

Flanges & Fittings

Section Two



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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



Flanges & Fittings

ISO Flange General Information



SPECIFICATIONS

General: Optional fastener or nonrotatable flanges with clearance bolt holes

Nominal OD sizes: ISO-63 to ISO-500

Tube OD sizes: 2 1/2 to 20 inches

Materials

Flange: 304 or 316L stainless steel

O-rings: Viton, Buna

Bolts: 18-8 stainless steel

Vacuum range

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

Metal seal: $\geq 1 \times 10^{-11}$ Torr - UHV

Temperature range

Viton: -20°C to 200°C

Buna: -30°C to 110°C

Metal seal: -270°C to 150°C

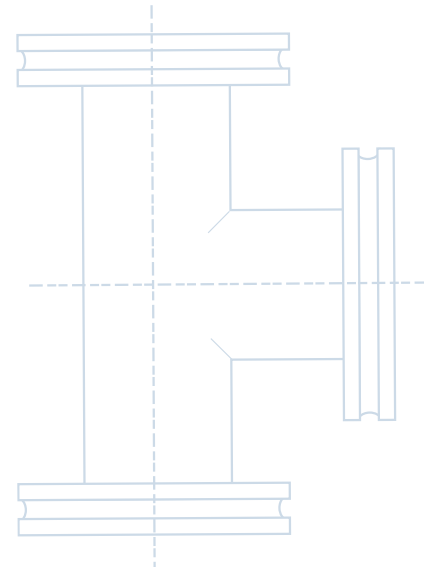
Nor-Cal ISO flanges and hardware are manufactured to the International Standards Organization specification so they can be mated to other manufacturers' ISO flanges. ISO flanges are made from Argon Oxygen Decarburization (AOD) 304 stainless steel. This material is certified to meet ASTM-240 and has less than 0.01% sulfur in order to prevent sulfur stringers. Grain size is 3 to 6 per ASTM E-112.

Maximum inclusion size is 2.5 per ASTM E-45. Normally our standard material is in the low carbon range for 304 stainless steel. For increased corrosion resistance, some sizes are available from stock in 316L stainless steel.

Optional fastener and nonrotatable ISO flanges are available from stock for 2 1/2 to 20 inch tube sizes. Both use a Viton

O-ring, held in place by a centering ring, to effect a seal with a vacuum range of 10^{-8} Torr. ISO components can be baked to 204°C.

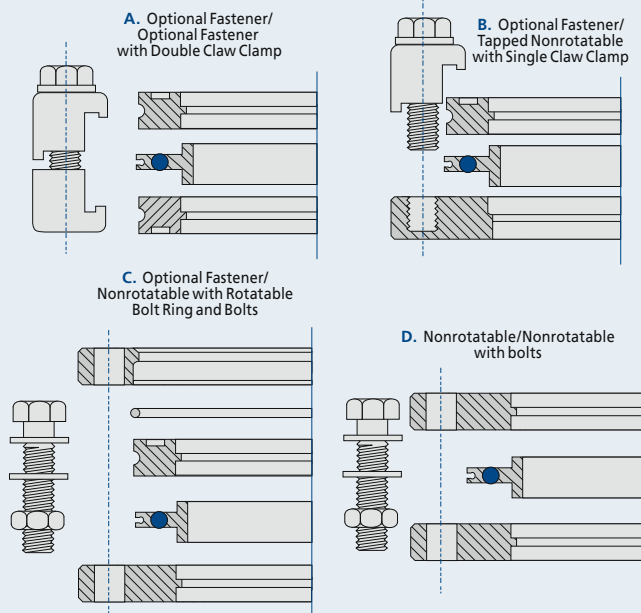
ISO flanges can also be used with standard clamps and aluminum seals to obtain a UHV seal bakeable to 150°C. Seals are described in detail in Section 2.1 of this catalog.

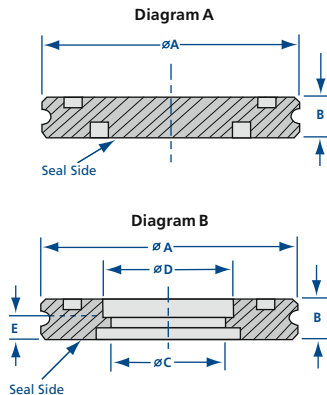


All dimensions are in inches unless otherwise noted

ISO Flange Assembly Instructions

Optional fastener flanges are joined around the periphery with clamps. Double claw clamps are used when a pair of OF flanges are joined (See diagram A.), or single claw clamps are used to join an OF flange to a tapped nonrotatable on a pump or gate valve. (See diagram B.) This fastening method allows the OF flange to be rotated for ease of component alignment. Additionally, a rotatable bolt ring can be used to fasten an OF flange to a nonrotatable flange using bolts. (See diagram C.) A retainer ring prevents the OF flange from slipping through the bolt ring. Nonrotatable ISO flanges are assembled with bolts. (See diagram D.) They do not allow rotation of bolt holes on mating flanges to align components.





