



ULTRA HIGH PURITY & ULTRA HIGH VACUUM SEALS

Advanced metal sealing solutions for
critical UHP/UHV & cryogenic applications

INTRODUCTION

Today's sealing requirements for Ultra-High Purity and Ultra-High Vacuum are more demanding than ever before:

- Ultra-low Leak Rates ($< 1 \times 10^{-13}$ atm.cm³.s⁻¹ He)
- Low Outgassing
- Cryogenic Temperatures ($< 1.8^\circ$ K)
- Long Life Expectancy
- Chemical Compatibility
- Aluminum Flanges
- Odd Shapes & Sizes
- High Temperature Bake Out
- Radiation Resistance
- Remote Handling Capability
- Quartz & Ceramic Flanges
- Reduced Load

Through extensive research, Technetics Group, in conjunction with the French Atomic Energy Commission, has developed a family of high performance metal seals to solve these demanding applications:

- HELICOFLEX® DELTA
- O-FLEX™
- Quick Disconnect Systems (QDS)
- HELICOFLEX®
- C-FLEX™
- Machined Seals

The HELICOFLEX® DELTA seal is particularly suited for these extreme conditions. The DELTA seal requires less load than a regular HELICOFLEX® seal or a CF copper gasket solution, is excellent for sealing on smooth surfaces and offers the lowest Helium leak rate of any other seal.

TYPICAL APPLICATIONS

ACCELERATORS / FUSION RESEARCH

- Tandem Seals: Metal and Elastomer
- RF Waveguide Connections
- Cryogenics / Superconducting Magnets
- Beam Tube Connections
- Custom Vacuum Chambers

PVD / CVD / ETCH EQUIPMENT

- Flange Connections: Stainless Steel to Stainless Steel, Stainless Steel to Aluminum
- UHV Pump / Chamber Connections
- Gate / Slit Valves
- Odd Shaped Chamber Ports
- Standard ISO KF Flanges

GAS / CHEMICAL DELIVERY SYSTEMS

- Gas Systems
- Mass Flow Controllers: Inlet / Outlet Ports, Sensor Ports
- Flow Control Components: Valves, Regulators, Transducers
- Chemical Delivery Canisters / Ampoules
- Bulk Chemical: Flange Connections



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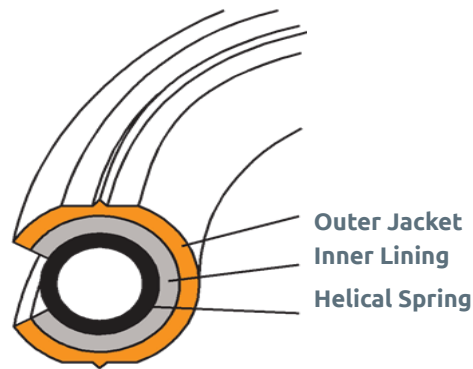
SEALING CONCEPT

The sealing principle of the HELICOFLEX® family of seals is based upon the plastic deformation of a jacket that has greater ductility than the flange materials. This occurs between the sealing face of a flange and an elastic core composed of a close-wound helical spring. The spring is selected to have a specific compression resistance. During compression, the resulting specific pressure forces the jacket to yield and ensures positive contact with the flange sealing faces. Each coil of the helical spring acts independently and allows the seal to conform to irregularities on the flange surface.

The HELICOFLEX® DELTA uses two small ridges or “Deltas” on the face of the seal. The load required to reach ultra-low Helium leak rates is reduced by concentrating the seal contact area. There is no risk of damage to the sealing surfaces as long as the minimum hardness requirements are maintained.

TECHNICAL DATA

Dimensions:	(\varnothing 3.8 to \varnothing 2000mm) \varnothing 0.150 in. to \varnothing 80 in.
Temperature:	-272 to 700°C -458 to 1292°F +1.8 to 973K
Helium sealing level:	$Q \leq 10^{-13} \text{atm cm}^3 \text{s}^{-1}$
Seal Classification Type:	HNV

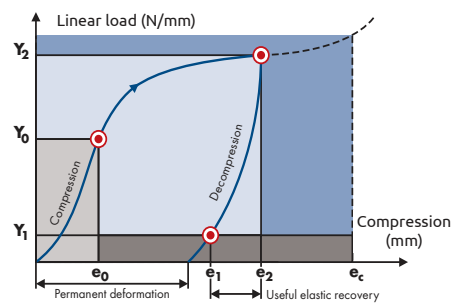


CHARACTERISTIC CURVE

The resilient characteristic of the HELICOFLEX® DELTA seal ensures useful elastic recovery during service. This elastic recovery permits the HELICOFLEX® DELTA seal to accommodate minor distortions in the flange assembly due to temperature cycling. For most sealing applications the Y_0 value will occur early in the compression curve and the Y_1 value will occur near the end of the decompression curve.

