

JETSEAL[®]



**HIGH
PERFORMANCE
METAL SEALING
TECHNOLOGY**

JETSEAL is a World Class Manufacturer of Metal Sealing Solutions

Founded in 1988, JETSEAL began in Spokane, Washington as a small manufacturer of metallic seals to the aerospace industry. Today, JETSEAL has evolved to become an industry leader providing cost-effective sealing solutions to many industries requiring absolute dependability, reliability and performance.

Our resilient metal seals are found in major industries including:

- Aviation • Space • Transportation
- Oil & Gas • Power Generation
- Laser • Alternative Energy

Whether your company is seeking a standard metal seal or a custom metallic seal assembly, JETSEAL solves difficult sealing issues. JETSEAL produces all of its products to the certified quality requirements of ISO 9001:2008 and AS 9100 Rev. C, and is NADCAP approved for welding.

Please visit us at
www.jetseal.com
 or call
 +1 509.467.9133



Aviation



Space



Power Generation



Defense



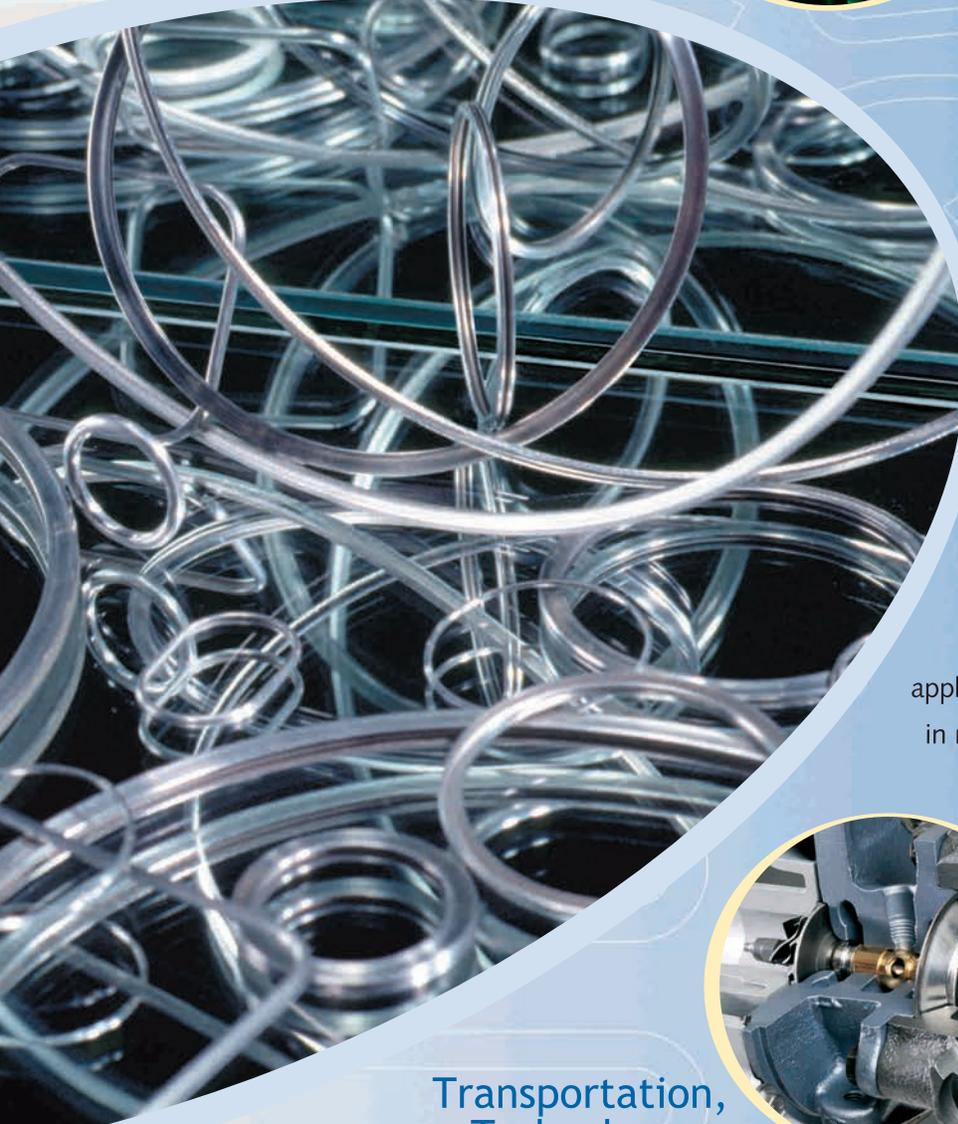
Alternative Energy



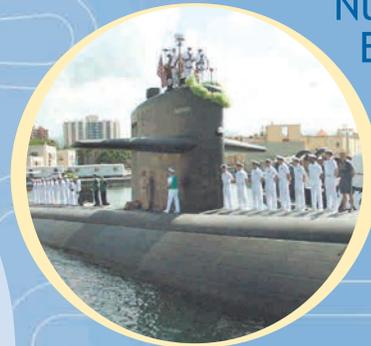
Aircraft Engines



Laser Technology



Nuclear Energy and Propulsion



JETSEAL produces application specific engineered seals to meet your sealing requirements. JETSEAL's resilient metal seals comprise a complete selection of cross-sections, sizes, shapes and materials capable of satisfying a vast variety of applications. Our resilient metal seals are found in major industries including aviation, space, power generation, laser, oil & gas and automotive, as well as research and development. Customers rely on JETSEAL's resilient metal seals whenever extreme temperature, pressure, vacuum or corrosive conditions are present.