ISO Optional Fastener Flanges

MODEL NUMBER	DIAGRAM	NOMINAL ID	A	B	C	D	E
ISO-63-000-OF	A	-	3.740	0.47	-	-	-
ISO-63-250-OF	B	2 1/2	3.740	0.47	2.438	2.510	0.250
ISO-80-000-OF	A	-	4.331	0.47	-	-	-
ISO-80-300-OF	B	3	4.331	0.47	2.938	3.010	0.250
ISO-100-000-OF	A	-	5.118	0.47	-	-	-
ISO-100-400-OF	B	4	5.118	0.47	3.910	4.010	0.250
ISO-160-000-OF	A	-	7.087	0.47	-	-	-
ISO-160-600-OF	B	6	7.087	0.47	5.875	6.020	0.375
ISO-200-000-OF	A	-	9.449	0.47	-	-	-
ISO-200-800-OF	B	8	9.449	0.47	7.875	8.020	0.375
ISO-250-000-OF	A	-	11.417	0.47	-	-	-
ISO-250-1000-OF	B	10	11.417	0.47	9.875	10.020	0.375
ISO-320-000-OF	A	-	14.567	0.67	-	-	-
ISO-320-1200-OF	B	12	14.567	0.67	11.875	12.020	0.375
ISO-320-1275-OF	B	12	14.567	0.67	12.420	12.770	0.375
ISO-400-000-OF	A	-	17.716	0.67	-	-	-
ISO-400-1600-OF	B	16	17.716	0.67	15.624	16.020	0.375
ISO-500-000-OF	A	-	21.653	0.67	-	-	-
ISO-500-2000-OF	B	20	21.653	0.67	19.624	20.020	0.375

ISO 316L Optional Fastener Flanges

MODEL NUMBER	DIAGRAM	NOMINAL ID	A	B	C	D	E
ISO-63-250-OF-316L	B	2 1/2	3.740	0.47	2.438	2.510	0.250
ISO-80-300-OF-316L	B	3	4.331	0.47	2.938	3.010	0.250
ISO-100-400-OF-316L	B	4	5.118	0.47	3.910	4.010	0.250

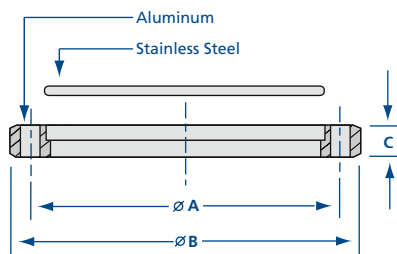


ISO Rotatable Bolt Ring and Retainer Ring

MODEL NUMBER	FLANGE SIZE	A	B	C
ISO-63-BR	ISO-63	4.331	5.118	0.472
ISO-80-BR	ISO-80	4.921	5.709	0.472
ISO-100-BR	ISO-100	5.709	6.496	0.472
ISO-160-BR	ISO-160	7.874	8.858	0.630
ISO-200-BR	ISO-200	10.236	11.220	0.630
ISO-250-BR	ISO-250	12.205	13.189	0.630
ISO-320-BR	ISO-320	15.551	16.732	0.787
ISO-400-BR	ISO-400	18.898	20.079	0.787
ISO-500-BR	ISO-500	22.835	24.016	0.787

Replacement Retainer Ring

MODEL NUMBER
ISO-63-RR
ISO-80-RR
ISO-100-RR
ISO-160-RR
ISO-200-RR
ISO-250-RR
ISO-320-RR
ISO-400-RR
ISO-500-RR



SPECIFICATIONS

General: Optional fastener or nonrotatable flanges with clearance bolt holes

Nominal OD sizes: ISO-63 to ISO-500

Tube OD sizes: 2 1/2 to 20 inches

Materials

Flange: 304 or 316L stainless steel
O-rings: Viton, Buna
Bolts: 18-8 stainless steel

Vacuum range

Elastomer seal: $\geq 1 \times 10^{-8}$ Torr - High vacuum
Metal seal: $\geq 1 \times 10^{-11}$ Torr - UHV

Temperature range

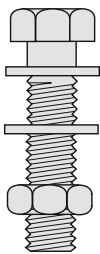
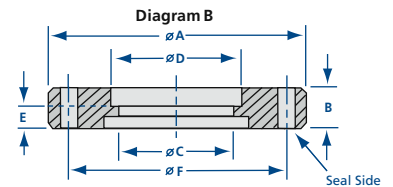
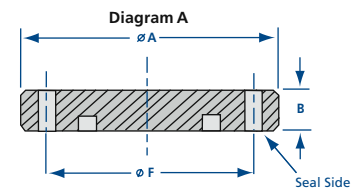
Viton: -20°C to 200°C
Silicone: -50° to 230°C
Buna: -30°C to 110°C
Metal seal: -270°C to 150°C