DEFINITION OF TERMS

- Y_0 = load on the compression curve above which leak rate is at required level
- Y_2 = load required to reach optimum compression e_2
- Y_1 = load on the decompression curve below which leak rate exceeds required level
- e_2 = optimum compression



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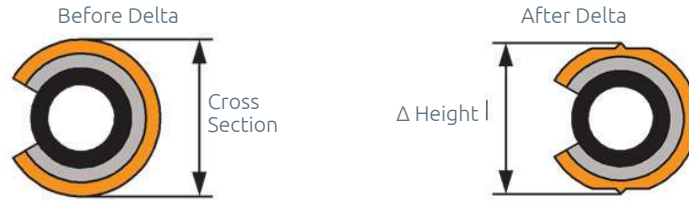
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HELICOFLEX® DELTA Δ SEAL



JACKET	SEAL DESIGN INFORMATION										
	Seal				Compression e2 ± 0.1 mm	Compression e2 ± 0.004 in	Helium Sealing Y ₂		Flange Hardness HV minimum	Maximum Temp	
	Cross Section mm	Δ Height mm	Cross Section in	Δ Height in			N/mm	PCI		°C	°F
Aluminum	2.0	1.9	0.079	0.075	0.6	0.024	100	571	65	150	302
	2.7	2.6	0.106	0.102	0.7	0.028	140	799	65	220	428
	3.4	3.3	0.134	0.130	0.8	0.031	140	799	65	250	482
	4.1	4.0	0.161	0.157	0.9	0.035	140	799	65	280	536
	4.9	4.8	0.193	0.189	0.9	0.035	140	799	65	280	536
	5.6	5.4	0.220	0.213	1.0	0.039	150	857	65	320	608
	6.9	6.7	0.272	0.264	1.1	0.043	150	857	65	340	644
Silver	1.8	1.7	0.071	0.067	0.5	0.020	150	857	100	240	464
	2.5	2.4	0.098	0.094	0.6	0.024	160	914	100	280	536
	3.2	3.1	0.126	0.122	0.6	0.024	160	914	100	300	572
	4.0	3.9	0.157	0.154	0.7	0.028	160	914	100	350	662
	4.8	4.7	0.189	0.185	0.8	0.031	160	914	100	370	698
	5.6	5.4	0.220	0.213	0.8	0.031	170	971	110	400	752
	6.7	6.5	0.264	0.256	0.9	0.035	180	1028	120	450	842
Copper	1.74	1.64	0.069	0.065	0.3	0.013	150	857	110	350	662
	2.44	2.34	0.096	0.092	0.4	0.017	180	1028	120	380	716
	3.14	3.04	0.124	0.120	0.5	0.021	180	1028	120	380	716
	4.04	3.94	0.159	0.155	0.6	0.025	180	1028	120	420	788
	4.64	4.54	0.183	0.179	0.6	0.025	180	1028	120	450	842
	5.54	5.34	0.218	0.210	0.6	0.025	180	1028	120	480	896
	6.54	6.34	0.257	0.250	0.7	0.029	190	1085	130	520	968
Nickel	1.6	1.5	0.063	0.059	0.3	0.010	150	857	140	380	716
	2.4	2.3	0.094	0.091	0.3	0.012	180	1028	140	420	788
	3.3	3.2	0.130	0.126	0.4	0.014	200	1142	150	480	896
	4.0	3.9	0.157	0.154	0.4	0.016	230	1313	170	550	1022
	4.7	4.6	0.185	0.181	0.4	0.016	230	1313	170	600	1112
	5.2	5.1	0.205	0.201	0.5	0.018	290	1656	190	650	1202
	6.2	6.1	0.244	0.240	0.5	0.020	360	2056	210	650	1202

Other materials are available on request: Annealed Nickel, Stainless Steel, Tantalum, etc.

Note: Minimum temperature is 1.8K/-272°C. Maximum temperatures shown in the tables only relate to the characteristics of the seal and are to be checked for every type of fluid. In specific applications, the HELICOFLEX® DELTA can be used with a seating load as low as 80 N/mm (450 lb/in).

