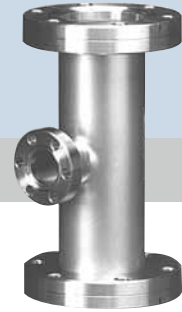


Flanges & Fittings

Section Two



2.1 Chain Clamp Components & Hardware

2.2 NW Flanges & Fittings

2.3 ISO Flanges & Fittings

2.4 ASA Flanges & Fittings

2.5 CF Flanges & Fittings

2

2.6 Wire Seal Flanges

2.7 Adapter Fittings

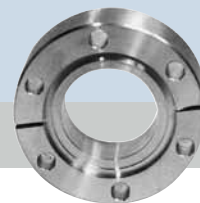
2.8 Flexible Hoses & Couplings

2.9 Weld Fittings

Nor-Cal Products, Inc.
1967 South Oregon Street
Yreka, CA 96097 USA

Tel: **800-824-4166**
or 530-842-4457
Main Fax: 530-842-9130
Sales Fax: 530-841-9189
www.n-c.com

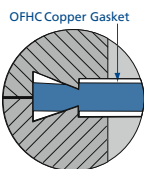




Nor-Cal CF flanges are compatible with other Conflat style flanges and are available in sizes from 1 1/3 to 16 1/2 inch OD for 1/4 to 14 inch tube diameters. Normally our standard material is in the low carbon range for 304. Flanges are made from 304 that has been specially treated to remove impurities inherent in 300 series steels. Special UHV-flanges 4 1/2 inches OD and smaller can be made from 304 electroslag remelt (ESR) bar stock. ESR is a refining process that produces stainless steel with higher purity, fewer inclusions and more uniform grain structure to eliminate microscopic leak paths. Our standard flange material is certified to meet ASTM A-240 and has less than 0.01% sulfur to prevent sulfur stringers. Grain size is 3 to 6 per ASTM E-112. Maximum inclusion size is 2.5 per ASTM E-45. As specials, 304L and 316L material can be supplied in roll-forged rings.

Machining is consistent with good UHV practice. Machine coolant is sulfur free to reduce outgassing. State-of-the-art CNC machine centers are used to produce flanges with consistent high quality. Flanges are machine washed in approved aqueous detergent after machining. Chem-cleaning and clean room packaging are available.

CF flanges utilize an OFHC copper gasket to produce a vacuum tight seal up to 10^{-13} Torr, even when baked repeatedly to 450°C. When the copper gasket is compressed between the knife edges of CF flanges, its material flows laterally to fill surface imperfections.



Nor-Cal offers CF flanges in rotatable as well as nonrotatable versions. (Refer to diagram on page 48.) When components of several systems are used interchangeably, the use of rotatable flanges is recommended. Assembly is facilitated by rotating the receiver portion of the flange to align its bolt holes with those of the mating flange. The insert is welded to the tube or component and contains the knife edge portion of the CF flange.

Nonrotatable CF flanges, unlike rotatable, contain both sealing surface and bolt holes in one unit. This makes the nonrotatable flange less expensive, and therefore the preferred choice when mating component orientation is not a concern. All fittings are priced with a rotatable flange opposing a nonrotatable. For fittings with all nonrotatable flanges subtract the difference in price between a rotatable and nonrotatable flange of the desired size multiplied by the number of additional nonrotatable flanges.



SPECIFICATIONS

General: Rotatable or nonrotatable with tapped or clearance bolt holes

Nominal OD sizes: 1 1/3 to 16 1/2 inches

Tube OD sizes: 1/4 to 14 inches

Materials

Flange: 304 stainless steel
(316L available on request)

Gaskets: Viton, copper or silver plated

Bolts: 18-8 stainless steel or silver plated

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV

Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature range

Metal seal: -200°C to 450°C

Elastomer seal: -20°C to 150°C

New Products



Metric Flanges and Hardware

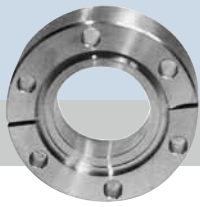
Nor-Cal now stocks bored metric tapped CF flanges in 2 3/4, 4 1/2, 6, 8 and 10 inch ODs. Other sizes are available upon request. Fasteners for metric flanges are stocked for each flange size.



Silver plated Gaskets and Bolts

We are now offering silver plated copper gaskets and bolt kits in a variety of sizes. Silver plated copper gaskets are recommended when the use of pure copper is unacceptable. Silver plated bolt kits offer an alternative to using anti-seize thread lubricant.

All dimensions are in inches unless otherwise noted



Flanges & Fittings

CF Flange Assembly Instructions

SPECIFICATIONS

General: Rotatable or nonrotatable flanges with tapped or clearance bolt holes

Nominal OD sizes: 1¹/₃ to 16¹/₂ inches

Tube sizes: 1/4 to 14 inches

Materials

Flange: 304 stainless steel
(316L available on request)

Gaskets: Viton, copper or silver plated

Bolts: 18-8 stainless steel or silver plated

Vacuum range

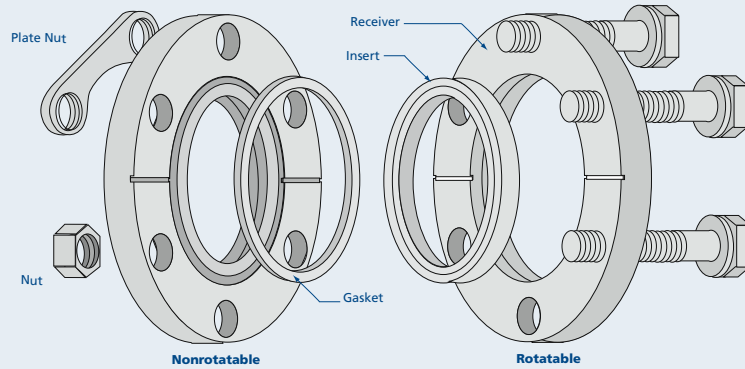
Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV

Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature Range

Metal seal: -200°C to 450°C

Elastomer seal: -20°C to 150°C



Fastening Hardware

CF flanges are available with tapped or untapped holes. Tapped flanges are available in UNC/UNF or metric threads. Tapped flanges have through holes, so bolts may protrude slightly from the back of the flange when fastened to an untapped flange. Untapped CF flanges can be fastened to each other with stainless steel bolts and hex nuts or plate nuts. Plate nuts center themselves over two adjacent holes and can be held in place with one finger while the bolts are tightened. They are available for most flange sizes from 1¹/₃ to 10 inch ODs. As an alternative to hex head bolts, 12-point bolts are available for CF flanges from 2³/₄ to 10 inch ODs. Silver plated bolts eliminate the need for anti-seize compound in clean room environments.

Assembly Instructions for Nor-Cal CF (Conflat) Flanges

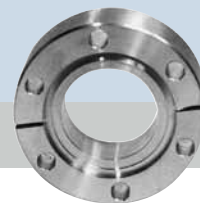
1. Apply a small amount of high temperature anti-seize compound to the bolt threads.
2. Check that both flange surfaces are clean and sealing edges are free from nicks and scratches.
3. Using clean, lint free gloves, unpack gasket.
4. Place gasket in the knife edge counterbore of nonrotatable flange.
5. Align the mating hole pattern and leak test grooves.
6. Install the proper bolts and tighten hand tight. Check to see that the flange faces are parallel.
7. Tighten the bolts 1/4 to 1/2 turns using a circular clockwise pattern until the flange faces are metal to metal.
8. Torque the fasteners to the listed value using the same pattern.

Torque Specifications*

NOMINAL OD	BOLT SIZE	TORQUE IN INCH / LBS
1 ¹ / ₃	8-32	28
2 ¹ / ₈	1/4 - 28	110
2 ³ / ₄	1/4 - 28	110
3 ³ / ₈	5/16 - 24	190
4 ¹ / ₂	5/16 - 24	190
4 ⁵ / ₈	5/16 - 24	190
6	5/16 - 24	190
6 ³ / ₄	5/16 - 24	190
8	5/16 - 24	190
10	5/16 - 24	190
12	5/16 - 24	190
13 ¹ / ₄	3/8 - 24	345
14	3/8 - 24	345
14 ¹ / ₂	3/8 - 24	345
16 ¹ / ₂	3/8 - 24	345

* Specifications for Nor-Cal supplied fasteners only





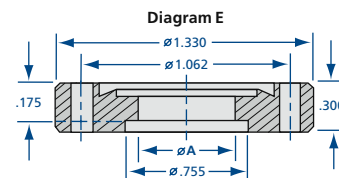
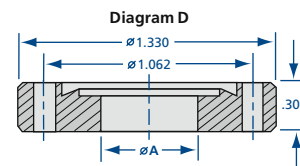
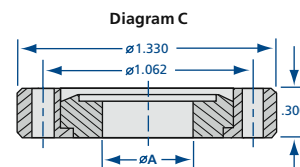
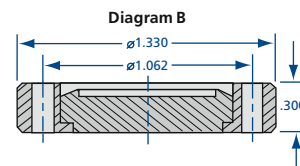
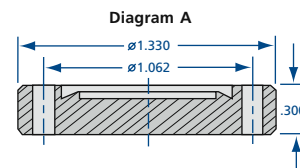
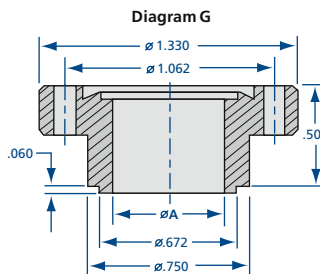
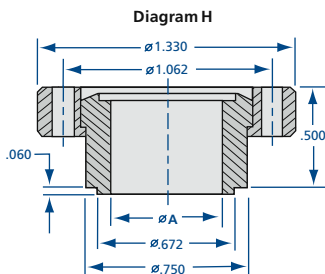
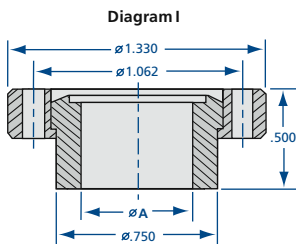
CF mini flanges are manufactured to the same high standard as our other CF flanges for 1/4, 3/8, 1/2, and 3/4 inch OD tube sizes. Nor-Cal offers special purpose, double-sided and zero-length reducer mini flanges along with fittings, viewports and feedthroughs in this size, so we can supply all the components necessary to build a complete table-top, small laboratory or gas handling system from stock.

CF Mini Flanges

MODEL NUMBER	TYPE	DIAGRAM	A	BOLT HOLES	DIAMETER OR THREAD
133-000N	Blank	A	-	6	.172
133-000NK	Blank weld neck with weld prep	G	-	6	.172
133-025N	Bored	D	0.255	6	.172
133-038N	Bored	D	0.380	6	.172
133-050N	Bored	D	0.505	6	.172
133-075N	Counterbored for tube OD	E	0.625	6	.172
133-075NK	Bored weld neck with weld prep	G	0.625	6	.172
133-075NBK	Bored weld neck without weld prep	F	0.625	6	.172
133-000NT	Blank	A	-	6	8-32
133-000NKT	Blank weld neck with weld prep	G	-	6	8-32
133-025NT	Bored	D	0.255	6	8-32
133-038NT	Bored	D	0.380	6	8-32
133-050NT	Bored	D	0.505	6	8-32
133-075NT	Counterbored for tube OD	E	0.625	6	8-32
133-075NKT	Bored weld neck with weld prep	G	0.625	6	8-32
133-075NBKT	Bored weld neck without weld prep	F	0.625	6	8-32
133-000R	Blank	B	-	6	.172
133-000RK	Blank weld neck with weld prep	H	-	6	.172
133-025R	Bored	C	0.255	6	.172
133-038R	Bored	C	0.380	6	.172
133-050R	Bored	C	0.505	6	.172
133-075R	Bored	C	0.625	6	.172
133-075RK	Bored weld neck with weld prep	H	0.625	6	.172
133-075RBK	Bored weld neck without weld prep	I	0.625	6	.172
133-000RT	Blank	B	-	6	8-32
133-000RKT	Blank weld neck with weld prep	H	-	6	8-32
133-025RT	Bored	C	0.255	6	8-32
133-038RT	Bored	C	0.380	6	8-32
133-050RT	Bored	C	0.505	6	8-32
133-075RT	Bored	C	0.625	6	8-32
133-075RKT	Bored weld neck with weld prep	H	0.625	6	8-32
133-075RBKT	Bored weld neck without weld prep	I	0.625	6	8-32

Model Number Definitions

N = Nonrotatable, clearance bolt holes **NT** = Nonrotatable, tapped bolt holes **R** = Rotatable, clearance bolt holes
RT = Rotatable, tapped bolt holes **K** = Weld neck with weld prep **BK** = Weld neck without weld prep



CF Mini Flange Hardware

MODEL NUMBER	DESCRIPTION
G-133	(10) OFHC copper gaskets
G-133-SP	(10) Silver plated copper gaskets
G-133V	(5) Viton gaskets
B-133	(25) SS 8-32 x .75" bolts, nuts & washers
B-133T	(25) SS 8-32 x .56" bolts & washers
B-133-SP	(25) Silver plated SS 8-32 x .75" bolts, nuts & washers
B-133T-SP	(25) Silver plated SS 8-32 x .56" bolts & washers
NP-075	(24) 8-32 plate nuts. See page 63.
KNP-075	(12) Plate nuts and (24) 8-32 x .75" bolts



SPECIFICATIONS

General: Rotatable and nonrotatable with tapped or clearance bolt holes

Materials

Flanges: 304 stainless steel
 (316L available upon request)
 Gaskets: Copper, Viton or silver plated
 Bolts: 18-8 stainless steel or silver plated

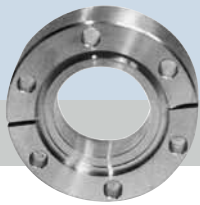
Torque: 28 inch / lbs.