See Section 2.1 for metal seals



ISO Nonrotatable Flanges

MODEL NUMBER	DIAGRAM	NOMINAL ID	A	B	C	D	E	F	BOLT HOLES	BOLT DIAMETER
ISO-63-000N	A	-	5.118	0.472	-	-	-	4.331	4	0.359
ISO-63-250N	B	2½	5.118	0.472	2.438	2.510	0.250	4.331	4	0.359
ISO-80-000N	A	-	5.709	0.472	-	-	-	4.921	8	0.359
ISO-80-300N	B	3½	5.709	0.472	2.938	3.010	0.250	4.921	8	0.359
ISO-100-000N	A	-	6.496	0.472	-	-	-	5.709	8	0.359
ISO-100-400N	B	4	6.496	0.472	3.910	4.010	0.250	5.709	8	0.359
ISO-160-000N	A	-	8.858	0.630	-	-	-	7.874	8	0.438
ISO-160-600N	B	6	8.858	0.630	5.875	6.020	0.375	7.874	8	0.438
ISO-200-000N	A	-	11.220	0.630	-	-	-	10.236	12	0.438
ISO-200-800N	B	8	11.220	0.630	7.875	8.020	0.375	10.236	12	0.438
ISO-250-000N	A	-	13.189	0.630	-	-	-	12.205	12	0.438
ISO-250-1000N	B	10	13.189	0.630	9.875	10.020	0.375	12.205	12	0.438
ISO-320-000N	A	-	16.732	0.787	-	-	-	15.551	12	0.551
ISO-320-1200N	B	12	16.732	0.787	11.760	12.020	0.375	15.551	12	0.551
ISO-320-1275N	B	12	16.732	0.787	12.420	12.770	0.375	15.551	12	0.551
ISO-400-000N	A	-	20.079	0.787	-	-	-	18.898	16	0.551
ISO-400-1600N	B	16	20.079	0.787	15.642	16.020	0.375	18.898	16	0.551
ISO-500-000N	A	-	24.016	0.787	-	-	-	22.835	16	0.551
ISO-500-2000N	B	20	24.016	0.787	19.642	20.020	0.375	22.835	16	0.551



ISO Bolt Kits

MODEL NUMBER	DESCRIPTION
B-ISO-63	(4) SS bolts, nuts & washers, M8 x 40mm
B-ISO-80	(8) SS bolts, nuts & washers, M8 x 40mm
B-ISO-100	(8) SS bolts, nuts & washers, M8 x 40mm
B-ISO-160	(8) SS bolts, nuts & washers, M10 x 50mm
B-ISO-200	(12) SS bolts, nuts & washers, M10 x 50mm
B-ISO-250	(12) SS bolts, nuts & washers, M10 x 50mm
B-ISO-320	(12) SS bolts, nuts & washers, M12 x 60mm
B-ISO-400	(16) SS bolts, nuts & washers, M12 x 60mm
B-ISO-500	(16) SS bolts, nuts & washers, M12 x 60mm

SPECIFICATIONS

General: Optional fastener or nonrotatable flanges with clearance bolt holes

Nominal OD sizes: ISO-63 to ISO-500

Tube OD sizes: 2½ to 20 inches

Materials

Flange: 304 or 316L stainless steel

O-rings: Viton, Buna

Bolts: 18-8 stainless steel

Vacuum range

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

Metal seal: $\geq 1 \times 10^{-11}$ Torr - UHV

Temperature range

Viton: -20°C to 200°C

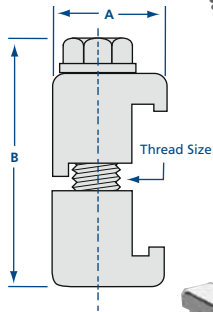
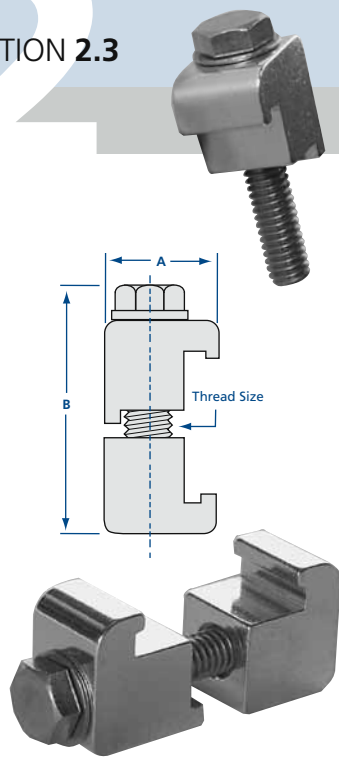
Buna: -30°C to 110°C

Metal seal: -270°C to 150°C

See Section 2.1 for metal seals

Flanges & Fittings

ISO Clamps

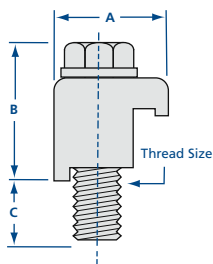


ISO Double Claw Aluminum Clamps

MODEL NUMBER	FLANGE SIZE	A	B	THREAD SIZE	CLAMPS REQUIRED
ISO-63-DCP	ISO-63	0.94	1.96	5/16-18	3-4
ISO-80-DCP	ISO-80	0.94	1.96	5/16-18	4-8
ISO-100-DCP	ISO-100	0.94	1.96	5/16-18	4-8
ISO-160-DCP	ISO-160	1.10	1.96	5/16-18	4-8
ISO-200-DCP	ISO-200	1.10	1.96	5/16-18	6-12
ISO-250-DCP	ISO-250	1.10	1.96	5/16-18	6-12
ISO-320-DCP	ISO-320	1.34	2.20	7/16-14	8-12
ISO-400-DCP	ISO-400	1.34	2.20	7/16-14	8-16
ISO-500-DCP	ISO-500	1.34	2.20	7/16-14	12-16