Transportation, Turbochargers and Sensors



Oil and Gas

JETSEAL's Resilient Metal Seals



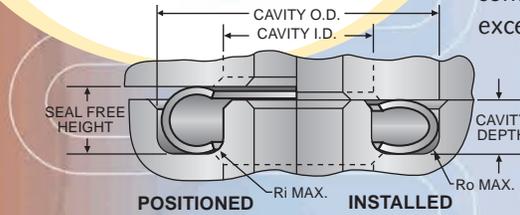
Aviation's demanding applications associated with operating aircraft and aircraft engines require sealing components that perform in extreme environments.

JETSEAL's resilient metal seals are designed to function in high temperature, high pressure and corrosive environments. Our metallic seal solutions provide long-life and dependability while meeting your strict design requirements.



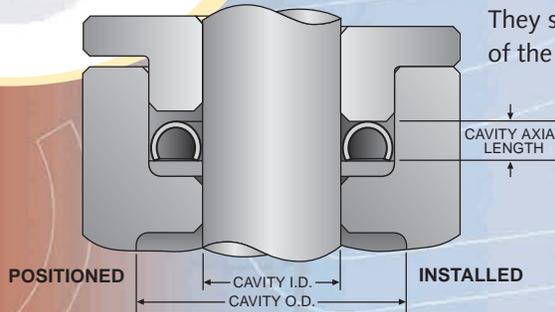
C-Seal

JETSEAL manufactures a superior quality metallic solution that is available in various cross-sections, material types and in virtually any diameter. The sealing surfaces are polished using an innovative JETSEAL process to ensure continuous sealing contact, giving excellent performance in both standard cavities and in cases where dynamic separation occurs. We offer C-Seal configurations in both circular and non-circular forms. Both are customizable to your specifications.



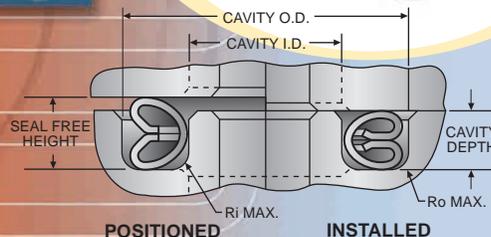
Axial C-Seal

Axial C-Seals are a highly specialized seal for use in low actuation, limited linear and rotary motion environments. They seal against both the ID and OD of the application hardware.