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
 Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

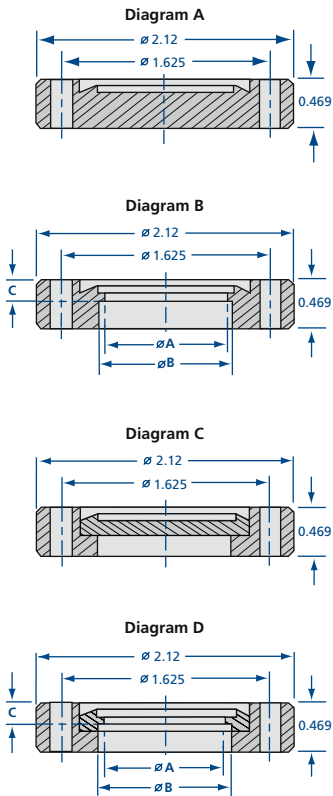
Temperature Range

Metal seal: -200°C to 450°C
 Elastomer seal: -20°C to 150°C



Flanges & Fittings

CF Flanges and Hardware



CF Flanges - 2 1/8 Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	ID A	B	C	BOLT HOLES	DIAMETER OR THREAD
212-000N	Blank	A	-	-	-	4	.265
212-025N	Bored	B	0.255	-	-	4	.265
212-050N	Bored	B	0.505	-	-	4	.265
212-075N	Bored	B	0.688	0.760	0.167	4	.265
212-100N	Bored	B	0.938	1.010	0.167	4	.265
212-000NT	Blank	A	-	-	-	4	1/4-28
212-025NT	Bored	B	0.255	-	-	4	1/4-28
212-050NT	Bored	B	0.505	-	-	4	1/4-28
212-075NT	Bored	B	0.688	0.760	0.167	4	1/4-28
212-100NT	Bored	B	0.938	1.010	0.167	4	1/4-28
212-000R	Blank	C	-	-	-	4	.265
212-025R	Bored	D	0.255	-	-	4	.265
212-050R	Bored	D	0.505	-	-	4	.265
212-075R	Bored	D	0.688	0.760	0.167	4	.265
212-100R	Bored	D	0.938	1.010	0.167	4	.265
212-000RT	Blank	C	-	-	-	4	1/4-28
212-025RT	Bored	D	0.255	-	-	4	1/4-28
212-050RT	Bored	D	0.505	-	-	4	1/4-28
212-075RT	Bored	D	0.688	0.760	0.167	4	1/4-28
212-100RT	Bored	D	0.938	1.010	0.167	4	1/4-28

Model Number Definitions

N = Nonrotatable, clearance bolt holes **NT** = Nonrotatable, tapped bolt holes **R** = Rotatable, clearance bolt holes
RT = Rotatable, tapped bolt holes **M** = Metric tapped bolt holes

CF Flange Hardware - 2 1/8 Inch Nominal OD



MODEL NUMBER	DESCRIPTION
G-212	(10) OFHC copper gaskets
G-212V	(5) Viton gaskets
B-212	(25) SS 1/4-28 x 1 1/4" bolts, nuts & washers
B-212T	(25) SS 1/4-28 x 7/8" bolts & washers
B-212-12	(25) SS 12-pt. 1/4-28 x 1 1/4" bolts, nuts & washers
B-212T-12	(25) SS 12-pt. 1/4-28 x 7/8" bolts & washers

SPECIFICATIONS

General: Rotatable and nonrotatable with tapped or clearance bolt holes

Materials

Flanges: 304 stainless steel
 (316L available upon request)
 Gaskets: Copper, Viton
 Bolts: 18-8 stainless steel

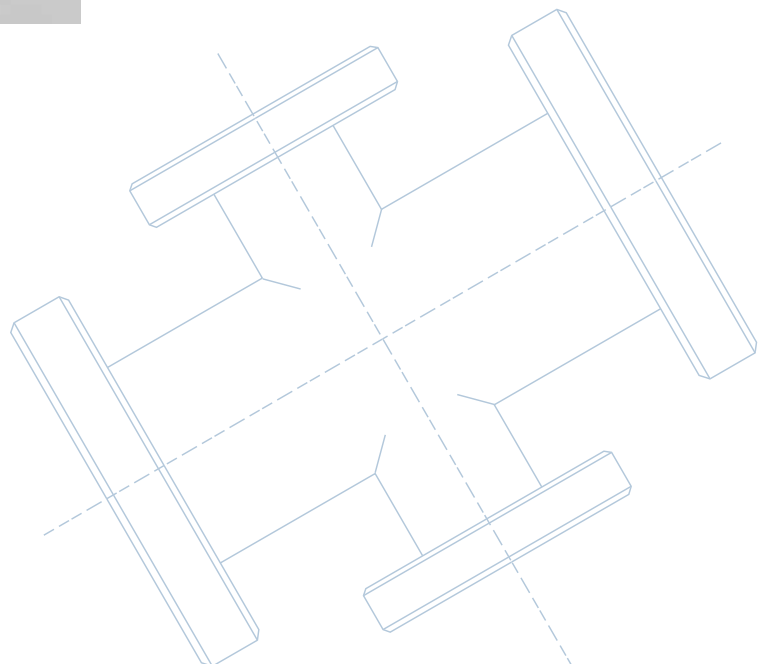
Torque: 110 inch/lbs.

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
 Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature range

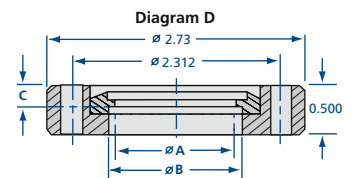
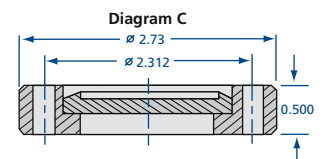
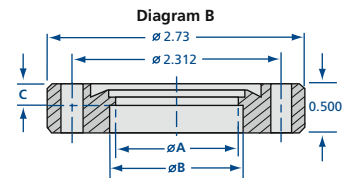
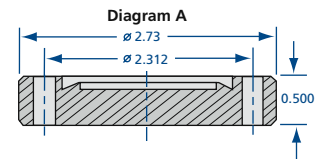
Metal seal: -200°C to 450°C
 Elastomer seal: -20°C to 150°C





CF Flanges - 2 3/4 Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	ID A	B	C	BOLT HOLES	DIAMETER OR THREAD
275-000N	Blank	A	-	-	-	6	.265
275-025N	Bored	B	0.255	-	-	6	.265
275-050N	Bored	B	0.505	-	-	6	.265
275-075N	Bored	B	0.688	0.760	0.209	6	.265
275-100N	Bored	B	0.938	1.010	0.209	6	.265
275-125N	Bored	B	1.188	1.260	0.209	6	.265
275-150N	Bored	B	1.438	1.510	0.209	6	.265
275-162N	Bored	B	1.560	1.635	0.209	6	.265
275-175N	Bored	B	1.620	1.760	0.209	6	.265
275-000NT	Blank	A	-	-	-	6	1/4-28
275-025NT	Bored	B	0.255	-	-	6	1/4-28
275-050NT	Bored	B	0.505	-	-	6	1/4-28
275-075NT	Bored	B	0.688	0.760	0.209	6	1/4-28
275-100NT	Bored	B	0.938	1.010	0.209	6	1/4-28
275-125NT	Bored	B	1.188	1.260	0.209	6	1/4-28
275-150NT	Bored	B	1.438	1.510	0.209	6	1/4-28
275-150NT-M	Metric, bored	B	1.438	1.510	0.209	6	M6
275-162NT	Bored	B	1.560	1.635	0.209	6	1/4-28
275-175NT	Bored	B	1.620	1.760	0.209	6	1/4-28
275-000R	Blank	C	-	-	-	6	.265
275-025R	Bored	D	0.255	-	-	6	.265
275-050R	Bored	D	0.505	-	-	6	.265
275-075R	Bored	D	0.688	0.760	0.209	6	.265
275-100R	Bored	D	0.938	1.010	0.209	6	.265
275-125R	Bored	D	1.188	1.260	0.209	6	.265
275-150R	Bored	D	1.438	1.510	0.209	6	.265
275-000RT	Blank	C	-	-	-	6	1/4-28
275-025RT	Bored	D	0.255	-	-	6	1/4-28
275-050RT	Bored	D	0.505	-	-	6	1/4-28
275-075RT	Bored	D	0.688	0.760	0.209	6	1/4-28
275-100RT	Bored	D	0.938	1.010	0.209	6	1/4-28
275-125RT	Bored	D	1.188	1.260	0.209	6	1/4-28
275-150RT	Bored	D	1.438	1.510	0.209	6	1/4-28



Model Number Definitions

N = Nonrotatable, clearance bolt holes **NT** = Nonrotatable, tapped bolt holes **R** = Rotatable, clearance bolt holes
RT = Rotatable, tapped bolt holes **M** = Metric tapped bolt holes

CF Flange Hardware - 2 3/4 Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-275	(10) OFHC copper gaskets
G-275V	(5) Viton gaskets
G-275-SP	(10) Silver plated copper gaskets
B-275	(25) SS 1/4-28 x 1 1/4" bolts, nuts & washers
B-275T	(25) SS 1/4-28 x 1" bolts & washers
B-275-12	(25) SS 12-pt. 1/4-28 x 1 1/4" bolts, nuts & washers
B-275-12-SP	(25) Silver plated SS 12-pt. 1/4-28 x 1 1/4" bolts, nuts & washers
B-275T-12	(25) SS 12-pt. 1/4-28 x 1" bolts & washers
B-275T-12-SP	(25) Silver plated SS 12-pt. 1/4-28 x 7/8" bolts & washers
B-275T-M	(25) SS (metric) M6 x 1.00 x 25mm bolts & washers
NP-150	(24) 1/4-28 plate nuts. See page 63
KNP-150	(12) Plate nuts, (24) 1/4-28 x 1 1/4" bolts & washers
KNP-150-12	(12) Plate nuts, (24) 12-pt. 1/4-28 x 1 1/4" bolts & washers



SPECIFICATIONS

General: Rotatable and nonrotatable with tapped or clearance holes

Materials

Flanges: 304 stainless steel
(316L available upon request)
 Gaskets: Copper, Viton or silver plated
 Bolts: 18-8 stainless steel or silver plated

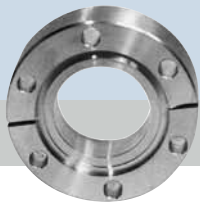
Torque: 110 inch/lbs.

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
 Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature Range

Metal seal: -200°C to 450°C
 Elastomer seal: -20°C to 150°C



Flanges & Fittings

CF Flanges and Hardware

Diagram A

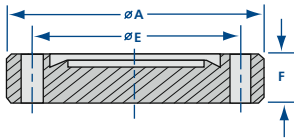


Diagram B

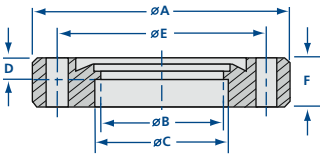


Diagram C

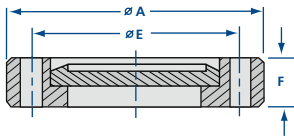
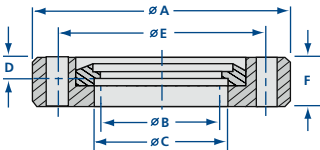


Diagram D



CF Flanges - 3³/₈ Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	F	BOLT HOLES	DIAMETER OR THREAD
338-000N	Blank	A	3.36	-	-	-	2.850	0.687	8	.332
338-150N	Bored	B	3.36	1.438	1.510	0.225	2.850	0.687	8	.332
338-200N	Bored	B	3.36	1.938	2.010	0.225	2.850	0.687	8	.332
338-000NT	Blank	A	3.36	-	-	-	2.850	0.687	8	5/16-24
338-150NT	Bored	B	3.36	1.438	1.510	0.225	2.850	0.687	8	5/16-24
338-200NT	Bored	B	3.36	1.938	2.010	0.225	2.850	0.687	8	5/16-24
338-000R	Blank	C	3.36	-	-	-	2.850	0.687	8	.332
338-150R	Bored	D	3.36	1.438	1.510	0.225	2.850	0.687	8	.332
338-200R	Bored	D	3.36	1.938	2.010	0.225	2.850	0.687	8	.332
338-000RT	Blank	C	3.36	-	-	-	2.850	0.687	8	5/16-24
338-150RT	Bored	D	3.36	1.438	1.510	0.225	2.850	0.687	8	5/16-24
338-200RT	Bored	D	3.36	1.938	2.010	0.225	2.850	0.687	8	5/16-24

CF Flanges - 4¹/₂ Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	F	BOLT HOLES	DIAMETER OR THREAD
450-000N	Blank	A	4.47	-	-	-	3.628	0.687	8	.332
450-150N	Bored	B	4.47	1.438	1.510	0.375	3.628	0.687	8	.332
450-200N	Bored	B	4.47	1.938	2.010	0.375	3.628	0.687	8	.332
450-250N	Bored	B	4.47	2.438	2.510	0.375	3.628	0.687	8	.332
450-000NT	Blank	A	4.47	-	-	-	3.628	0.687	8	5/16-24
450-150NT	Bored	B	4.47	1.438	1.510	0.375	3.628	0.687	8	5/16-24
450-200NT	Bored	B	4.47	1.938	2.010	0.375	3.628	0.687	8	5/16-24
450-250NT	Bored	B	4.47	2.438	2.510	0.375	3.628	0.687	8	5/16-24
450-250NT-M	Metric, Bored	B	4.47	2.438	2.510	0.375	3.628	0.687	8	M8
450-000R	Blank	C	4.47	-	-	-	3.628	0.750	8	.332
450-150R	Bored	D	4.47	1.438	1.510	0.375	3.628	0.750	8	.332
450-200R	Bored	D	4.47	1.938	2.010	0.375	3.628	0.750	8	.332
450-250R	Bored	D	4.47	2.438	2.510	0.375	3.628	0.750	8	.332
450-000RT	Blank	C	4.47	-	-	-	3.628	0.750	8	5/16-24
450-150RT	Bored	D	4.47	1.438	1.510	0.375	3.628	0.750	8	5/16-24
450-200RT	Bored	D	4.47	1.938	2.010	0.375	3.628	0.750	8	5/16-24
450-250RT	Bored	D	4.47	2.438	2.510	0.375	3.628	0.750	8	5/16-24

Model Number Definitions

N = Nonrotatable, clearance bolt holes
 NT = Nonrotatable, tapped bolt holes
 R = Rotatable, clearance bolt holes
 RT = Rotatable, tapped bolt holes
 M = Metric tapped bolt holes