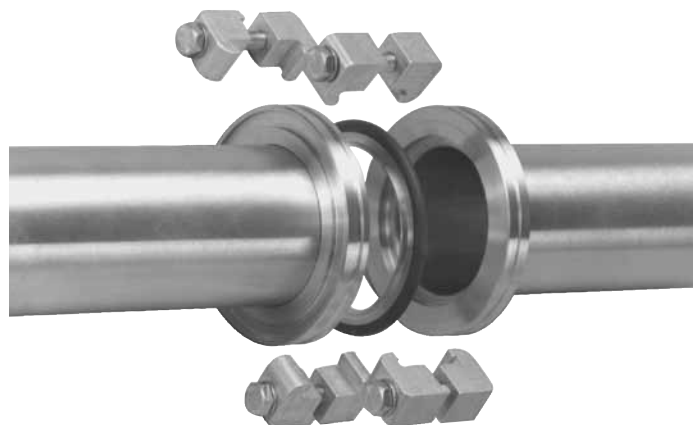
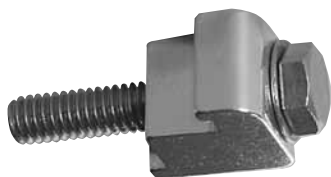
ISO Single Claw Aluminum Clamps

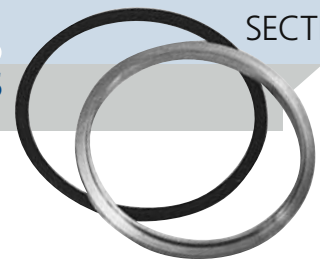
MODEL NUMBER	FLANGE SIZE	A	B	C	THREAD SIZE	CLAMPS REQUIRED
ISO-63-SCP	ISO-63	0.94	1.18	0.52	5/16-18	4
ISO-80-SCP	ISO-80	0.94	1.18	0.52	5/16-18	8
ISO-100-SCP	ISO-100	0.94	1.18	0.52	5/16-18	8
ISO-160-SCP	ISO-160	1.10	1.18	0.52	5/16-18	8
ISO-200-SCP	ISO-200	1.10	1.18	0.52	5/16-18	12
ISO-250-SCP	ISO-250	1.10	1.18	0.52	5/16-18	12
ISO-320-SCP	ISO-320	1.34	1.46	0.88	7/16-14	12
ISO-400-SCP	ISO-400	1.34	1.46	0.88	7/16-14	16
ISO-500-SCP	ISO-500	1.34	1.46	0.88	7/16-14	16



ISO Single Claw Aluminum Clamps – Metric

MODEL NUMBER	FLANGE SIZE	A	B	C	METRIC THREAD SIZE	CLAMPS REQUIRED
ISO-63-SCP-M	ISO-63	0.94	1.20	0.40	M8 x 1.25	4
ISO-80-SCP-M	ISO-80	0.94	1.20	0.40	M8 x 1.25	8
ISO-100-SCP-M	ISO-100	0.94	1.20	0.40	M8 x 1.25	8
ISO-160-SCP-M	ISO-160	1.10	1.20	0.40	M10 x 1.50	8
ISO-200-SCP-M	ISO-200	1.10	1.20	0.40	M10 x 1.50	12
ISO-250-SCP-M	ISO-250	1.10	1.20	0.40	M10 x 1.50	12
ISO-320-SCP-M	ISO-320	1.34	1.48	0.79	M12 x 1.75	12
ISO-400-SCP-M	ISO-400	1.34	1.48	0.79	M12 x 1.75	16
ISO-500-SCP-M	ISO-500	1.34	1.48	0.79	M12 x 1.75	16

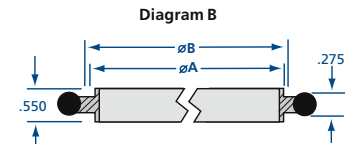
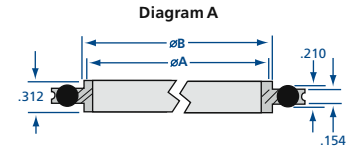