HELICOFLEX® DELTA Δ SEAL

JACKET	SEAL		GROOVE DESIGN INFORMATION									
	Δ Height mm	Δ Height in	Depth ± 0.1 mm	Depth ± 0.004 in	Recommended Width mm	Recommended Width in	Mini Width mm	Mini Width in	Clearance OD seal/OD seal mm	Clearance OD seal/OD seal in	Recommended Surface Finish	
											RMS	Ra in μm
Aluminum	1.9	0.075	1.3	0.051	5.0	0.197	2.5	0.098	0.5	0.020	≤ 32	≤ 0.8
	2.6	0.102	1.9	0.075	5.6	0.220	3.3	0.130	0.5	0.020	≤ 32	≤ 0.8
	3.3	0.130	2.5	0.098	6.4	0.252	4.1	0.161	0.8	0.031	≤ 32	≤ 0.8
	4.0	0.157	3.1	0.122	7.1	0.280	4.9	0.193	0.8	0.031	≤ 32	≤ 0.8
	4.8	0.189	3.9	0.154	8.1	0.319	5.7	0.224	0.9	0.035	≤ 32	≤ 0.8
	5.4	0.213	4.6	0.181	8.9	0.350	6.6	0.260	1.0	0.039	≤ 32	≤ 0.8
	6.7	0.264	5.6	0.220	10.0	0.394	7.8	0.307	1.0	0.039	≤ 32	≤ 0.8
Silver	1.7	0.067	1.2	0.047	4.8	0.189	2.2	0.087	0.5	0.020	≤ 32	≤ 0.8
	2.4	0.094	1.8	0.071	5.5	0.217	3.0	0.118	0.5	0.020	≤ 32	≤ 0.8
	3.1	0.122	2.5	0.098	6.1	0.240	3.7	0.146	0.5	0.020	≤ 32	≤ 0.8
	3.9	0.154	3.2	0.126	6.9	0.272	4.6	0.181	0.6	0.024	≤ 32	≤ 0.8
	4.7	0.185	3.9	0.154	8.0	0.315	5.5	0.217	0.8	0.031	≤ 32	≤ 0.8
	5.4	0.213	4.6	0.181	8.6	0.339	6.2	0.244	0.8	0.031	≤ 32	≤ 0.8
	6.5	0.256	5.6	0.220	9.8	0.386	7.4	0.291	0.9	0.035	≤ 32	≤ 0.8
Copper	1.64	0.065	1.3	0.051	4.7	0.185	2.0	0.079	0.5	0.020	≤ 32	≤ 0.8
	2.34	0.092	1.9	0.075	5.3	0.209	2.8	0.110	0.5	0.020	≤ 32	≤ 0.8
	3.04	0.120	2.5	0.098	6.1	0.240	3.6	0.142	0.5	0.020	≤ 32	≤ 0.8
	3.94	0.155	3.3	0.130	6.9	0.272	4.5	0.177	0.6	0.024	≤ 32	≤ 0.8
	4.54	0.179	3.9	0.154	7.9	0.311	5.2	0.205	0.6	0.024	≤ 32	≤ 0.8
	5.34	0.210	4.7	0.185	8.6	0.339	6.0	0.236	0.6	0.024	≤ 32	≤ 0.8
	6.34	0.250	5.6	0.220	9.7	0.382	7.1	0.280	0.8	0.031	≤ 32	≤ 0.8
Nickel	1.5	0.059	1.25	0.049	4.7	0.185	1.8	0.071	0.5	0.020	≤ 32	≤ 0.8
	2.3	0.091	2.00	0.079	5.3	0.209	2.7	0.106	0.5	0.020	≤ 32	≤ 0.8
	3.2	0.126	2.85	0.112	6.1	0.240	3.6	0.142	0.5	0.020	≤ 32	≤ 0.8
	3.9	0.154	3.50	0.138	6.9	0.272	4.4	0.173	0.6	0.024	≤ 32	≤ 0.8
	4.6	0.181	4.20	0.165	7.9	0.311	5.2	0.205	0.6	0.024	≤ 32	≤ 0.8
	5.1	0.201	4.65	0.183	8.6	0.339	5.7	0.224	0.6	0.024	≤ 32	≤ 0.8
	6.1	0.240	5.60	0.220	9.7	0.382	6.7	0.264	0.8	0.031	≤ 32	≤ 0.8

SHAPED SEALS

Groove Design: Contact our engineering staff for assistance in designing non-circular grooves.