CF Flange Hardware - 3³/₈ Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-338	(10) OFHC copper gaskets
G-338-SP	(10) Silver plated copper gaskets
G-338V	(1) Viton gasket
B-338	(25) SS 5/16-24 x 1 3/4" bolts, nuts & washers
B-338T	(25) SS 5/16-24 x 1 1/4" bolts & washers
B-338-12	(25) SS 12-pt. 5/16-24 x 1 3/4" bolts, nuts & washers
B-338T-12	(25) SS 12-pt. 5/16-24 x 1 1/4" bolts & washers
B-338-12-SP	(25) Silver plated SS 12-pt. 5/16-24 x 1 3/4" bolts, nuts & washers
B-338T-12-SP	(25) Silver plated SS 12-pt. 5/16-24 x 1 1/4" bolts, washers
NP-200	(24) 5/16-24 plate nuts. See page 63
KNP-200	(16) Plate nuts, (32) 5/16-24 x 1 3/4" bolts & washers
KNP-200-12	(16) Plate nuts, (32) 12-pt. 5/16-24 x 1 3/4" bolts & washers

CF Flange Hardware - 4¹/₂ Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-450	(10) OFHC copper gaskets
G-450-SP	(10) Silver plated copper gaskets
G-450V	(1) Viton gasket
B-450	(25) SS 5/16-24 x 2" bolts, nuts & washers
B-450T	(25) SS 5/16-24 x 1 1/4" bolts & washers
B-450-12	(25) SS 12-pt. 5/16-24 x 2" bolts, nuts & washers
B-450T-12	(25) SS 12-pt. 5/16-24 x 1 1/4" bolts & washers
B-450-12-SP	(25) Silver plated SS 12-pt. 5/16-24 x 2" bolts, nuts & washers
B-450T-12-SP	(25) Silver plated SS 12-pt. 5/16-24 x 1 1/4" bolts & washers
B-450-M	(25) SS (metric) M8 x 1.25 x 35mm bolts & washers
NP-250	(24) 5/16-24 plate nuts. See page 63
KNP-250	(16) Plate nuts, (32) 5/16-24 x 2" bolts & washers
KNP-250-12	(16) Plate nuts, (32) 12-pt. 5/16-24 x 2" bolts & washers

SPECIFICATIONS

General: Rotatable and nonrotatable with tapped or clearance bolt holes

Materials

Flanges: 304 stainless steel
 (316L available upon request)
 Gaskets: Copper, Viton or silver plated
 Bolts: 18-8 stainless steel or silver plated

Torque: 190 inch/lbs.

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
 Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature range

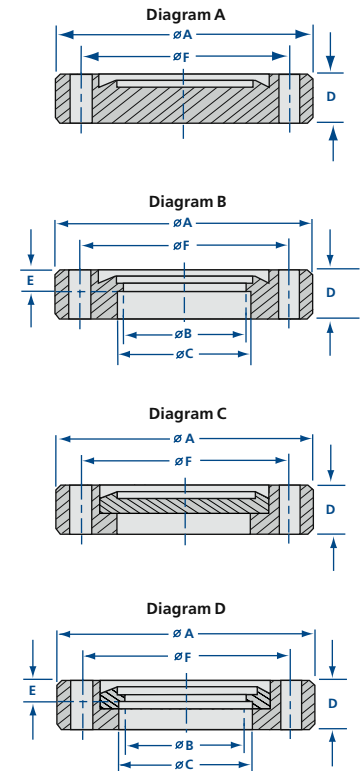
Metal seal: -200°C to 450°C
 Elastomer seal: -20°C to 150°C





CF Flanges - 4⁵/₈ Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	F	BOLT HOLES	DIAMETER OR THREAD
462-000N	Blank	A	4.61	-	-	0.812	-	4.030	10	.332
462-300N	Bored	B	4.61	2.938	3.010	0.812	0.281	4.030	10	.332
462-000NT	Blank	A	4.61	-	-	0.812	-	4.030	10	5/16-24
462-300NT	Bored	B	4.61	2.938	3.010	0.812	0.281	4.030	10	5/16-24
462-000R	Blank	C	4.61	-	-	0.812	-	4.030	10	.332
462-300R	Bored	D	4.61	2.938	3.010	0.812	0.281	4.030	10	.332
462-000RT	Blank	C	4.61	-	-	0.812	-	4.030	10	5/16-24
462-300RT	Bored	D	4.61	2.938	3.010	0.812	0.281	4.030	10	5/16-24



CF Flanges - 6 Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	F	BOLT HOLES	DIAMETER OR THREAD
600-000N	Blank	A	5.97	-	-	0.781	-	5.128	16	.332
600-400N	Bored	B	5.97	3.910	4.010	0.781	0.438	5.128	16	.332
600-000NT	Blank	A	5.97	-	-	0.781	-	5.128	16	5/16-24
600-400NT	Bored	B	5.97	3.910	4.010	0.781	0.438	5.128	16	5/16-24
600-400NT-M	Metric, bored	B	5.97	3.910	4.010	0.781	0.438	5.128	16	M8
600-000R	Blank	C	5.97	-	-	0.844	-	5.128	16	.332
600-400R	Bored	D	5.97	3.910	4.010	0.844	0.438	5.128	16	.332
600-000RT	Blank	C	5.97	-	-	0.844	-	5.128	16	5/16-24
600-400RT	Bored	D	5.97	3.910	4.010	0.844	0.438	5.128	16	5/16-24

Model Number Definitions

N = Nonrotatable, clearance bolt holes **NT** = Nonrotatable, tapped bolt holes **R** = Rotatable, clearance bolt holes
RT = Rotatable, tapped bolt holes **M** = Metric tapped bolt holes

CF Flange Hardware - 4⁵/₈ Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-462	(10) OFHC copper gaskets
G-462V	(1) Viton gasket
B-462	(25) SS 5/16-24 x 2 1/4" bolts, nuts & washers
B-462T	(25) SS 5/16-24 x 1 1/4" bolts & washers
B-462-12	(25) SS 12-pt. 5/16-24 x 2 1/4" bolts, nuts & washers
B-462T-12	(25) SS 12-pt. 5/16-24 x 1 1/4" bolts & washers
NP-300	(24) 5/16-24 plate nuts. See page 63
KNP-300	(20) Plate nuts, (40) 5/16-24 x 2 1/4" bolts & washers
KNP-300-12	(20) Plate nuts, (40) 12-pt. 5/16-24 x 2 1/4" bolts & washers



SPECIFICATIONS

General: Rotatable and nonrotatable with tapped or clearance bolt holes

Materials

Flanges: 304 stainless steel
(316L available upon request)
Gaskets: Copper, Viton and silver plated
Bolts: 18-8 stainless steel and silver plated

Torque: 190 inch / lbs.

Vacuum range

Metal seal: ≥ 1 x 10⁻¹³ Torr - UHV
Elastomer seal: ≥ 1 x 10⁻⁸ Torr - High vacuum

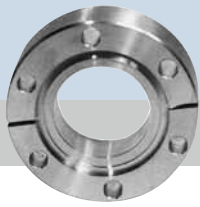
Temperature Range

Metal seal: -200°C to 450°C
Elastomer seal: -20°C to 150°C

CF Flange Hardware - 6 Inch Nominal OD

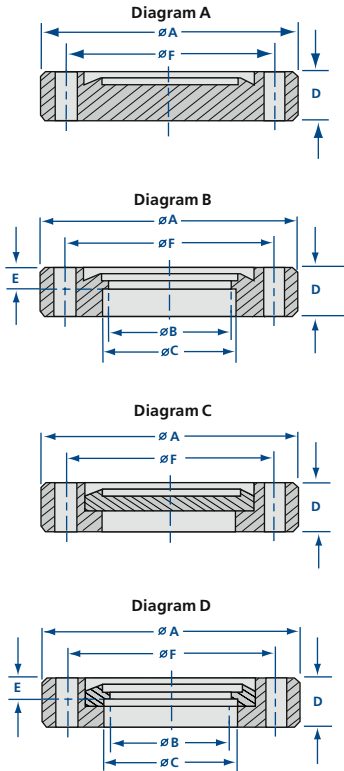
MODEL NUMBER	DESCRIPTION
G-600	(10) OFHC copper gaskets
G-600V	(1) Viton gasket
G-600-SP	(10) Silver plated copper gaskets
B-600	(25) SS 5/16-24 x 2 1/4" bolts, nuts & washers
B-600T	(25) SS 5/16-24 x 1 1/4" bolts & washers
B-600-12	(25) SS 12-pt. 5/16-24 x 2 1/4" bolts, nuts & washers
B-600T-12	(25) SS 12-pt. 5/16-24 x 1 1/4" bolts & washers
B-600-12-SP	(25) Silver plated SS 12-pt. 5/16-24 x 2 1/4" bolts, nuts & washers
B-600T-12-SP	(25) Silver plated SS 12-pt. 5/16-24 x 1 1/4" bolts & washers
B-600T-M	(25) SS (metric) M8 x 1 1/4 x 35mm bolts & washers
NP-400	(24) 5/16-24 plate nuts. See page 63
KNP-400	(16) Plate nuts (32) 5/16-24 x 2 1/4" bolts & washers
KNP-400-12	(16) Plate nuts (32) 12-pt. 5/16-24 x 2 1/4" bolts & washers





Flanges & Fittings

CF Flanges and Hardware



CF Flanges - 6³/₄ Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	F	BOLT HOLES	DIAMETER OR THREAD
675-000N	Blank	A	6.73	-	-	0.844	-	5.969	18	.332
675-500N	Bored	B	6.73	4.875	5.010	0.844	0.460	5.969	18	.332
675-000NT	Blank	A	6.73	-	-	0.844	-	5.969	18	5/16-24
675-500NT	Bored	B	6.73	4.875	5.010	0.844	0.460	5.969	18	5/16-24
675-000R	Blank	C	6.73	-	-	0.844	-	5.969	18	.332
675-500R	Bored	D	6.73	4.875	5.010	0.844	0.460	5.969	18	.332
675-000RT	Blank	C	6.73	-	-	0.844	-	5.969	18	5/16-24
675-500RT	Bored	D	6.73	4.875	5.010	0.844	0.460	5.969	18	5/16-24

CF Flanges - 8 Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	F	BOLT HOLES	DIAMETER OR THREAD
800-000N	Blank	A	7.97	-	-	0.875	-	7.128	20	.332
800-600N	Bored	B	7.97	5.875	6.020	0.875	0.500	7.128	20	.332
800-000NT	Blank	A	7.97	-	-	0.875	-	7.128	20	5/16-24
800-600NT	Bored	B	7.97	5.875	6.020	0.875	0.500	7.128	20	5/16-24
800-600NT-M	Metric, bored	B	7.97	5.875	6.020	0.875	0.500	7.128	20	M8
800-000R	Blank	C	7.97	-	-	0.937	-	7.128	20	.332
800-600R	Bored	D	7.97	5.875	6.020	0.937	0.500	7.128	20	.332
800-000RT	Blank	C	7.97	-	-	0.937	-	7.128	20	5/16-24
800-600RT	Bored	D	7.97	5.875	6.020	0.937	0.500	7.128	20	5/16-24

Model Number Definitions

N = Nonrotatable, clearance bolt holes **NT** = Nonrotatable, tapped bolt holes **R** = Rotatable, clearance bolt holes
RT = Rotatable, tapped bolt holes **M** = Metric tapped bolt holes

SPECIFICATIONS

General: Rotatable and nonrotatable with tapped or clearance bolt holes

Material
 Flanges: 304 stainless steel
 (316L available upon request)
 Gaskets: Copper, Viton or silver plated
 Bolts: 18-8 stainless steel or silver plated

Torque: 190 inch/lbs.

Vacuum range
 Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
 Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature range
 Metal seal: -200°C to 450°C
 Elastomer seal: -20°C to 150°C

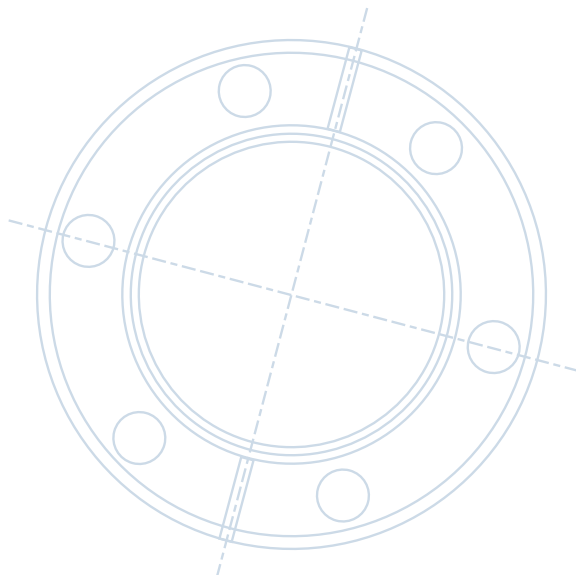


CF Flange Hardware - 6³/₄ Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-675	(10) OFHC copper gaskets
G-675V	(1) Viton gasket
B-675	(25) SS 5/16-24 x 2 1/4" bolts, nuts & washers
B-675T	(25) SS 5/16-24 x 1 1/2" bolts & washers
B-675-12	(25) SS 12-pt. 5/16-24 x 2 1/4" bolts, nuts & washers
B-675T-12	(25) SS 12-pt. 5/16-24 x 1 3/4" bolts & washers

