolts/Washers, 1/4-28x1.25, 2 3/4"	100889189	Silver-Plated Copper Gasket (1), 8"
100889081	Plate Nut/Bolt Set: 16 Plate Nuts, 32 Bolts/Washers, 5/16-24x1.75, 3 3/8"	100889190	Silver-Plated Copper Gasket (1), 10"



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