Groove Finish: Most UHP/UHV applications will require a finish of ≤16 RMS (≤0.4 Ra μm). All machining & polishing marks must follow seal circumference.

Min. Seal Radius: The minimum seal bending radius is six times the seal cross section (CS).

Seating Load: The load (Y₂) to seat the seal is approximately 30% higher due to a slightly stiffer spring design.



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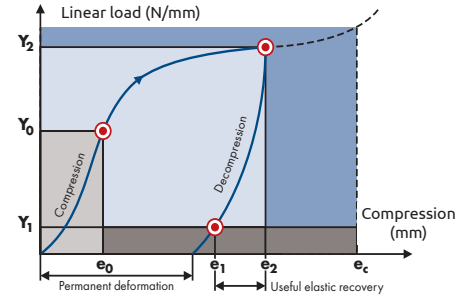
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HELICOFLEX® SEAL BASIC DESIGN

COMPRESSION AND DECOMPRESSION CYCLE

The compression and decompression cycle of the HELICOFLEX® seal is characterized by gradual flattening of the compression curve. The decompression curve is distinct from the compression curve as the result of a hysteresis phenomenon to which is added a permanent dual deformation (spring deformation and lining creep).



DEFINITION OF TERMS

Please refer to page 3.

	Cross Section		Compression e_2^*		Helium Sealing				Maximum Temperature		Surface Finish			
	C.S. mm	C.S. in	e_2 mm	e_2 in	Y_2^* N/mm	Y_1^* N/mm	Y_2^* PCI	Y_1^* PCI	°C	°F	Recommended Ra in μm	Acceptable Ra in μm	Recommended RMS	Acceptable RMS
Aluminum	2.0	0.079	0.7	0.028	160	20	914	114	150	302	1.6	0.8 to 3.2	63	32 to 125
	2.6	0.102	0.7	0.028	175	20	999	114	220	428	1.6	0.8 to 3.2	63	32 to 125
	3.3	0.130	0.8	0.031	185	25	1056	143	250	482	1.6	0.8 to 3.2	63	32 to 125
	4.0	0.157	0.9	0.035	200	25	1142	143	280	536	1.6	0.8 to 3.2	63	32 to 125
	4.8	0.189	0.9	0.035	210	25	1199	143	280	536	1.6	0.8 to 3.2	63	32 to 125
	5.6	0.220	0.9	0.035	230	30	1313	171	320	608	1.6	0.8 to 3.2	63	32 to 125
	6.7	0.264	1.0	0.039	245	35	1399	200	340	644	1.6	0.8 to 3.2	63	32 to 125
Silver	1.9	0.075	0.6	0.024	220	30	1256	171	240	464	1.6	0.8 to 3.2	63	32 to 125
	2.6	0.102	0.7	0.028	240	45	1370	257	280	536	1.6	0.8 to 3.2	63	32 to 125
	3.3	0.130	0.8	0.031	260	50	1485	286	300	572	1.6	0.8 to 3.2	63	32 to 125
	4.0	0.157	0.8	0.031	300	55	1713	314	350	662	1.6	0.8 to 3.2	63	32 to 125
	4.8	0.189	0.8	0.031	320	60	1827	343	370	698	1.6	0.8 to 3.2	63	32 to 125
	5.6	0.220	0.8	0.031	360	65	2056	371	400	752	1.6	0.8 to 3.2	63	32 to 125
	6.7	0.264	0.9	0.035	400	70	2284	400	450	842	1.6	0.8 to 3.2	63	32 to 125
Copper	1.9	0.075	0.6	0.024	280	50	1599	286	350	662	1.6	0.8 to 3.2	63	32 to 125
	2.6	0.102	0.7	0.028	320	70	1827	400	380	716	1.6	0.8 to 3.2	63	32 to 125
	3.3	0.130	0.7	0.028	350	80	1999	457	380	716	1.6	0.8 to 3.2	63	32 to 125
	4.0	0.157	0.8	0.031	430	90	2455	514	420	788	1.6	0.8 to 3.2	63	32 to 125
	4.8	0.189	0.8	0.031	470	100	2684	571	450	842	1.6	0.8 to 3.2	63	32 to 125
	5.6	0.220	0.8	0.031	550	120	3141	685	480	896	1.6	0.8 to 3.2	63	32 to 125
	6.7	0.264	0.9	0.035	630	140	3597	799	520	968	1.6	0.8 to 3.2	63	32 to 125

*Please refer to page 3.