CF Flange Hardware - 8 Inch Nominal OD

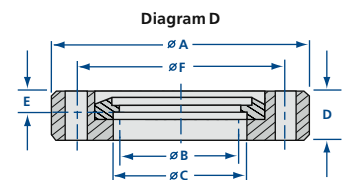
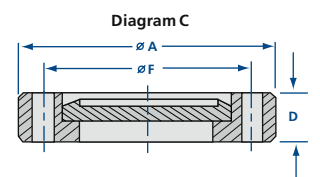
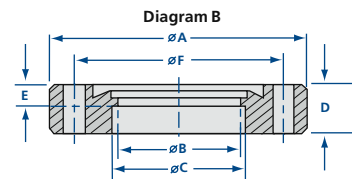
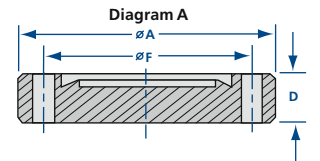
MODEL NUMBER	DESCRIPTION
G-800	(10) OFHC copper gaskets
G-800V	(1) Viton gasket
G-800-SP	(10) Silver plated copper gaskets
B-800	(25) SS 5/16-24 x 2 1/4" bolts, nuts & washers
B-800T	(25) SS 5/16-24 x 1 3/4" bolts & washers
B-800-12	(25) SS 12-pt. 5/16-24 x 2 1/4" bolts, nuts & washers
B-800T-12	(25) SS 12-pt. 5/16-24 x 1 3/4" bolts & washers
B-800-12-SP	(25) Silver plated SS 12-pt. 5/16-24 x 2 1/4" bolts, nuts & washers
B-800T-12-SP	(25) Silver plated SS 12-pt. 5/16-24 x 1 3/4" bolts & washers
B-800T-M	(25) SS (metric) M8 x 1 1/4 x 45mm bolts & washers
NP-600	(24) 5/16-24 plate nuts. See page 63
KNP-600	(20) Plate nuts, (40) 5/16-24 x 2 1/4" bolts & washers
KNP-600-12	(20) Plate nuts, (40) 5/16-24 x 2 1/4" 12-pt. bolts & washers





CF Flanges - 10 Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	F	BOLT HOLES	DIAMETER OR THREAD
1000-000N	Blank	A	9.97	-	-	0.968	-	9.128	24	.332
1000-800N	Bored	B	9.97	7.875	8.020	0.968	0.500	9.128	24	.332
1000-000NT	Blank	A	9.97	-	-	0.968	-	9.128	24	5/16-24
1000-800NT	Bored	B	9.97	7.875	8.020	0.968	0.500	9.128	24	5/16-24
1000-800NT-M	Metric, bored	B	9.97	7.875	8.020	0.968	0.500	9.128	24	M8
1000-000R	Blank	C	9.97	-	-	0.968	-	9.128	24	.332
1000-800R	Bored	D	9.97	7.875	8.020	0.968	0.500	9.128	24	.332
1000-000RT	Blank	C	9.97	-	-	0.968	-	9.128	24	5/16-24
1000-800RT	Bored	D	9.97	7.875	8.020	0.968	0.500	9.128	24	5/16-24



CF Flanges - 12 Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	F	BOLT HOLES	DIAMETER OR THREAD
1200-000N	Blank	A	12.00	-	-	1.125	-	11.181	32	.332
1200-1000N	Bored	B	12.00	9.875	10.020	1.125	0.500	11.181	32	.332
1200-000NT	Blank	A	12.00	-	-	1.125	-	11.181	32	5/16-24
1200-1000NT	Bored	B	12.00	9.875	10.020	1.125	0.500	11.181	32	5/16-24
1200-000R	Blank	C	12.00	-	-	1.125	-	11.181	32	.332
1200-1000R	Bored	D	12.00	9.875	10.020	1.125	0.500	11.181	32	.332
1200-000RT	Blank	C	12.00	-	-	1.125	-	11.181	32	5/16-24
1200-1000RT	Bored	D	12.00	9.875	10.020	1.125	0.500	11.181	32	5/16-24

Model Number Definitions

N = Nonrotatable, clearance bolt holes NT = Nonrotatable, tapped bolt holes R = Rotatable, clearance bolt holes
 RT = Rotatable, tapped bolt holes M = Metric tapped bolt holes

CF Flange Hardware - 10 Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-1000	(10) OFHC copper gaskets
G-1000V	(1) Viton gasket
G-1000-SP	(10) Silver plated copper gaskets
B-1000	(25) SS 5/16-24 x 2 1/2" bolts, nuts & washers
B-1000T	(25) SS 5/16-24 x 1 3/4" bolts & washers
B-1000-12	(25) SS 12-pt. 5/16-24 x 2 1/2" bolts, nuts & washers
B-1000T-12	(25) SS 12-pt. 5/16-24 x 1 3/4" bolts & washers
B-1000-12-SP	(25) Silver plated SS 12-pt. 5/16-24 x 2 1/2" bolts, nuts & washers
B-1000T-12-SP	(25) Silver plated SS 12-pt. 5/16-24 x 1 3/4" bolts & washers
B-1000T-M	(25) SS (metric) M8 x 1 1/4 x 45mm bolts & washers
NP-800	(24) 5/16-24 plate nuts. See page 63
KNP-800	(24) Plate nuts, (48) 5/16-24 x 2 1/4" bolts & washers
KNP-800-12	(24) Plate nuts, (48) 12-pt. 5/16-24 x 2 1/4" bolts & washers



SPECIFICATIONS

General: Rotatable and nonrotatable with tapped or clearance bolt holes

Material

Flanges: 304 stainless steel (316L available upon request)
 Gaskets: Copper, Viton or silver plated
 Bolts: 18-8 stainless steel or silver plated

Torque: 190 inch/lbs.

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
 Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

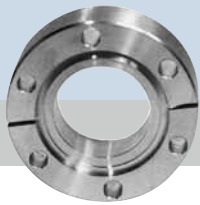
Temperature Range

Metal seal: -200°C to 450°C
 Elastomer seal: -20°C to 150°C

CF Flange Hardware - 12 Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-1200	(1) OFHC copper gasket
B-1200	(32) SS 5/16-24 x 3" bolts, nuts & washers
B-1200T	(32) SS 5/16-24 x 1 3/4" bolts & washers





Flanges & Fittings

CF Flanges and Hardware

Diagram A

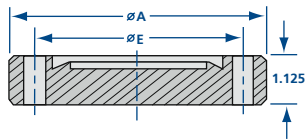


Diagram B

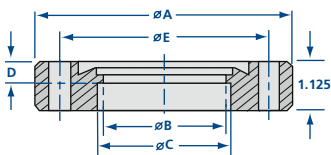


Diagram C

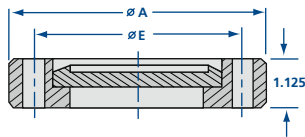
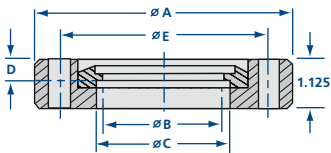


Diagram D



CF Flanges - 13 1/4 Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	BOLT HOLES	DIAMETER OR THREAD
1325-000N	Blank	A	13.25	-	-	-	12.055	30	.390
1325-1000N	Bored	B	13.25	9.875	10.020	0.500	12.055	30	.390
1325-000NT	Blank	A	13.25	-	-	-	12.055	30	3/8-24
1325-1000NT	Bored	B	13.25	9.875	10.020	0.500	12.055	30	3/8-24
1325-000R	Blank	C	13.25	-	-	-	12.055	30	.390
1325-1000R	Bored	D	13.25	9.875	10.020	0.500	12.055	30	.390
1325-000RT	Blank	C	13.25	-	-	-	12.055	30	3/8-24
1325-1000RT	Bored	D	13.25	9.875	10.020	0.500	12.055	30	3/8-24

CF Flanges - 14 Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	BOLT HOLES	DIAMETER OR THREAD
1400-000N	Blank	A	14.00	-	-	-	12.810	30	.390
1400-1200N	Bored	B	14.00	11.875	12.030	0.500	12.810	30	.390
1400-000NT	Blank	A	14.00	-	-	-	12.810	30	3/8-24
1400-1200NT	Bored	B	14.00	11.875	12.030	0.500	12.810	30	3/8-24
1400-000R	Blank	C	14.00	-	-	-	12.810	30	.390
1400-1200R	Bored	D	14.00	11.875	12.030	0.500	12.810	30	.390
1400-000RT	Blank	C	14.00	-	-	-	12.810	30	3/8-24
1400-1200RT	Bored	D	14.00	11.875	12.030	0.500	12.810	30	3/8-24

Model Number Definitions

N = Nonrotatable, clearance bolt holes NT = Nonrotatable, tapped bolt holes R = Rotatable, clearance bolt holes
RT = Rotatable, tapped bolt holes M = Metric tapped bolt holes

CF Flange Hardware - 13 1/4 Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-1325	(1) OFHC copper gasket
G-1325V	(1) Viton gasket
B-1325	(30) SS 3/8-24 x 3" bolts, nuts & washers
B-1325T	(30) SS 3/8-24 x 2" bolts & washers

CF Flange Hardware - 14 Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-1400	(1) OFHC copper gasket
G-1400V	(1) Viton gasket
B-1400	(30) SS 3/8-24 x 3" bolts, nuts & washers
B-1400T	(30) SS 3/8-24 x 2" bolts & washers



SPECIFICATIONS

General: Rotatable and nonrotatable with tapped or clearance bolt holes

Material
Flanges: 304 stainless steel
(316L available upon request)
Gaskets: Copper, Viton
Bolts: 18-8 stainless steel

Torque: 345 inch/lbs.

Vacuum range
Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

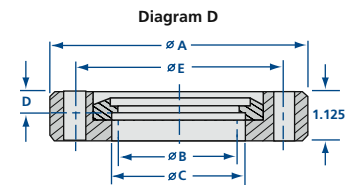
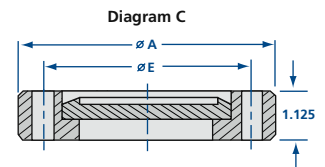
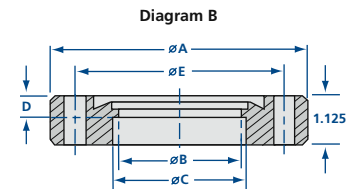
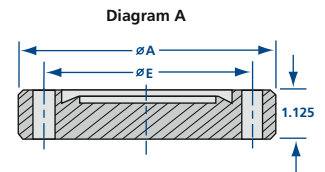
Temperature range
Metal seal: -200°C to 450°C
Elastomer seal: -20°C to 150°C





CF Flanges - 14½ Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	BOLT HOLES	DIAMETER OR THREAD
1450-000N	Blank	A	14.50	Blank	-	-	13.310	32	0.390
1450-1200N	Bored	B	14.50	11.875	12.020	0.500	13.310	32	0.390
1450-000NT	Blank	A	14.50	Blank	-	-	13.310	32	¾-24
1450-1200NT	Bored	B	14.50	11.875	12.020	0.500	13.310	32	¾-24
1450-000R	Blank	C	14.50	Blank	-	-	13.310	32	0.390
1450-1200R	Bored	D	14.50	11.875	12.020	0.500	13.310	32	0.390
1450-000RT	Blank	C	14.50	Blank	-	-	13.310	32	¾-24
1450-1200RT	Bored	D	14.50	11.875	12.020	0.500	13.310	32	¾-24



CF Flanges - 16½ Inch Nominal OD

MODEL NUMBER	TYPE	DIAGRAM	OD A	ID B	C	D	E	BOLT HOLES	DIAMETER OR THREAD
1650-000N	Blank	A	16.50	Blank	-	-	15.310	36	0.390
1650-1400N	Bored	B	16.50	13.750	14.020	0.500	15.310	36	0.390
1650-000NT	Blank	A	16.50	Blank	-	-	15.310	36	¾-24
1650-1400NT	Bored	B	16.50	13.750	14.020	0.500	15.310	36	¾-24
1650-000R	Blank	C	16.50	Blank	-	-	15.310	36	0.390
1650-1400R	Bored	D	16.50	13.750	14.020	0.500	15.310	36	0.390
1650-000RT	Blank	C	16.50	Blank	-	-	15.310	36	¾-24
1650-1400RT	Bored	D	16.50	13.750	14.020	0.500	15.310	36	¾-24

Model Number Definitions

N = Nonrotatable, clearance bolt holes **NT** = Nonrotatable, tapped bolt holes **R** = Rotatable, clearance bolt holes
RT = Rotatable, tapped bolt holes **M** = Metric tapped bolt holes

CF Flange Hardware - 14½ Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-1450	(1) OFHC copper gasket
B-1450	(32) SS ¾-24 x 3" bolts, nuts & washers
B-1450T	(32) SS ¾-24 x 2" bolts & washers



CF Flange Hardware - 16½ Inch Nominal OD

MODEL NUMBER	DESCRIPTION
G-1650	(1) OFHC copper gasket
G-1650V	(1) Viton gasket
B-1650	(36) SS ¾-24 x 3" bolts, nuts & washers
B-1650T	(36) SS ¾-24 x 2" bolts & washers

SPECIFICATIONS

General: Rotatable and nonrotatable with tapped or clearance bolt holes

Material

Flanges: 304 stainless steel
 (316L available upon request)
 Gaskets: Copper, Viton
 Bolts: 18-8 stainless steel

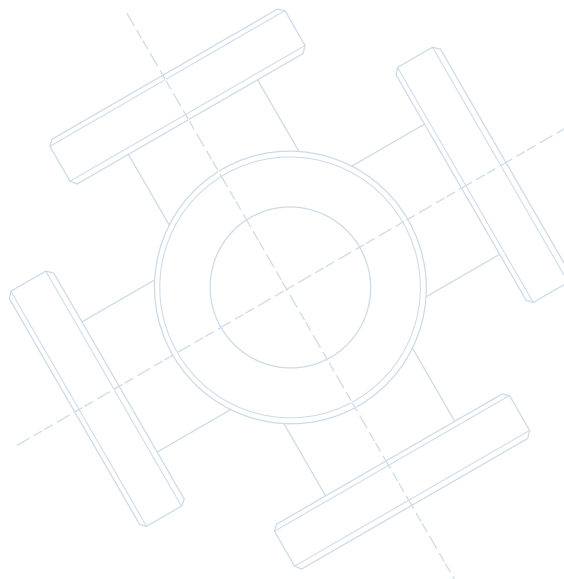
Torque: 345 inch/lbs.