ISO Aluminum Centering Rings with O-ring and Aluminum Spacer Ring

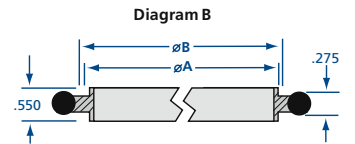
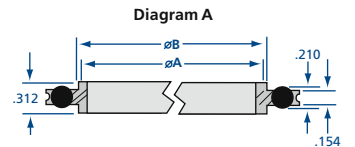
MODEL NUMBER	DIAGRAM	O-RING MATERIAL	A	B
ISO-63-CR-AV*	A	Viton	2.63	2.74
ISO-63-CR-AB*	A	Buna	2.63	2.74
ISO-80-CR-AV	A	Viton	3.14	3.25
ISO-80-CR-AB	A	Buna	3.14	3.25
ISO-100-CR-AV	A	Viton	3.89	4.00
ISO-100-CR-AB	A	Buna	3.89	4.00
ISO-160-CR-AV	A	Viton	5.90	6.01
ISO-160-CR-AB	A	Buna	5.90	6.01
ISO-200-CR-AV	A	Viton	8.26	8.37
ISO-200-CR-AB	A	Buna	8.26	8.37
ISO-250-CR-AV	A	Viton	10.14	10.25
ISO-250-CR-AB	A	Buna	10.14	10.25
ISO-320-CR-AV	B	Viton	12.32	12.51
ISO-320-CR-AB	B	Buna	12.32	12.51
ISO-400-CR-AV	B	Viton	15.55	15.75
ISO-400-CR-AB	B	Buna	15.55	15.75
ISO-500-CR-AV	B	Viton	19.53	19.72
ISO-500-CR-AB	B	Buna	19.53	19.72

*Machined centering ring.



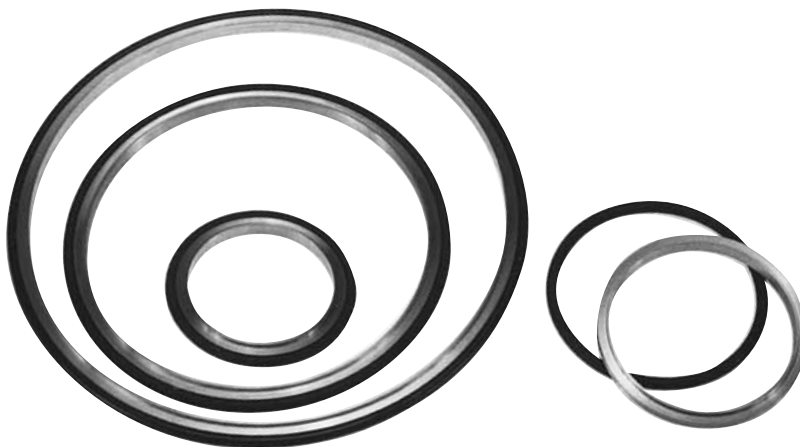
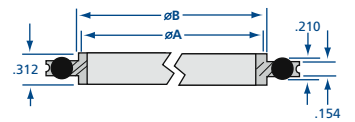
ISO Stainless Steel Centering Rings with O-ring and Aluminum Spacer Ring

MODEL NUMBER	DIAGRAM	O-RING MATERIAL	A	B
ISO-63-CR-SV	A	Viton	2.63	2.74
ISO-80-CR-SV	A	Viton	3.14	3.25
ISO-100-CR-SV	A	Viton	3.89	4.00
ISO-160-CR-SV	A	Viton	5.90	6.01
ISO-200-CR-SV	A	Viton	8.26	8.37
ISO-250-CR-SV	A	Viton	10.14	10.25
ISO-320-CR-SV	B	Viton	12.36	12.52
ISO-400-CR-SV	B	Viton	15.55	15.75



ISO 316L Stainless Steel Centering Rings with O-ring and Aluminum Spacer Ring

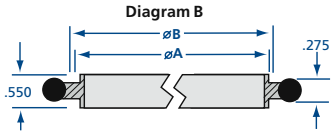
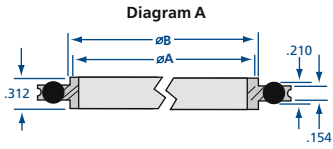
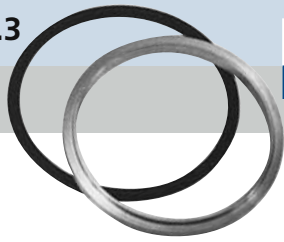
MODEL NUMBER	O-RING MATERIAL	A	B
ISO-63-CR-SV-316L	Viton	2.63	2.74
ISO-80-CR-SV-316L	Viton	3.14	3.25
ISO-100-CR-SV-316L	Viton	3.89	4.00



See next page for replacement O-rings
See Section 2.1 for metal seals

Flanges & Fittings

ISO Centering Rings

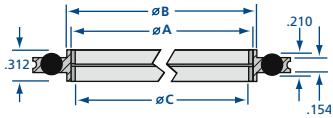


ISO Stainless Steel Centering Rings with O-ring

MODEL NUMBER	DIAGRAM	O-RING MATERIAL	A	B
ISO-63-CR	A	Viton	2.63	2.74
ISO-80-CR	A	Viton	3.14	3.25
ISO-100-CR	A	Viton	3.89	4.00
ISO-160-CR	A	Viton	5.90	6.01
ISO-200-CR	A	Viton	8.26	8.37
ISO-250-CR	A	Viton	10.14	10.25
ISO-320-CR	B	Viton	12.32	12.52
ISO-400-CR	B	Viton	15.55	15.74

See below for replacement O-rings.