IN ULTRA HIGH VACUUM APPLICATIONS

The sealing performance is very dependant on the surface finish of the flanges. It is important to meet the surface finish requirements specified on the above chart. For other materials, please consult our engineering staff.

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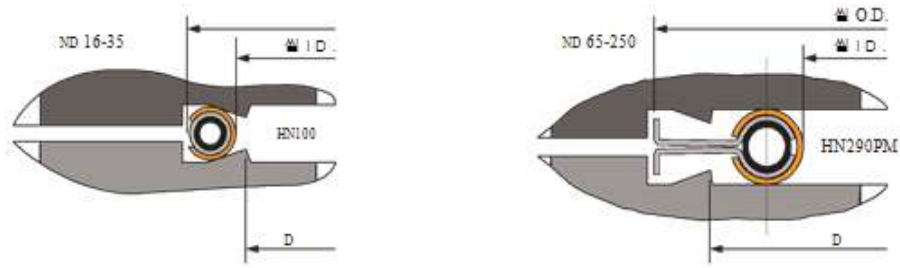
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HELICOFLEX® SEALS FOR CF FLANGE UPGRADE

HELICOFLEX® seals can upgrade the performance of your CF flange - even with damaged knife edges.



JACKET	GROOVE DESIGN INFORMATION													
	ND mm	ND in	Cross Section C.S. mm	Cross Section C.S. in	Compression e ₂ mm	Compression e ₂ in	Helium Sealing Y ₂ N/mm	Helium Sealing Y ₂ PCI	Seal Dimensions				Knife Edge Diameter	
									ID mm	ID in	OD mm	OD in	D mm	D in
Aluminum Maximum 200°C 392°F	16	1 1/8	2.2	0.087	0.6	0.024	180	1028	17.0	0.669	21.4	0.843	18.3	0.720
	35	2 3/4	2.8	0.110	0.6	0.024	180	1028	42.5	1.673	48.1	1.894	42.0	1.654
	63	4 1/2	3.0	0.118	0.7	0.028	180	1028	68.1	2.681	82.2	3.236	77.2	3.039
	100	6	3.0	0.118	0.7	0.028	180	1028	106.2	4.181	120.2	4.732	115.3	4.539
	150	8	3.0	0.118	0.7	0.028	180	1028	157.0	6.181	171.0	6.732	166.1	6.539
	200	10	3.0	0.118	0.7	0.028	180	1028	207.8	8.181	221.8	8.732	216.9	8.539
	250	12	3.0	0.118	0.7	0.028	180	1028	258.9	10.193	273.0	10.748	268.0	10.551
Copper Maximum 450°C 842°F	16	1 1/8	2.14	0.084	0.6	0.024	300	1713	17.06	0.672	21.3	0.839	18.3	0.720
	35	2 3/4	2.74	0.108	0.6	0.024	320	1827	42.56	1.676	48.0	1.890	42.0	1.654
	63	4 1/2	2.94	0.116	0.7	0.028	320	1827	68.16	2.683	82.2	3.236	77.2	3.039
	100	6	2.94	0.116	0.7	0.028	320	1827	106.26	4.183	120.2	4.732	115.3	4.539
	150	8	2.94	0.116	0.7	0.028	320	1827	157.06	6.183	171.0	6.732	166.1	6.539
	200	10	2.94	0.116	0.7	0.028	320	1827	207.86	8.183	221.8	8.732	216.9	8.539
	250	12	2.94	0.116	0.7	0.028	320	1827	258.96	10.195	273.0	10.748	268.0	10.551

Designed for ISO 3669 compatible CF Flanges.

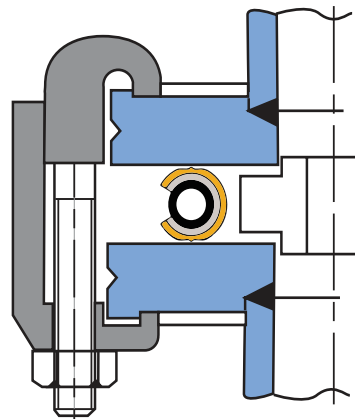
Recommended surface finish in seal contact area: 32 - 63 microinches (0.8 - 1.6 micrometers) lathe turned/circular lay. Must be free of dings and scratches.