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
 Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

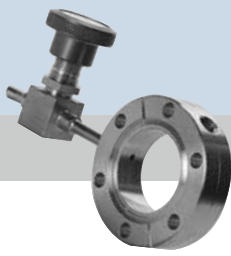
Temperature range

Metal seal: -200°C to 450°C
 Elastomer seal: -20°C to 150°C



Flanges & Fittings

CF Special Purpose Flanges



SPECIFICATIONS

General: Nonrotatable with clearance bolt holes

Material
 Flanges: 304 stainless steel (316L available on request)
 Gaskets: Copper, Viton
 Bolts: 18-8 stainless steel

Torque: See page 48

Vacuum range
 Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
 Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature range
 Metal seal: -200°C to 450°C
 Elastomer seal: -20°C to 150°C

Nor-Cal's special purpose CF flanges are used as roughing accessories, accommodating thermocouple gauge tubes, up-to-air valves and/or NPT threaded fittings. Double-sided flanges are provided with one or more radially tapped holes. Blank flanges are provided with a single concentric $1/8$ " NPT tapped hole. Hardware for special purpose flanges is located on the appropriate flange size pages.



CF Double-Sided Special Purpose Flanges

MODEL NUMBER	FLANGE OD	FEATURE	DIAGRAM	A	B
133-D1	1.33	(1) $1/16$ " NPT hole	A	0.25	0.50
275-D1	2.75	(1) $1/8$ " NPT hole	A	0.38	0.75
133-D2	1.33	(2) $1/16$ " NPT holes	B	0.25	0.50
275-D2	2.75	(2) $1/8$ " NPT holes	B	0.38	0.75
133-DT	1.33	Thermocouple gauge tube	C	0.25	0.50
275-DT	2.75	Thermocouple gauge tube	C	0.38	0.75
133-DV	1.33	Up-to-air valve	D	0.25	0.50
275-DV	2.75	Up-to-air valve	D	0.38	0.75
133-DV-1/4 MVCR	1.33	Up-to-air valve & $1/4$ " Cajon male VCR fitting on valve	D	0.25	0.50
275-DV-1/4 MVCR	2.75	Up-to-air valve & $1/4$ " Cajon male VCR fitting on valve	D	0.38	0.75
133-DV-1/4 FVCR	1.33	Up-to-air valve & $1/4$ " Cajon female VCR fitting on valve	D	0.25	0.50
275-DV-1/4 FVCR	2.75	Up-to-air valve & $1/4$ " Cajon female VCR fitting on valve	D	0.38	0.75
133-DV-1/4 SWAG	1.33	Up-to-air valve & $1/4$ " Swagelok fitting on valve	D	0.25	0.50
275-DV-1/4 SWAG	2.75	Up-to-air valve & $1/4$ " Swagelok fitting on valve	D	0.38	0.75
133-D1V	1.33	(1) $1/16$ " NPT hole & up-to-air valve	F	0.25	0.50
275-D1V	2.75	(1) $1/8$ " NPT hole & up-to-air valve	F	0.38	0.75
133-DTV	1.33	Thermocouple gauge tube & up-to-air valve	E	0.25	0.50
275-DTV	2.75	Thermocouple gauge tube & up-to-air valve	E	0.38	0.75
133-DTV-1/4 MVCR	1.33	Thermocouple gauge tube & up-to-air valve with $1/4$ " Cajon male VCR fitting on valve	E	0.25	0.50
275-DTV-1/4 MVCR	2.75	Thermocouple gauge tube & up-to-air valve with $1/4$ " Cajon male VCR fitting on valve	E	0.38	0.75
133-DTV-1/4 FVCR	1.33	Thermocouple gauge tube & up-to-air valve with $1/4$ " Cajon female VCR fitting on valve	E	0.25	0.50
275-DTV-1/4 FVCR	2.75	Thermocouple gauge tube & up-to-air valve with $1/4$ " Cajon female VCR fitting on valve	E	0.38	0.75
133-DTV-1/4 SWAG	1.33	Thermocouple gauge tube & up-to-air valve with $1/4$ " Swagelok fitting on valve	E	0.25	0.50
275-DTV-1/4SWAG	2.75	Thermocouple gauge tube & up-to-air valve with $1/4$ " Swagelok fitting on valve	E	0.38	0.75
275-DS-MINI	2.75	(1) 1.33" OD side port	G	0.38	0.75

Diagram A

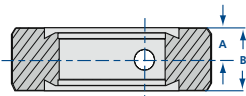


Diagram B

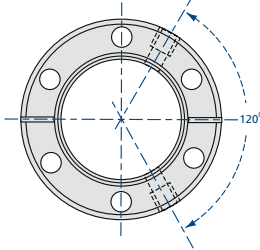


Diagram C

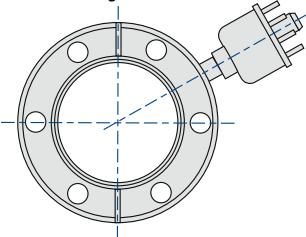


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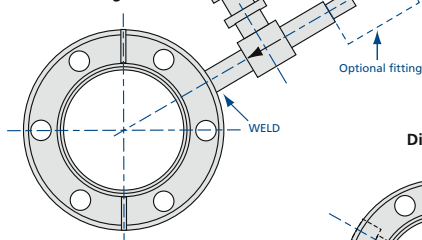


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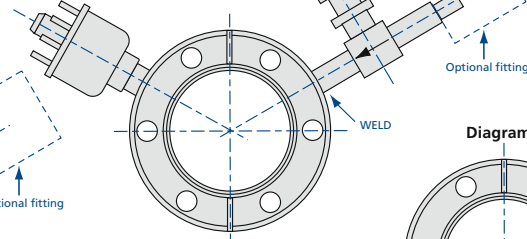


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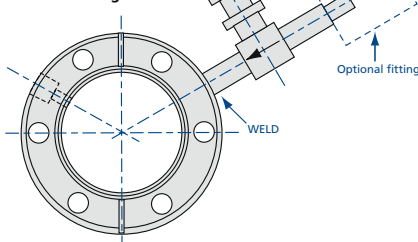
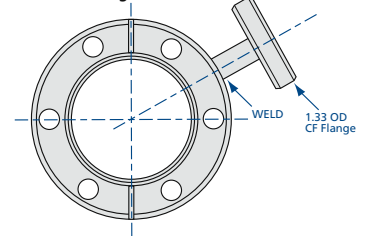
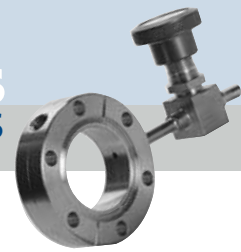


Diagram G





CF Straight-Through Special Purpose Flanges

MODEL NUMBER	FLANGE OD	FEATURE	DIAGRAM
133-ST	1.33	(1) 1/8" NPT hole	A
275-ST	2.75	(1) 1/8" NPT hole	A
133-STT	1.33	Thermocouple gauge tube	B
275-STT	2.75	Thermocouple gauge tube	B
133-STV	1.33	Up-to-air valve	C
275-STV	2.75	Up-to-air valve	C
133-STV-1/4 MVCR	1.33	Up-to-air valve and 1/4" Cajon male VCR fitting on valve	C
275-STV-1/4 MVCR	2.75	Up-to-air valve and 1/4" Cajon male VCR fitting on valve	C
133-STV-1/4 FVCR	1.33	Up-to-air valve and 1/4" Cajon female VCR fitting on valve	C
275-STV-1/4 FVCR	2.75	Up-to-air valve and 1/4" Cajon female VCR fitting on valve	C
133-STV-1/4 SWAG	1.33	Up-to-air valve and 1/4" Swagelok fitting on valve	C
275-STV-1/4 SWAG	2.75	Up-to-air valve and 1/4" Swagelok fitting on valve	C

SPECIFICATIONS

General: Nonrotatable with clearance bolt holes

Material

Flanges: 304 stainless steel
(316L available upon request)
Gaskets: Copper, Viton
Bolts: 18-8 stainless steel

Torque: See page 48

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature Range

Metal seal: -200°C to 450°C
Elastomer seal: -20°C to 150°C

Diagram A

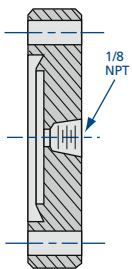


Diagram B

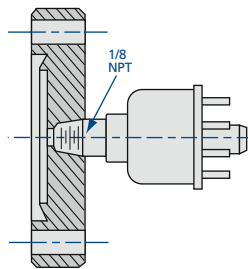
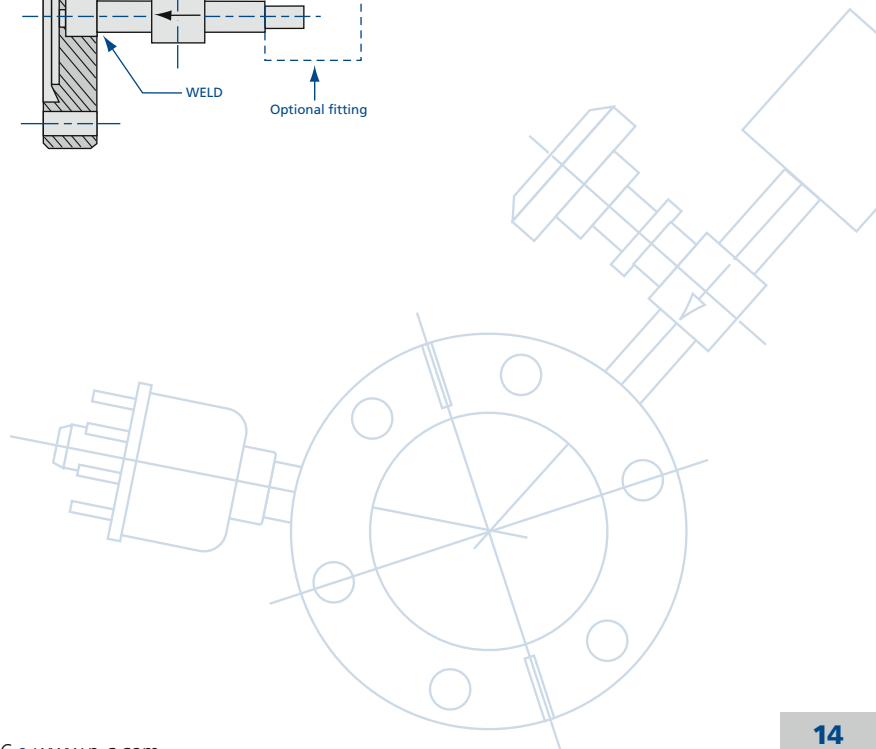
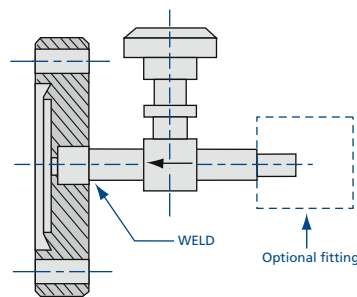


Diagram C





Flanges & Fittings

CF Double-Sided Flanges

Nor-Cal's double-sided flanges are identical to standard CF flanges except the same gasket-sealing detail is machined into both faces of the flange. These flanges can be inserted between like-sized flanges as spacers, orifice plates, or when radially drilled, as custom penetrations into vacuum systems.

CF Double-Sided Flanges - 1 1/3 thru 14 Inch Nominal OD

MODEL NUMBER	NOMINAL OD	MADE FROM	A	B
133-000D	1 1/3	133-000N	-	0.300
133-025D	1 1/3	133-000N	0.255	0.300
133-038D	1 1/3	133-000N	0.380	0.300
133-050D	1 1/3	133-000N	0.505	0.300
133-075D	1 1/3	133-000N	0.630	0.300
133-000DS	1 1/3	133-000NS	-	0.500
133-075DS	1 1/3	133-000NS	0.630	0.500
212-000D	2 1/8	212-000N	-	0.470
212-100D	2 1/8	212-000N	1.010	0.470
275-000D	2 3/4	275-000N	-	0.500
275-025D	2 3/4	275-000N	0.255	0.500
275-050D	2 3/4	275-000N	0.505	0.500
275-075D	2 3/4	275-000N	0.760	0.500
275-100D	2 3/4	275-000N	1.010	0.500
275-125D	2 3/4	275-000N	1.260	0.500
275-150D	2 3/4	275-000N	1.510	0.500
275-000DS	2 3/4	275-000NS	-	0.750
275-150DS	2 3/4	275-000NS	1.510	0.750
338-000D	3 3/8	338-000N	-	0.687
338-150D	3 3/8	338-000N	1.510	0.687
338-200D	3 3/8	338-000N	2.010	0.687
450-000D	4 1/2	450-000N	-	0.687
450-150D	4 1/2	450-000N	1.510	0.687
450-200D	4 1/2	450-000N	2.010	0.687
450-250D	4 1/2	450-000N	2.510	0.687
462-000D	4 5/8	462-000N	-	0.812
462-300D	4 5/8	462-000N	3.010	0.812
600-000D	6	600-000N	-	0.781
600-400D	6	600-000N	4.010	0.781
675-000D	6 3/4	675-000N	-	0.844
675-500D	6 3/4	675-000N	5.010	0.844
800-000D	8	800-000N	-	0.875
800-600D	8	800-000N	6.020	0.875
1000-000D	10	1000-000N	-	0.968
1000-800D	10	1000-000N	8.020	0.968
1325-000D	13 1/4	1325-000N	-	1.125
1325-1000D	13 1/4	1325-000N	10.020	1.125
1400-000D	14	1400-000N	-	1.125
1400-1200D	14	1400-000N	12.020	1.125