ISO Screened Stainless Steel Centering Rings with O-ring and Aluminum Spacer Ring



MODEL NUMBER	O-RING MATERIAL	A	B	C	MESH (sq.in.)
ISO-63-CR-SV-16	Viton	2.63	2.74	2.38	16
ISO-80-CR-SV-16	Viton	3.14	3.25	2.87	16
ISO-100-CR-SV-16	Viton	3.89	4.00	3.50	16
ISO-160-CR-SV-16	Viton	5.90	6.01	5.50	16

Includes O-ring. See below for replacement O-rings.

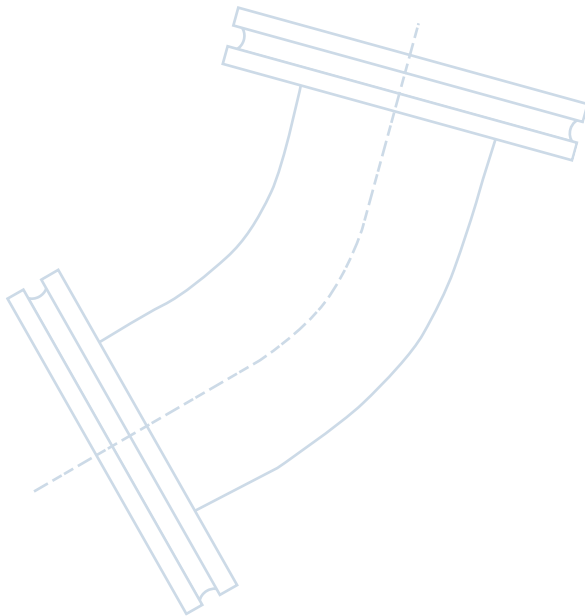


Viton O-Rings

MODEL NUMBER	FLANGE TYPE
ISO-63-OR-V	ISO-63
ISO-80-OR-V	ISO-80
ISO-100-OR-V	ISO-100
ISO-160-OR-V	ISO-160
ISO-200-OR-V	ISO-200
ISO-250-OR-V	ISO-250
ISO-320-OR-V	ISO-320
ISO-400-OR-V	ISO-400
ISO-500-OR-V	ISO-500

Buna O-Rings

MODEL NUMBER	FLANGE TYPE
ISO-63-OR-B	ISO-63
ISO-80-OR-B	ISO-80
ISO-100-OR-B	ISO-100
ISO-160-OR-B	ISO-160
ISO-200-OR-B	ISO-200
ISO-250-OR-B	ISO-250
ISO-320-OR-B	ISO-320
ISO-400-OR-B	ISO-400
ISO-500-OR-B	ISO-500



See Section 2.1 for metal seals



Nor-Cal Products manufactures a complete line of ISO vacuum fittings with optional fastener or nonrotatable flanges. The tube portions are fabricated from 304 stainless steel. For increased resistance to corrosion in downstream semiconductor processes, some ISO flanges and fittings are available in 316L stainless steel. 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. Fittings are shown with OF flanges only. To order a fitting with nonrotatable flanges substitute “-N” for “-OF” in the model number. Fittings are also available with CF (Conflat style), NW (ISO-KF compatible) and ASA flanges. Standard finish is bead blasted. Electropolished finish also available. Call for pricing.



SPECIFICATIONS

General: Optional fastener or nonrotatable flanges with clearance bolt holes

Nominal OD sizes: ISO-63 to ISO-500

Tube OD sizes: 2½ to 20 inches

Tube finish: Beadblast, tumbled, or electropolish

Materials

Flange: 304 or 316L stainless steel

O-rings: Viton, Buna

Bolts: 18-8 stainless steel

Vacuum range

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

Metal seal: $\geq 1 \times 10^{-11}$ Torr - UHV

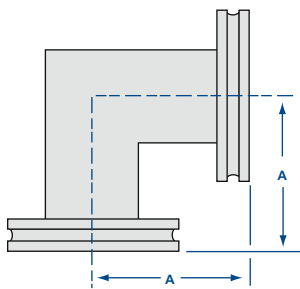
Temperature range

Viton: -20°C to 200°C

Buna: -30°C to 110°C

Metal seal: -270°C to 150°C

See Section 2.1 for metal seals



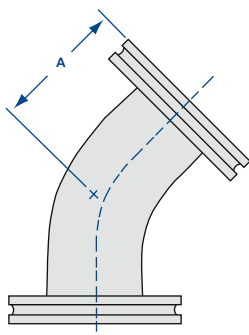
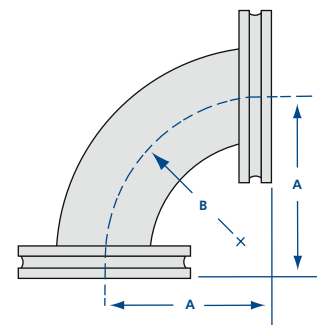
ISO 90° Mitered Elbows

MODEL NUMBER	TUBE OD	A
2E-ISO-63-OF-M	2½	3.25
2E-ISO-80-OF-M	3	3.50
2E-ISO-100-OF-M	4	4.13
2E-ISO-160-OF-M	6	5.38
2E-ISO-200-OF-M	8	7.38
2E-ISO-250-OF-M	10	9.88