Note: Flange dimensions, especially groove depth, may vary among manufacturers. Please check with our engineering staff to confirm before ordering.

LARGE ISO FLANGE APPLICATIONS

HELICOFLEX® DELTA seals can be used with an internal spacer and external claw clamps.

Note: extra clamps may be required due to increased seal seating load.



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QUICK DISCONNECT SYSTEMS (QDS)

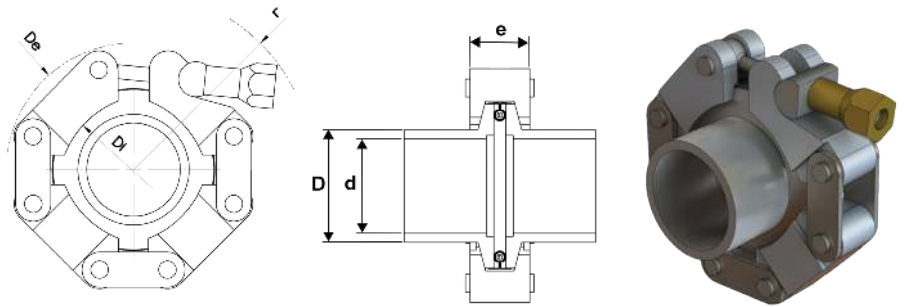
QDS CLASS 150

Material:

- Aluminum
- Non-magnetic side-plates
- Non-magnetic stainless steel screws

Technical Data:

- Clamping load: 150 N/mm (860 lb/in)
- Temperature: 200°C (392°F) max.



CLAMP DIMENSIONS													
ISO Nominal Diameter	Part Number	De mm	De in	Di mm	Di in	r mm	r in	e mm	e in	Max Pressure		Max Torque	
										bar	psi	Nm	in.lb
10/16	150 L 30	58	2.283	21	0.827	61	2.402	23	0.906	20	290	4	35
20/25	150 L 40	71	2.795	30	1.181	58	2.283	23	0.906	12	174	7	62
32/40	150 L 55	85	3.346	45	1.772	65	2.559	23	0.906	10	145	9	80
50	150 L 75	102	4.016	65	2.559	71	2.795	23	0.906	5	73	10	89

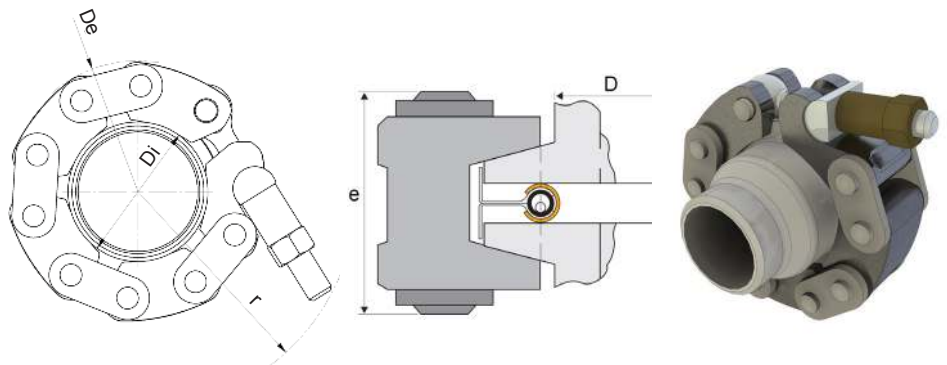
QDS CLASS 300

Material:

- Stainless Steel
- Stainless steel side-plates
- Steel screw (stainless steel on request)

Technical Data:

- Clamping load: 300 N/mm (1715 lb/in)
- Temperature: 150°C (300°F) max.



CLAMP DIMENSIONS													
ISO Nominal Diameter	Part Number	De mm	De in	Di mm	Di in	r mm	r in	e mm	e in	Max Pressure		Max Torque	
										bar	psi	Nm	in.lb
10/16	300 A 30	60	2.362	20	0.787	55	2.165	32	1.260	60	870	6	53
20/25	300 A 40	70	2.756	30	1.181	58	2.283	32	1.260	40	580	10	89
32/40	300 A 55	84	3.307	45	1.772	62	2.441	32	1.260	40	580	14	124
50	300 A 75	100	3.937	65	2.559	70	2.756	32	1.260	20	290	18	159

Consult our Engineering Staff for QDS clamps and flanges up to 400 mm in diameter.