CF Double-Sided Flange Hardware

MODEL NUMBER	NOMINAL OD	DESCRIPTION
G-133	1 1/3	(10) OFHC copper gaskets
G-133V	1 1/3	(5) Viton gaskets
B-133D	1 1/3	(5) SS 8-32 x 1 1/4" bolts, nuts and washers
G-212	2 1/8	(10) OFHC copper gaskets
G-212V	2 1/8	(5) Viton gaskets
B-212D	2 1/8	(25) SS 1/4-28 x 1 3/4" bolts, nuts and washers
G-275	2 3/4	(10) OFHC copper gaskets
G-275V	2 3/4	(5) Viton gaskets
B-275DS	2 3/4	(25) SS 1/4-28 x 2" bolts, nuts and washers
B-275D	2 3/4	(25) SS 1/4-28 x 1 3/4" bolts, nuts and washers
KNP-150D	2 3/4	(6) Plate nuts, 1/4-28 x 2" (12) bolts and washers
G-338	3 3/8	(10) OFHC copper gaskets
G-338V	3 3/8	(1) Viton gaskets
B-338D	3 3/8	(25) SS 5/16-24 x 2 1/2" bolts, nuts and washers
G-450	4 1/2	(10) OFHC copper gaskets
G-450V	4 1/2	(1) Viton gaskets
B-450D	4 1/2	(25) SS 5/16-24 x 2 3/4" bolts, nuts and washers
G-462	4 5/8	(10) OFHC copper gaskets
G-462V	4 5/8	(1) Viton gaskets
B-462D	4 5/8	(25) SS 5/16-24 x 3" bolts, nuts and washers
G-600	6	(10) OFHC copper gaskets
G-600V	6	(1) Viton gaskets
B-600D	6	(25) SS 5/16-24 x 3" bolts, nuts and washers
G-675	6 3/4	(10) OFHC copper gaskets
G-675V	6 3/4	(1) Viton gaskets
B-675D	6 3/4	(25) SS 5/16-24 x 3" bolts, nuts and washers
G-800	8	(10) OFHC copper gaskets
G-800V	8	(1) Viton gaskets
B-800D	8	(25) SS 5/16-24 x 3" bolts, nuts & washers
G-1000	10	(10) OFHC copper gaskets
G-1000V	10	(1) Viton gaskets
B-1000D	10	(25) SS 5/16-24 x 3 1/2" bolts, nuts and washers
G-1325	13 1/4	(1) OFHC copper gaskets
G-1325V	13 1/4	(1) Viton gaskets

DS = Thicker than standard flange D = Double-sided flange, nonrotatable

SPECIFICATIONS

General: Nonrotatable with clearance bolt holes

Material

Flanges: 304 stainless steel
(316L available upon request)
Gaskets: Copper, Viton
Bolts: 18-8 stainless steel

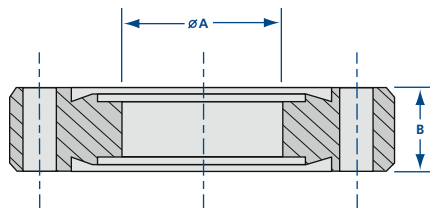
Torque: See page 48

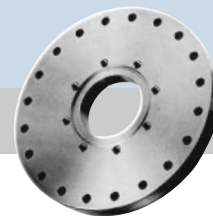
Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature range

Metal seal: -200°C to 450°C
Elastomer seal: -20°C to 150°C





Nor-Cal's zero length reducer flanges are a convenient and inexpensive way to reduce a large flange for smaller vacuum plumbing and/or component connection. To list all possible reducer combinations would require excessive space, therefore only the most commonly used reducers are listed. If your requirement is not listed, please inquire.

CF Zero Length Reducer Flanges

MODEL NUMBER	SMALL FLANGE DETAIL	LARGE FLANGE DETAIL	A	B
212-133-075Z	133-000NT	212-000NT	0.625	0.470
275-133-075Z	133-000NT	275-000N	0.625	0.500
275-212-100Z	212-000NT	275-000NT	1.000	0.500
338-133-075Z	133-000NT	338-000N	0.625	0.687
338-212-100Z	212-000NT	338-000NT	1.000	0.687
338-275-150Z	275-000NT	338-000NT	1.500	0.687
450-133-075Z	133-000NT	450-000N	0.625	0.687
450-212-100Z	212-000NT	450-000N	1.000	0.687
450-275-150Z	275-000NT	450-000N	1.500	0.687
450-338-200Z	338-000NT	450-000NT	2.000	0.687
462-133-075Z	133-000NT	462-000N	0.625	0.812
462-212-100Z	212-000NT	462-000N	1.000	0.812
462-275-150Z	275-000NT	462-000N	1.500	0.812
462-338-200Z	338-000NT	462-000N	2.000	0.812
600-133-075Z	133-000NT	600-000N	0.625	0.781
600-212-100Z	212-000NT	600-000N	1.000	0.781
600-275-150Z	275-000NT	600-000N	1.500	0.781
600-338-200Z	338-000NT	600-000N	2.000	0.781
600-450-250Z	450-000NT	600-000N	2.500	0.781
600-462-300Z	462-000NT	600-000NT	3.000	0.781
675-133-075Z	133-000NT	675-000N	0.625	0.844
675-212-100Z	212-000NT	675-000N	1.000	0.844
675-275-150Z	275-000NT	675-000N	1.500	0.844
675-338-200Z	338-000NT	675-000N	2.000	0.844
675-450-250Z	450-000NT	675-000N	2.500	0.844
675-462-300Z	462-000NT	675-000N	3.000	0.844
675-600-400Z	600-000NT	675-000NT	4.000	0.844
800-133-075Z	133-000NT	800-000N	0.625	0.875
800-212-100Z	212-000NT	800-000N	1.000	0.875
800-275-150Z	275-000NT	800-000N	1.500	0.875
800-338-200Z	338-000NT	800-000N	2.000	0.875
800-450-250Z	450-000NT	800-000N	2.500	0.875
800-462-300Z	462-000NT	800-000N	3.000	0.875
800-600-400Z	600-000NT	800-000N	4.000	0.875
800-675-500Z	675-000NT	800-000NT	5.000	0.875
1000-133-075Z	133-000NT	1000-000N	0.625	0.968
1000-212-100Z	212-000NT	1000-000N	1.000	0.968
1000-275-150Z	275-000NT	1000-000N	1.500	0.968
1000-338-200Z	338-000NT	1000-000N	2.000	0.968
1000-450-250Z	450-000NT	1000-000N	2.500	0.968
1000-462-300Z	462-000NT	1000-000N	3.000	0.968
1000-600-400Z	600-000NT	1000-000N	4.000	0.968
1000-675-500Z	675-000NT	1000-000N	5.000	0.968
1000-800-600Z	800-000NT	1000-000N	6.000	0.968
1325-133-075Z	133-000NT	1325-000N	0.625	1.125
1325-212-100Z	212-000NT	1325-000N	1.000	1.125
1325-275-150Z	275-100NT	1325-000N	1.500	1.125
1325-338-200Z	338-000NT	1325-000N	2.000	1.125
1325-450-250Z	450-000NT	1325-000N	2.500	1.125
1325-462-300Z	462-000NT	1325-000N	3.000	1.125
1325-600-400Z	600-000NT	1325-000N	4.000	1.125
1325-675-500Z	675-000NT	1325-000N	5.000	1.125
1325-800-600Z	800-000NT	1325-000N	6.000	1.125
1325-1000-800Z	1000-000NT	1325-000N	8.000	1.125

SPECIFICATIONS

General: Nonrotatable with tapped or clearance bolt holes

Material

Flanges: 304 stainless steel
(316L available upon request)
Gaskets: Copper, Viton or silver plated
Bolts: 18-8 stainless steel or silver plated

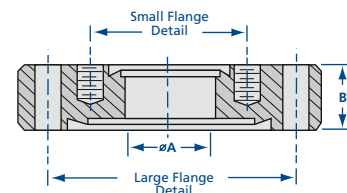
Torque: See page 48

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature range

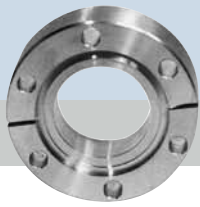
Metal seal: -200°C to 450°C
Elastomer seal: -20°C to 150°C



For gasket and hardware options please refer to appropriate flange page

Flange Detail Definitions

N = Nonrotatable, clearance bolt holes NT = Nonrotatable, tapped bolt holes



Flanges & Fittings

Aluminum to Stainless Steel Transitions

SPECIFICATIONS

General: Nonrotatable with clearance bolt holes

Material

Flanges: 304 stainless steel
(316L available upon request)
Gaskets: Copper, Viton or silver plated
Bolts: 18-8 stainless steel or silver plated

Torque: 190 inch/lbs.

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV
Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature range

Metal seal: -200°C to 450°C
Elastomer seal: -20°C to 150°C

Nor-Cal's new Aluminum to Stainless Steel Transitions provide a reliable UHV seal for aluminum vacuum systems. An explosion bonded composite of aluminum, stainless steel and two other UHV materials make these transitions leak tight at UHV pressures. Transitions are welded to a stainless steel CF flange as a complete unit ready to weld to your aluminum chamber or beamline, or the transition can be purchased separately for welding to your own CF flange.

The explosion bonds have been tested for tensile, shear and thermal stress. Testing included thermal quenching from 773°K to 77°K. This process has shown vacuum integrity to better than 5×10^{-10} standard cc per second with wall thickness as thin as 0.025". Each unit is thermally cycled to 300°C. Helium leak testing is done before and after thermal cycling.

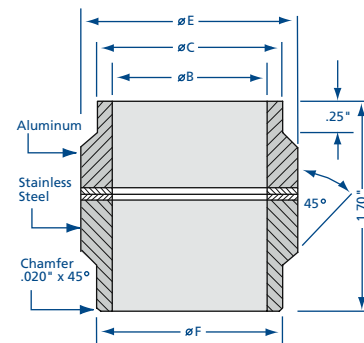
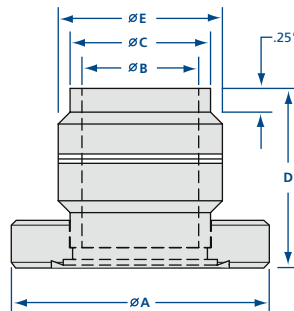


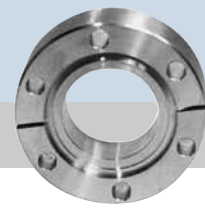
Applications

- Accelerators
- Synchrotrons
- Semiconductor processing

Aluminum to Stainless Steel Transitions

MODEL NUMBER	DESCRIPTION	A	B	C	D	E
ALST-075-CF	Nonrotatable CF	1.33	0.50	0.750	2.20	1.00
ALST-075	Transition only	-	0.50	0.750	-	1.00
ALST-150-CF	Nonrotatable CF	2.73	1.25	1.500	1.91	1.75
ALST-150	Transition only	-	1.25	1.500	-	1.75
ALST-250-CF	Nonrotatable CF	4.47	2.25	2.500	2.08	2.75
ALST-250	Transition only	-	2.25	2.500	-	2.75
ALST-400-CF	Nonrotatable CF	5.97	3.75	4.000	2.14	4.25
ALST-400	Transition only	-	3.75	4.000	-	4.25
ALST-600-CF	Nonrotatable CF	7.97	5.75	6.000	2.20	6.25
ALST-600	Transition only	-	5.75	6.000	-	6.25
ALST-800-CF	Nonrotatable CF	9.97	7.75	8.000	2.20	8.25
ALST-800	Transition only	-	7.75	8.000	-	8.25





Nor-Cal manufactures plate nuts for most sizes of CF flanges from 1 1/3 to 10 inches OD. These handy backing nuts center themselves over two adjacent bolt holes on the back side of a flange and can be held in place with one finger while bolts are tightened with a single wrench. Plate nuts are perfect for those hard to reach (and see) spaces that are encountered during system assembly and service.

Plate Nuts

MODEL NUMBER	FLANGE OD	THREAD SIZE	A	B	C	D
NP-075	1 1/3	8-32	0.80	0.3	0.53	0.15
NP-150	2 3/4	1/4-28	1.59	0.5	1.15	0.18
NP-200	3 3/8	5/16-24	1.75	0.5	1.09	0.22
NP-250	4 1/2	5/16-24	2.03	0.5	1.39	0.22
NP-300	4 5/8	5/16-24	1.75	0.5	1.25	0.22
NP-400	6	5/16-24	1.75	0.5	1.00	0.22
NP-600	8	5/16-24	1.75	0.5	1.12	0.22
NP-800	10	5/16-24	1.75	0.5	1.19	0.22

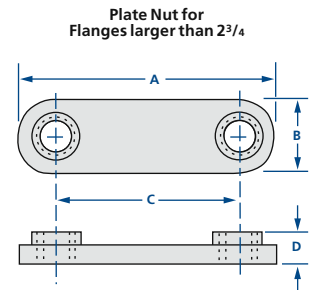
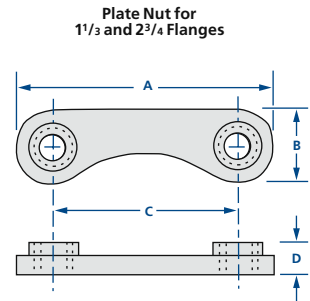
All plate nuts – 24 per package

Plate Nut Assembly Kits with Hex Head Bolts

MODEL NUMBER	FLANGE OD	DESCRIPTION
KNP-075	1 1/3	(12) Plate nuts (24) SS 8-32 x 3/4" bolts and washers
KNP-150	2 3/4	(12) Plate nuts (24) SS 1/4-28 x 1 1/4" bolts and washers
KNP-200	3 3/8	(16) Plate nuts (32) SS 5/16-24 x 1 3/4" bolts and washers
KNP-250	4 1/2	(16) Plate nuts (32) SS 5/16-24 x 2" bolts and washers
KNP-300	4 5/8	(20) Plate nuts (40) SS 5/16-24 x 2 1/4" bolts and washers
KNP-400	6	(16) Plate nuts (32) SS 5/16-24 x 2 1/4" bolts and washers
KNP-600	8	(16) Plate nuts (32) SS 5/16-24 x 2 1/4" bolts and washers
KNP-800	10	(24) Plate nuts (48) SS 5/16-24 x 2 1/2" bolts and washers

Plate Nut Assembly Kits with 12-pt. Bolts

MODEL NUMBER	FLANGE OD	DESCRIPTION
KNP-150-12	2 3/4	(12) Plate nuts (24) SS 12-pt. 1/4-28 x 1 1/4" bolts and washers
KNP-200-12	3 3/8	(16) Plate nuts (32) SS 12-pt. 5/16-24 x 1 3/4" bolts and washers
KNP-250-12	4 1/2	(16) Plate nuts (32) SS 12-pt. 5/16-24 x 2" bolts and washers
KNP-300-12	4 5/8	(20) Plate nuts (40) SS 12-pt. 5/16-24 x 2 1/4" bolts and washers
KNP-400-12	6	(16) Plate nuts (32) SS 12-pt. 5/16-24 x 2 1/4" bolts and washers
KNP-600-12	8	(20) Plate nuts (49) SS 12-pt. 5/16-24 x 2 1/4" bolts and washers
KNP-800-12	10	(24) Plate nuts (48) SS 12-pt. 5/16-24 x 2 1/2" bolts and washers