ISO 90° Radius Elbows

MODEL NUMBER	TUBE OD	A	B
2E-ISO-63-OF	2½	4.00	3.75
2E-ISO-80-OF	3	4.75	4.50
2E-ISO-100-OF	4	6.25	6.00
2E-ISO-160-OF	6	9.38	9.00
2E-ISO-200-OF	8	12.38	12.00
2E-ISO-250-OF	10	15.38	15.00



ISO 45° Elbows with Tangents

MODEL NUMBER	TUBE OD	A
2KL-ISO-63-OF	2½	3.25
2KL-ISO-80-OF	3	3.93
2KL-ISO-100-OF	4	5.03

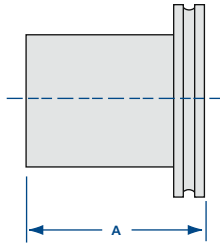




Flanges & Fittings

ISO Fittings

ISO Half Nipples



MODEL NUMBER	TUBE OD	A
1N-ISO-63-OF	2½	3.25
1N-ISO-63-OF-V	2½	4.00
1N-ISO-63-OF-H	2½	3.94
1N-ISO-80-OF	3	3.50
1N-ISO-80-OF-H	3	3.94
1N-ISO-100-OF	4	4.13
1N-ISO-100-OF-V	4	5.12
1N-ISO-100-OF-H	4	3.94
1N-ISO-160-OF	6	5.38
1N-ISO-160-OF-V	6	6.44
1N-ISO-160-OF-H	6	3.94
1N-ISO-200-OF	8	7.38
1N-ISO-250-OF	10	9.88
1N-ISO-320-OF	12	9.88
1N-ISO-400-OF	16	9.88
1N-ISO-500-OF	20	9.88



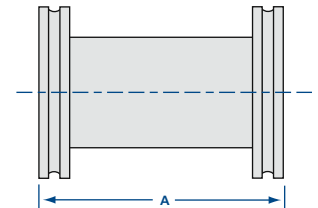
ISO 316L Half Nipples

MODEL NUMBER	TUBE OD	A
1N-ISO-63-OF-316L	2½	3.25
1N-ISO-80-OF-316L	3	3.50
1N-ISO-100-OF-316L	4	4.13



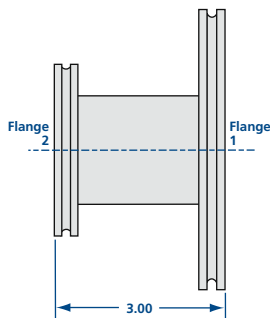
ISO Full Nipples

MODEL NUMBER	TUBE OD	A
2N-ISO-63-OF	2½	6.50
2N-ISO-80-OF	3	7.00
2N-ISO-100-OF	4	8.26
2N-ISO-160-OF	6	10.76
2N-ISO-200-OF	8	14.76
2N-ISO-250-OF	10	19.76
2N-ISO-320-OF	12	19.76
2N-ISO-400-OF	16	19.76
2N-ISO-500-OF	20	19.76



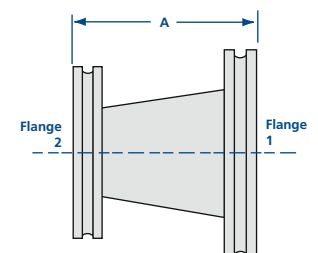
ISO Reducer Nipples

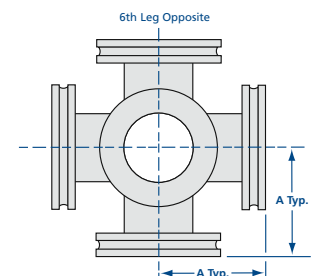
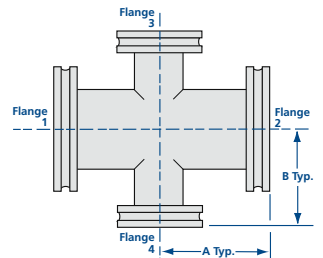
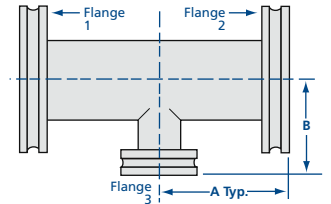
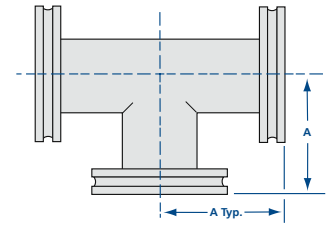
MODEL NUMBER	FLANGE 1	FLANGE 2	TUBE OD
2NR-ISO-80-63-OF	ISO-80	ISO-63	2½
2NR-ISO-100-63-OF	ISO-100	ISO-63	2½
2NR-ISO-100-80-OF	ISO-100	ISO-80	3
2NR-ISO-160-63-OF	ISO-160	ISO-63	2½
2NR-ISO-160-80-OF	ISO-160	ISO-80	3
2NR-ISO-160-100-OF	ISO-160	ISO-100	4
2NR-ISO-200-63-OF	ISO-200	ISO-63	2½
2NR-ISO-200-80-OF	ISO-200	ISO-80	3
2NR-ISO-200-100-OF	ISO-200	ISO-100	4
2NR-ISO-200-160-OF	ISO-200	ISO-160	6
2NR-ISO-250-63-OF	ISO-250	ISO-63	2½
2NR-ISO-250-80-OF	ISO-250	ISO-80	3
2NR-ISO-250-100-OF	ISO-250	ISO-100	4
2NR-ISO-250-160-OF	ISO-250	ISO-160	6
2NR-ISO-250-200-OF	ISO-250	ISO-200	8