QDS components can be specially modified for remote control handling requirements.

Contact our engineering staff for more information.

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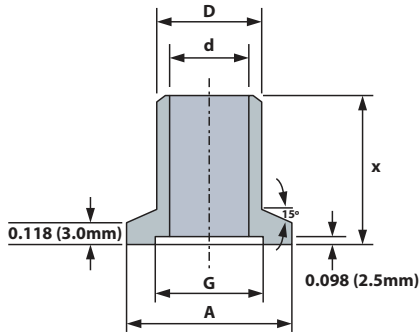
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ISO STANDARD FLANGES



Example reference for flange part number: 150 KF 40 ND 25 S:

1. Description of the junction class: 150
2. Name of the conical flange: KF
3. Outside diameter of the flange: 40
4. Description of the tube: ND 25
5. Length of the flange: Short (25mm) or Long (50mm)
6. Blind flanges are described by the flange reference preceded by a T.
Example: T 150 KF 40.

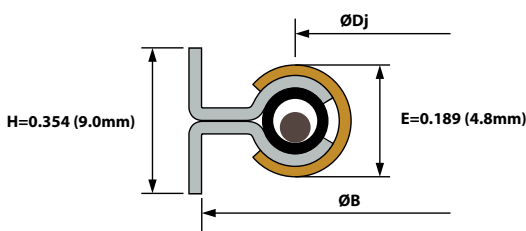
Compatible with class 150 and class 300 QDS clamps for ISO sizes up to ND 50.
Consult our engineering staff for larger sizes. Standard material Z2CN18.10 (304 L)

FLANGE DIMENSIONS													
ISO Nominal Diameter	A		D		d		G		X-short		X-long		Flange Part Number
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	
10	30	1.181	14	0.551	10	0.394	12.2	0.480	20	0.787	50	1.969	150 KF 30 ND 10
16	30	1.181	19.8	0.780	16	0.630	17.2	0.677	20	0.787	50	1.969	150 KF 30 ND 16
20	40	1.575	25	0.984	21	0.827	22.2	0.874	25	0.984	50	1.969	150 KF 40 ND 20
25	40	1.575	28	1.102	24	0.945	26.2	1.031	25	0.984	50	1.969	150 KF 40 ND 25
32	55	2.165	38	1.496	32	1.260	34.2	1.346	30	1.181	60	2.362	150 KF 55 ND 32
40	55	2.165	44	1.732	40	1.575	41.2	1.622	30	1.181	60	2.362	150 KF 55 ND 40
50	75	2.953	57	2.244	50	1.969	52.2	2.055	30	1.181	60	2.362	150 KF 75 ND 50

Flange class 150 NF E 29-724/ISO 2861



HELICOFLEX® SEALS FOR QDS



SEAL DIMENSIONS - ALUMINUM JACKET					
ISO Nominal Diameter	Dj		ØB		Flange Part Number
	mm	in	mm	in	
10/16	22.0	0.866	30.1	1.185	HL290p-4.8 Al ND 16
20/25	32.2	1.268	40.1	1.579	HL290p-4.8 Al ND 25
32/40	47.7	1.878	55.1	2.169	HL290p-4.8 Al ND 40
50	62.2	2.449	75.1	2.957	HL290p-4.8 Al ND 50

Other jacket materials available upon request.

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BELFAB® EDGE-WELDED METAL BELLOWS

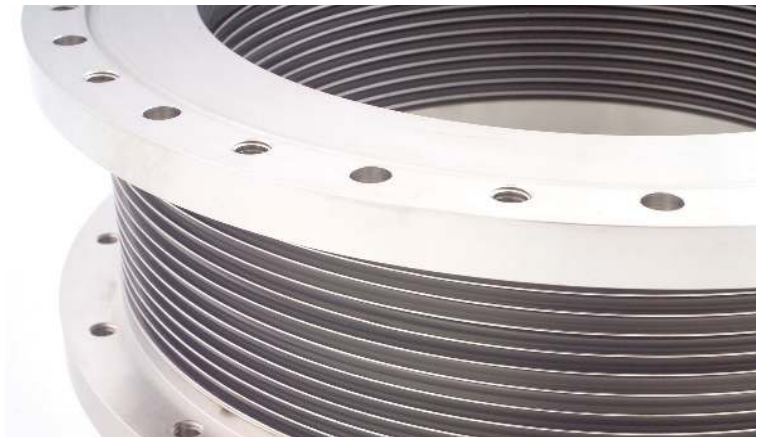
Technetics Group is a world leader in the design, production, and application of high precision sealing products incorporating edge-welded metal bellows. As a forerunner in the development of this technology, we continually work to advance the state of the art by engineering unique design solutions that solve critical needs within complex mechanical systems. We also offer contract assembly services including design, fabrication, welding, upper-level assembly, testing, and packaging. A certified Class 100/ Class 1000/ Class 10000 clean room assembly environment is available as required. As an ISO 9001-certified organization noted for world class cellular manufacturing, Technetics Group has built its reputation on a foundation of total quality achievement.