SPECIFICATIONS

General: Rotatable or nonrotatable with clearance bolt holes

Materials

Tube/Flanges: 304 stainless steel
(316L available on request)

Gaskets: Viton, copper or silver plated

Bolts: 18-8 stainless steel or silver plated

Torque: Refer to specific flange specs

Vacuum range

Metal seal: $\geq 1 \times 10^{-13}$ Torr - UHV

Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum

Temperature range

Metal seal: -200°C to 450°C

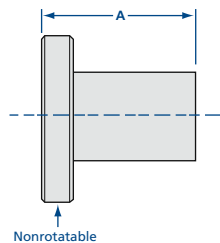
Elastomer: -20°C to 150°C



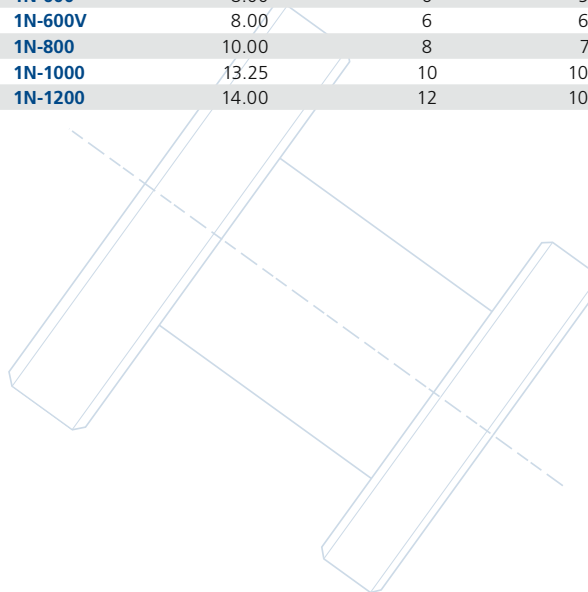
Nor-Cal manufactures a complete line of vacuum fittings with CF flanges. The tube portions are fabricated from 304 stainless steel. On request 316L stainless steel can be supplied. Nor-Cal makes its own elbows, and all tees and crosses are made with the pulled port technique. This allows smooth, crevice-free butt welds to provide the maximum in cleanliness for UHV applications. Bakeout range is up to 450°C.

Standard finish is bead blasted. Electropolish can also be provided as an option. Call for pricing.

CF Half Nipples



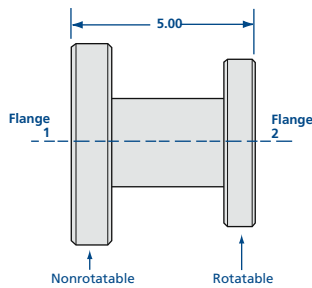
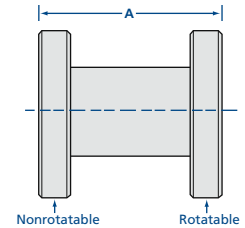
MODEL NUMBER	FLANGE OD	TUBE OD	A
1N-075	1.33	3/4	1.50
1N-100	2.12	1	2.05
1N-150	2.75	1 1/2	2.46
1N-200	3.38	2	3.22
1N-250	4.50	2 1/2	3.38
1N-250V	4.50	2 1/2	4.12
1N-300	4.62	3	3.53
1N-400	6.00	4	4.32
1N-400V	6.00	4	5.31
1N-600	8.00	6	5.50
1N-600V	8.00	6	6.56
1N-800	10.00	8	7.50
1N-1000	13.25	10	10.00
1N-1200	14.00	12	10.00





CF Full Nipples

MODEL NUMBER	FLANGE OD	TUBE OD	A
2N-075	1.33	3/4	3.00
2N-100	2.12	1	4.10
2N-150	2.75	1 1/2	4.92
2N-200	3.38	2	6.44
2N-250	4.50	2 1/2	6.76
2N-250V	4.50	2 1/2	8.24
2N-300	4.62	3	7.06
2N-400	6.00	4	8.64
2N-400V	6.00	4	10.62
2N-600	8.00	6	11.00
2N-600V	8.00	6	13.12
2N-800	10.00	8	15.00
2N-1000	13.25	10	20.00
2N-1200	14.00	12	20.00



CF Reducer Nipples

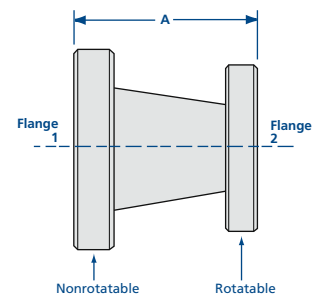
MODEL NUMBER	FLANGE 1 OD	FLANGE 2 OD	TUBE OD
2NR-600-275	6.00	2 3/4	1.50
2NR-800-275	8.00	2 3/4	1.50
2NR-800-450	8.00	4 1/2	2.50
2NR-800-600	8.00	6	4.00
2NR-1000-275	10.00	2 3/4	1.50
2NR-1000-450	10.00	4 1/2	2.50
2NR-1000-600	10.00	6	4.00
2NR-1000-800	10.00	8	6.00
2NR-1325-1000	13.25	10	8.00
2NR-1400-1200	14.00	12	10.00

Note: Reducer nipples with other CF flanges and different lengths are available upon request.



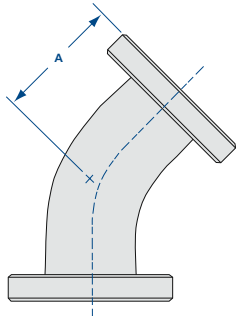
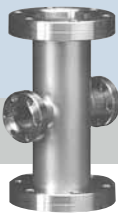
CF Conical Reducer Nipples

MODEL NUMBER	FLANGE 1 OD	FLANGE 1 TUBE OD	FLANGE 2 OD	FLANGE 2 TUBE OD	A
2NRC-212-133	2.12	1	1.33	3/4	2.04
2NRC-275-133	2.75	1 1/2	1.33	3/4	3.08
2NRC-275-212	2.75	1 1/2	2.12	1	2.75
2NRC-338-212	3.38	2	2.12	1	2.77
2NRC-338-275	3.38	2	2.75	1 1/2	2.81
2NRC-450-275	4.50	2 1/2	2.75	1 1/2	2.96
2NRC-450-338	4.50	2 1/2	3.38	2	2.98
2NRC-462-275	4.62	3	2.75	1 1/2	4.12
2NRC-462-338	4.62	3	3.38	2	4.13
2NRC-462-450	4.62	3	4.50	2 1/2	4.28
2NRC-600-338	6.00	4	3.38	2	4.29
2NRC-600-450	6.00	4	4.50	2 1/2	4.44
2NRC-600-462	6.00	4	4.62	3	4.34



Flanges & Fittings

CF Fittings



Both Flanges Rotatable

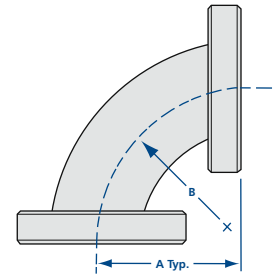
CF 45° Radius Elbow with Tangents

MODEL NUMBER	FLANGE OD	TUBE OD	A
2KL-075	1.33	3/4	0.94
2KL-100	2.12	1	1.14
2KL-150	2.75	1 1/2	1.74
2KL-200	3.38	2	2.07
2KL-250	4.50	2 1/2	3.37
2KL-300	4.62	3	3.96
2KL-400	6.00	4	5.22



CF 90° Radius Elbows

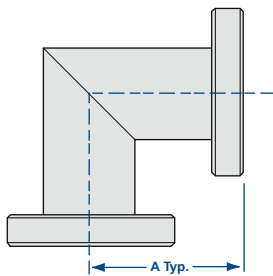
MODEL NUMBER	FLANGE OD	TUBE OD	A	B
2E-075	1.33	3/4	1.50	1.00
2E-100	2.12	1	1.67	1.50
2E-150	2.75	1 1/2	2.46	2.25
2E-200	3.38	2	3.22	3.00
2E-250	4.50	2 1/2	4.12	3.75
2E-300	4.62	3	4.78	4.50
2E-400	6.00	4	6.44	6.00
2E-600	8.00	6	9.50	9.00
2E-800	10.00	8	12.50	12.00
2E-1000	13.25	10	15.50	15.00



Both Flanges Rotatable

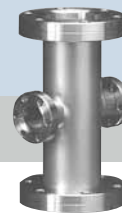
CF 90° Mitered Elbows

MODEL NUMBER	FLANGE OD	TUBE OD	A
2E-075M	1.33	3/4	1.50
2E-100M	2.12	1	2.05
2E-150M	2.75	1 1/2	2.46
2E-200M	3.38	2	3.22
2E-250M	4.50	2 1/2	3.38
2E-250MV	4.50	2 1/2	4.12
2E-300M	4.62	3	3.53
2E-400M	6.00	4	4.32
2E-400MV	6.00	4	5.31
2E-500M	6.75	5	4.71
2E-600M	8.00	6	5.50
2E-600MV	8.00	6	6.56
2E-800M	10.00	8	7.50
2E-1000M	13.25	10	10.00



Both Flanges Rotatable

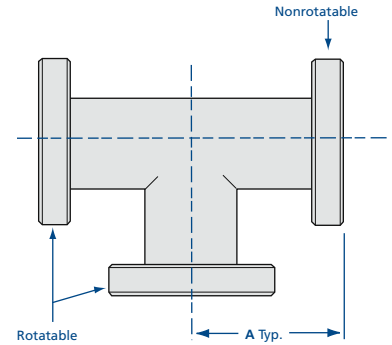




CF Tees

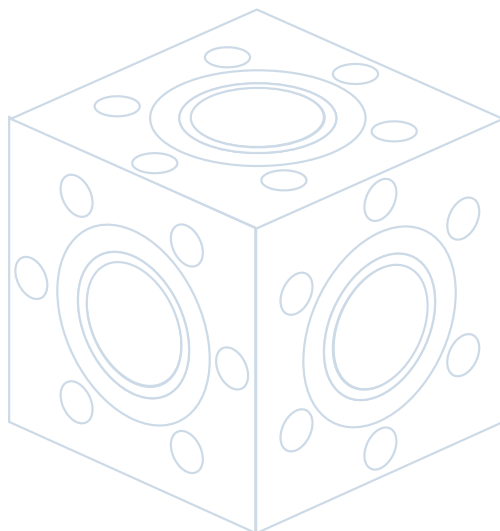
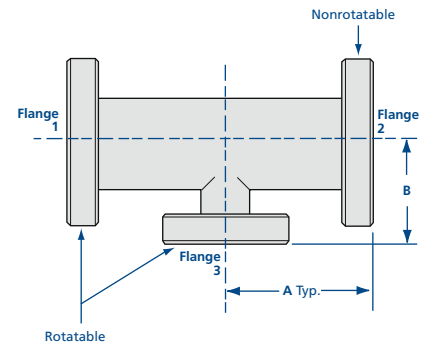
MODEL NUMBER	FLANGE OD	TUBE OD	A
3T-075	1.33	3/4	1.50
3T-100	2.12	1	2.05
3T-150	2.75	1 1/2	2.46
3T-200	3.38	2	3.22
3T-250	4.50	2 1/2	3.38
3T-250V	4.50	2 1/2	4.12
3T-300	4.62	3	3.53
3T-400	6.00	4	4.32
3T-400V	6.00	4	5.31
3T-500	6.75	5	4.71
3T-600	8.00	6	5.50
3T-600V	8.00	6	6.56
3T-800	10.00	8	7.50
3T-1000	13.25	10	10.00

Note: Reducer tees in other tube sizes are available upon request.



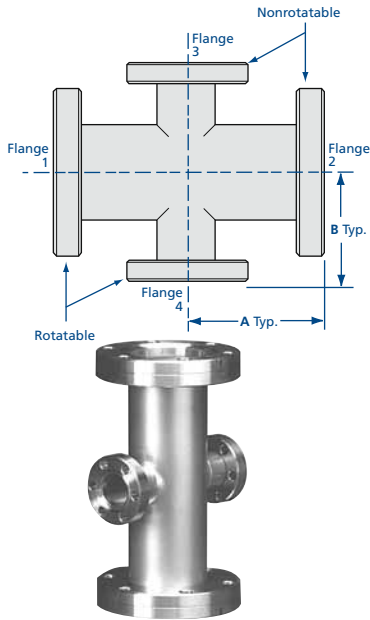
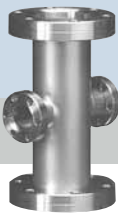
CF Reducer Tees

MODEL NUMBER	FLANGE 1 & 2 FLANGE OD	FLANGE 1 & 2 TUBE OD	FLANGE 3 FLANGE OD	FLANGE 3 TUBE OD	A	B
3TR-150-075	2.75	1 1/2	1.33	3/4	2.46	1.87
3TR-150-100	2.75	1 1/2	2.12	1	2.46	2.29
3TR-200-075	3.38	2	1.33	3/4	3.22	2.13
3TR-200-150	3.38	2	2.75	1 1/2	3.22	2.71
3TR-250-150	4.50	2 1/2	2.75	1 1/2	3.38	2.96
3TR-250-200	4.50	2 1/2	3.38	2	3.38	3.48
3TR-300-200	4.62	3	3.38	2	3.53	3.73
3TR-300-250	4.62	3	4.50	2 1/2	3.53	3.63
3TR-400-150	6.00	4	2.75	1 1/2	4.32	3.71
3TR-400-200	6.00	4	3.38	2	4.32	4.23
3TR-400-250	6.00	4	4.50	2 1/2	4.32	4.13
3TR-400-300	6.00	4	4.62	3	4.32	4.03
3TR-500-400	6.75	5	6.00	4	4.71	4.82
3TR-600-150	8.00	6	2.75	1 1/2	5.50	4.71
3TR-600-200	8.00	6	3.38	2	5.50	5.23
3TR-600-250	8.00	6	4.50	2 1/2	5.50	5.13
3TR-600-400	8.00	6	6.00	4	5.50	5.32
3TR-800-600	10.00	8	8.00	6	7.50	6.50