ISO Conical Reducer Nipples

MODEL NUMBER	FLANGE 1 TYPE	TUBE OD	FLANGE 2 TYPE	TUBE OD	A
2NRC-ISO-80-63-OF	ISO-80	3	ISO-63	2½	4.12
2NRC-ISO-100-63-OF	ISO-100	4	ISO-63	2½	4.12
2NRC-ISO-100-80-OF	ISO-100	4	ISO-80	3	4.12



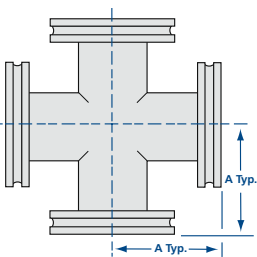


ISO Tees

MODEL NUMBER	TUBE OD	A
3T-ISO-63-OF	2 1/2	3.25
3T-ISO-80-OF	3	3.50
3T-ISO-100-OF	4	4.13
3T-ISO-160-OF	6	5.38
3T-ISO-200-OF	8	7.38
3T-ISO-250-OF	10	9.88

ISO Reducer Tees

MODEL NUMBER	FLANGE 1 & 2		FLANGE 3		A	B
	TYPE	ARM OD	TYPE	LEG OD		
3TR-ISO-80-63-OF	ISO-80	3	ISO-63	2 1/2	3.50	3.50
3TR-ISO-100-63-OF	ISO-100	4	ISO-63	2 1/2	4.13	4.00
3TR-ISO-100-80-OF	ISO-100	4	ISO-80	3	4.13	4.00
3TR-ISO-160-63-OF	ISO-160	6	ISO-63	2 1/2	5.38	5.00
3TR-ISO-160-80-OF	ISO-160	6	ISO-80	3	5.38	5.00
3TR-ISO-160-100-OF	ISO-160	6	ISO-100	4	5.38	5.13
3TR-ISO-200-63-OF	ISO-200	8	ISO-63	2 1/2	7.38	6.00
3TR-ISO-200-80-OF	ISO-200	8	ISO-80	3	7.38	6.00
3TR-ISO-200-100-OF	ISO-200	8	ISO-100	4	7.38	6.13
3TR-ISO-200-160-OF	ISO-200	8	ISO-160	6	7.38	6.38

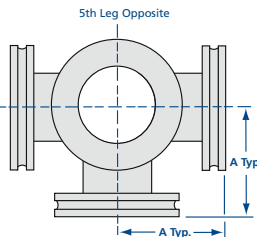


ISO 4-Way Crosses

MODEL NUMBER	TUBE OD	A
4C-ISO-63-OF	2 1/2	3.25
4C-ISO-80-OF	3	3.50
4C-ISO-100-OF	4	4.13
4C-ISO-160-OF	6	5.38
4C-ISO-200-OF	8	7.38
4C-ISO-250-OF	10	9.88

ISO 4-Way Reducer Crosses

MODEL NUMBER	FLANGES 1 & 2		FLANGES 3 & 4		A	B
	TYPE	ARM OD	TYPE	LEG OD		
4CR-ISO-80-63-OF	ISO-80	3	ISO-63	2 1/2	3.50	3.50
4CR-ISO-100-63-OF	ISO-100	4	ISO-63	2 1/2	4.13	4.00
4CR-ISO-100-80-OF	ISO-100	4	ISO-80	3	4.13	4.00
4CR-ISO-160-63-OF	ISO-160	6	ISO-63	2 1/2	5.38	5.00
4CR-ISO-160-80-OF	ISO-160	6	ISO-80	3	5.38	5.00
4CR-ISO-160-100-OF	ISO-160	6	ISO-100	4	5.38	5.13
4CR-ISO-200-160-OF	ISO-200	8	ISO-160	6	7.38	6.38



ISO 5-Way Crosses

MODEL NUMBER	TUBE OD	A
5C-ISO-63-OF	2 1/2	3.25
5C-ISO-80-OF	3	3.50
5C-ISO-100-OF	4	4.13
5C-ISO-160-OF	6	5.38
5C-ISO-200-OF	8	7.38
5C-ISO-250-OF	10	9.88



ISO 6-Way Crosses

MODEL NUMBER	TUBE OD	A
6C-ISO-63-OF	2 1/2	3.25
6C-ISO-80-OF	3	3.50
6C-ISO-100-OF	4	4.13
6C-ISO-160-OF	6	5.38
6C-ISO-200-OF	8	7.38
6C-ISO-250-OF	10	9.88