Edge-welded metal bellows provide superior stroke capabilities and more precise spring rates than formed bellows, thus offering greater flexibility and control in the smallest possible place. Because edge-welded metal bellows are manufactured by welding both the inner and outer diameters of the bellow plates, they can be produced in a broader variety of materials than formed bellows, in which the number and shape of the bellows convolutions are limited by material ductility. Technetics Group's experience in optimizing bellows configurations for demanding applications gives you the edge you need to make your equipment perform better and satisfy your own product requirements.

Our engineers will design a robust product that achieves the highest life-cycle possible while addressing all of your operating parameters, including stroke (lateral, angular and/or axial movement), pressure (internal and external), temperature and environment. Linear and thermal movements, vibration isolation and assembly offsets can all be accommodated with BELFAB®-designed bellows devices. Technetics Group has developed the rapid design/prototyping and production-ramp capabilities required for our demanding industry.

FEATURES

- Leak Tight to 1×10^{-10} std. cc/sec Helium
- Cleaned to the Highest Industry Standards
- Designed for the Highest Cycle Life Possible (One Million + Standard)
- Extreme Temperature Limits
- Low Magnetic Permeability
- Low Outgassing Rate
- Corrosion Resistant
- Linear/Wide Range of Spring Rates
- Diameters from 1/4" and up



BELLOWS MATERIALS

- 300 Series Stainless Steel
- Alloy 20
- AM 350 Stainless Steel
- Hastelloy C
- Haynes 242
- Inconel 625, 718
- Monel
- Titanium



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EXPERIENCE

- Over 50 years of Bellows Design Knowledge
- Over 500,000 Bellows Produced
- Key/Preferred Supplier to Leading Equipment OEM's and End Users
- Trusted Source for Direct Aftermarket

QUALITY

- AS9100C/ISO 9001 Certified
- NADCAP Certified Process (Welding, Heat Treat)
- Award-Winning Quality Programs
- Six-Sigma Focus

TESTING/RELIABILITY ENGINEERING

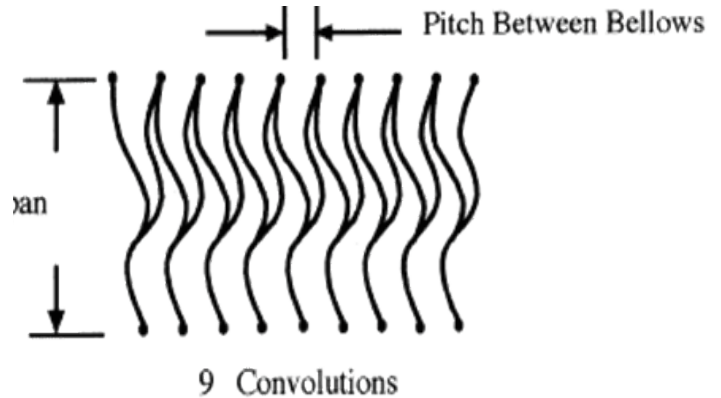
- Life Cycle (at Pressure, Temperature)
- Load/Force
- Mean Effective Area
- Metallurgical (Full Lab Onsite)
- MST (Mass Spectrometer Testing) Leak Detection
- Pressure (Burst, Impulse)
- Shock
- Spring Rate
- Vibration (Random, Sinusoidal)
- Volume Displacement

CONVENIENCE

- Extensive Design Database
- Custom Engineering
- Rapid Prototyping/Short Lead Times
- Production in US and Asia

WELDING

- Electron Beam Weld (EBW)
- Gas Tungsten Arc Weld (GTAW)
- Irregular (Non-Circular) Welding
- Laser Weld
- Micro Plasma Arc Weld (PAW)
- Automated and Semi-Automated
- Orbital Arc Weld



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