Flanges & Fittings

CF Fittings



CF Reducer Crosses

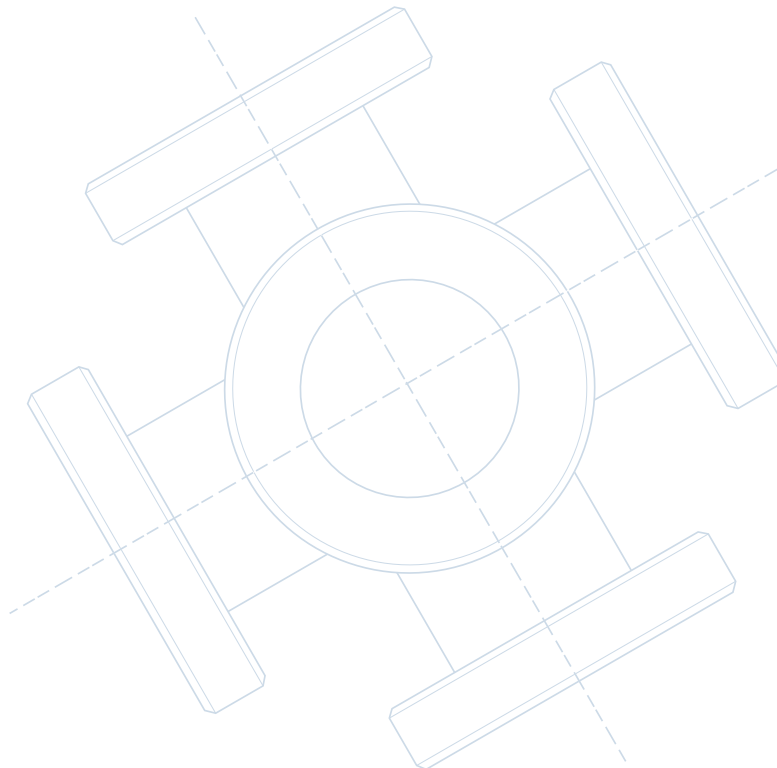
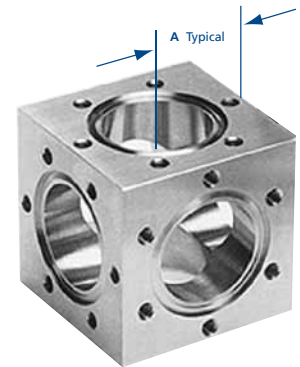
MODEL NUMBER	FLANGE 1 & 2 FLANGE OD	FLANGE 1 & 2 TUBE OD	FLANGE 3 & 4 FLANGE OD	FLANGE 3 & 4 TUBE OD	A	B
4CR-150-075	2.75	1½	1.33	¾	2.46	1.87
4CR-150-100	2.75	1½	2.12	1	2.46	2.29
4CR-200-075	3.38	2	1.33	¾	3.22	2.13
4CR-200-150	3.38	2	2.75	1½	3.22	2.71
4CR-250-150	4.50	2½	2.75	1½	3.38	2.96
4CR-250-200	4.50	2½	3.38	2	3.38	3.48
4CR-300-200	4.62	3	3.38	2	3.53	3.73
4CR-300-250	4.62	3	4.50	2½	3.53	3.63
4CR-400-150	6.00	4	2.75	1½	4.32	3.71
4CR-400-200	6.00	4	3.38	2	4.32	4.23
4CR-400-250	6.00	4	4.50	2½	4.32	4.13
4CR-400-300	6.00	4	4.62	3	4.32	4.03
4CR-500-400	6.75	5	6.00	4	4.71	4.82
4CR-600-150	8.00	6	2.75	1½	5.50	4.71
4CR-600-200	8.00	6	3.38	2	5.50	5.23
4CR-600-250	8.00	6	4.50	2½	5.50	5.13
4CR-600-400	8.00	6	6.00	4	5.50	5.32
4CR-800-600	10.00	8	8.00	6	7.50	6.50

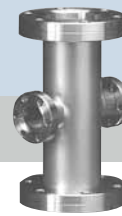
Note: Other reducer combinations can be supplied upon request.

CF 6-Way Cube Crosses

MODEL NUMBER	NOMINAL FLANGE SIZE	A
6C-075-CU	1.33	0.67
6C-150-CU	2.75	1.37
6C-250-CU	4.50	2.24
6C-400-CU	6.00	2.98
6C-600-CU	8.00	3.98

Note: Cube crosses are available in other sizes upon request

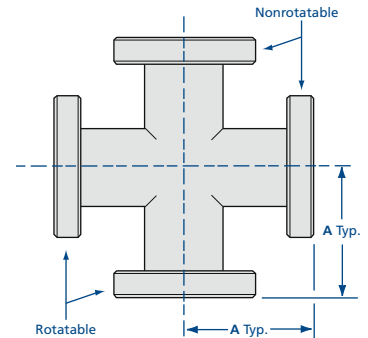




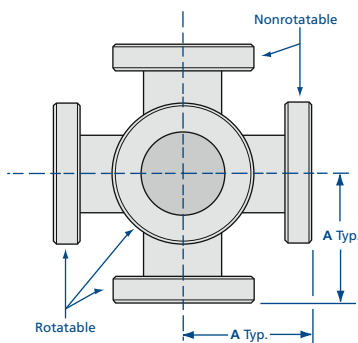
CF 4-Way Crosses



MODEL NUMBER	FLANGE OD	TUBE OD	A
4C-075	1.33	3/4	1.50
4C-100	2.12	1	2.05
4C-150	2.75	1 1/2	2.46
4C-200	3.38	2	3.22
4C-250	4.50	2 1/2	3.38
4C-250V	4.50	2 1/2	4.12
4C-300	4.62	3	3.53
4C-400	6.00	4	4.32
4C-400V	6.00	4	5.31
4C-500	6.75	5	4.71
4C-600	8.00	6	5.50
4C-600V	8.00	6	6.56
4C-800	10.00	8	7.50
4C-1000	13.25	10	10.00



CF 5-Way Crosses



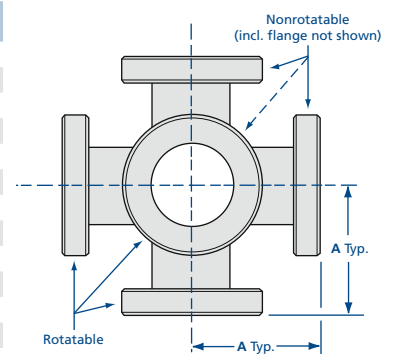
MODEL NUMBER	FLANGE OD	TUBE OD	A
5C-075	1.33	3/4	1.50
5C-100	2.12	1	2.05
5C-150	2.75	1 1/2	2.46
5C-200	3.38	2	3.22
5C-250	4.50	2 1/2	3.38
5C-250V	4.50	2 1/2	4.12
5C-300	4.62	3	3.53
5C-400	6.00	4	4.32
5C-400V	6.00	4	5.31
5C-500	6.75	5	4.71
5C-600	8.00	6	5.50
5C-600V	8.00	6	6.56
5C-800	10.00	8	7.50
5C-1000	13.25	10	10.00

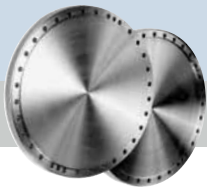


CF 6-Way Crosses



MODEL NUMBER	FLANGE OD	TUBE OD	A
6C-075	1.33	3/4	1.50
6C-100	2.12	1	2.05
6C-150	2.75	1 1/2	2.46
6C-200	3.38	2	3.22
6C-250	4.50	2 1/2	3.38
6C-250V	4.50	2 1/2	4.12
6C-300	4.62	3	3.53
6C-400	6.00	4	4.32
6C-400V	6.00	4	5.31
6C-500	6.75	5	4.71
6C-600	8.00	6	5.50
6C-600V	8.00	6	6.56
6C-800	10.00	8	7.50
6C-1000	13.25	10	10.00





Flanges & Fittings

Wire Seal Flanges

SPECIFICATIONS

General: Nonrotatable flanges with clearance bolt holes

Nominal OD sizes: 12³/₈ to 27¹/₈ inches

Tube OD sizes: 10 to 24 inches

Materials

Flange: 304 stainless steel
(316L available on request)

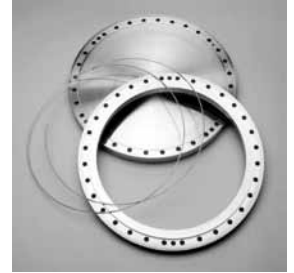
Gaskets: Copper

Bolts: 18-8 stainless steel

Vacuum range: ≥1 x 10⁻¹³ Torr - UHV

Temperature range: -200° to 450°C

Nor-Cal's wire seal flanges are designed for use on bell jars, custom vacuum chambers and related systems. Standard sizes range from 12 to 27 inch nominal OD for tube sizes from 10 to 24 inch OD. A male and female flange compress a 0.080 inch diameter OFHC copper wire to effect a seal. Gasket flow is confined by the geometry of the flange surfaces to the area of the seal. Minor nicks and scratches within this contact area are filled with crushed copper wire providing a seal that is leak tight at 10⁻¹³ Torr after repeated bake out to 450°C. Solid blanks are standard. Dished head blanks are offered as a lower cost alternative.

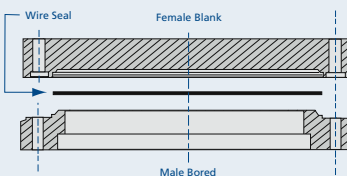


Wire Seal Flanges

MODEL NUMBER	OD A	B	C	D	E	F	BOLT HOLES
WS-12-000M	12.375	-	-	1.13	-	11.343	24
WS-12-1000M	12.375	9.750	10.020	1.13	0.630	11.343	24
WS-12-000F	12.375	-	-	1.13	-	11.343	24
WS-12-1000F	12.375	9.750	10.020	1.13	0.630	11.343	24
WS-14-000M	14.625	-	-	1.13	-	13.593	32
WS-14-1200M	14.625	11.750	12.020	1.13	0.630	13.593	32
WS-14-000F	14.625	-	-	1.13	-	13.593	32
WS-14-1200F	14.625	11.750	12.020	1.13	0.630	13.593	32
WS-17-000M	17.250	-	-	1.13	-	15.718	36
WS-17-1400M	17.250	13.750	14.020	1.13	0.630	15.718	36
WS-17-000F	17.250	-	-	1.13	-	15.718	36
WS-17-1400F	17.250	13.750	14.020	1.13	0.630	15.718	36
WS-19-000M	19.562	-	-	1.31	-	17.875	36
WS-19-1600M	19.562	15.750	16.020	1.31	0.630	17.875	36
WS-19-000F	19.562	-	-	1.31	-	17.875	36
WS-19-1600F	19.562	15.750	16.020	1.31	0.630	17.875	36
WS-22-000M	22.125	-	-	1.50	-	20.187	36
WS-22-1800M	22.125	17.750	18.020	1.50	1.000	20.187	36
WS-22-000F	22.125	-	-	1.50	-	20.187	36
WS-22-1800F	22.125	17.750	18.020	1.50	1.000	20.187	36
WS-27-000M	27.125	-	-	1.75	-	25.843	40
WS-27-2400M	27.125	23.625	24.020	1.75	1.125	25.843	40
WS-27-000F	27.125	-	-	1.75	-	25.843	40
WS-27-2400F	27.125	23.625	24.020	1.75	1.125	25.843	40

Wire Seal Flange Assembly Instructions

- Apply a small amount of high temperature anti-seize compound to the bolt threads.
- Check that both flange surfaces are clean and sealing edges are free from nicks and scratches.
- Using clean, lint free gloves, unpack gasket.
- Place seal over the sealing area on the male flange.
- Align the mating flange hole pattern and leak test grooves.
- Install the proper bolts and tighten hand tight. Check to see that the flange faces are parallel.
- Tighten the bolts 1/4 to 1/2 turns using a circular clockwise pattern until the flange faces are metal to metal.
- Torque the fasteners until leak tight using the same pattern. Never exceed maximum torque.

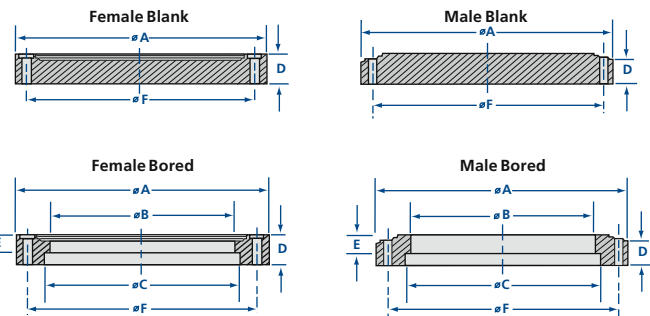


Torque Specifications

NOMINAL OD	BOLT SIZE	MAX. TORQUE INCH POUNDS
12	3/8 - 24	260
14	3/8 - 24	260
17	1/2 - 20	541
19	1/2 - 20	541
22	5/8 - 18	1,244
27	5/8 - 18	1,244

Model Number Definitions

M = Male flange F = Female flange



Wire Seal Flange Gaskets and Bolt Sets

MODEL NUMBER	FLANGE OD	DESCRIPTION	QUANTITY
WG-12	12.375	Copper gasket	1
WB-12	12.375	SS 3/8-24 x 2 1/2 bolts and nuts	24
WG-14	14.625	Copper gasket	1
WB-14	14.625	SS 3/8-24 x 2 1/2 bolts and nuts	32
WG-17	17.250	Copper gasket	1
WB-17	17.250	SS 1/2-20 x 2 3/4 bolts and nuts	36
WG-19	19.562	Copper gasket	1
WB-19	19.562	SS 1/2-20 x 3 bolts and nuts	36
WG-22	22.125	Copper gasket	1
WB-22	22.125	SS 5/8-18 x 3 1/2 bolts and nuts	36
WG-27	27.125	Copper gasket	1
WB-27	27.125	SS 5/8-18 x 4 bolts and nuts	40

All dimensions are called out in inches unless otherwise noted