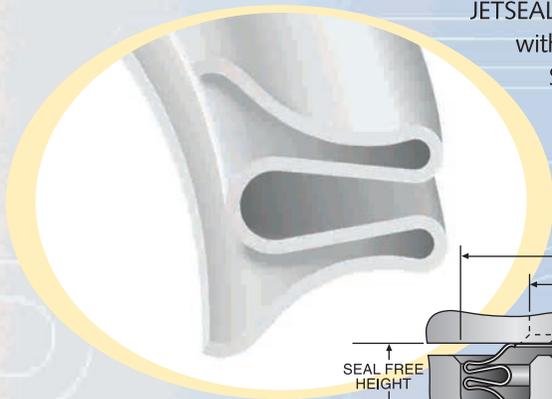


Super C-Seal

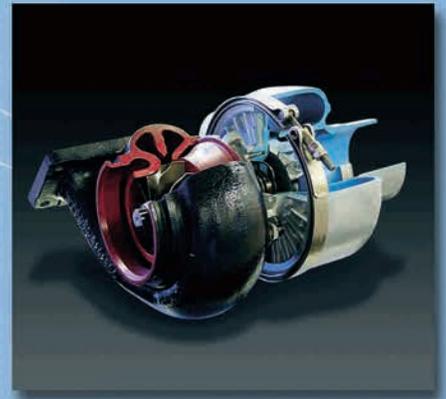
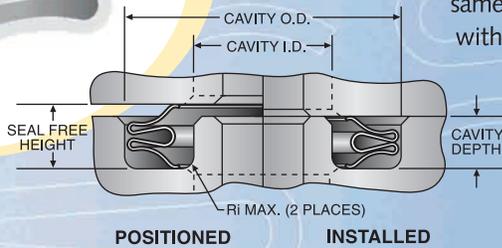
Our patented metal Super C-Seal is designed as an alternative to spring loaded C-Seals for applications requiring higher spring back and a tighter seal than regular C-Seals. The uncoated Super C-Seal can directly replace an unplated C-Seal or spring energized seal with no modifications to the cavity.



Lever Seal

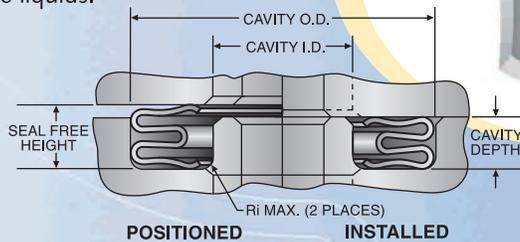
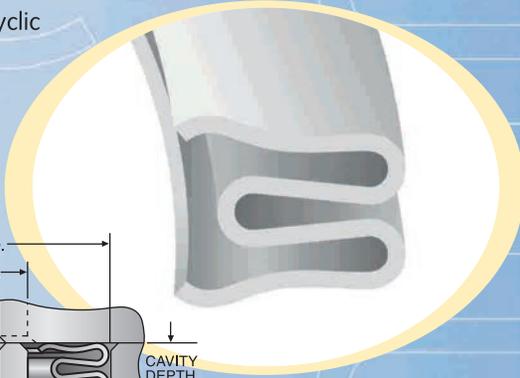


JETSEAL is on the cutting edge of sealing technology with the uniquely designed Lever Seal. The Lever Seal is superior to other "high deflection" seals available. Due to its patented stress-distributing design, the Lever Seal can handle three times the flange movement of a single-ply standard E-Seal with the same sealing capability without modifying the original cavity. The Lever Seal's lower stress design will outperform any other single convolution E-Seal type seal.

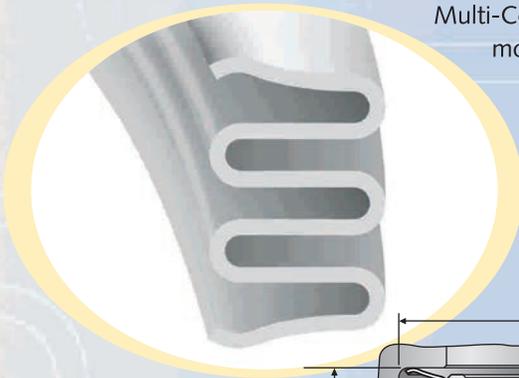


E-Seal

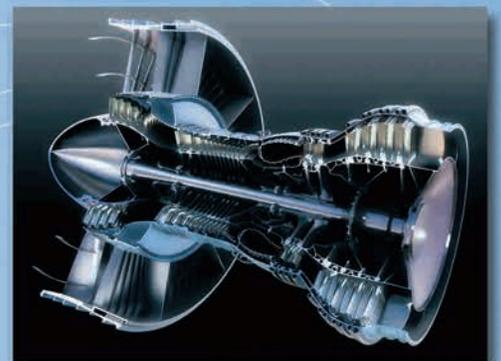
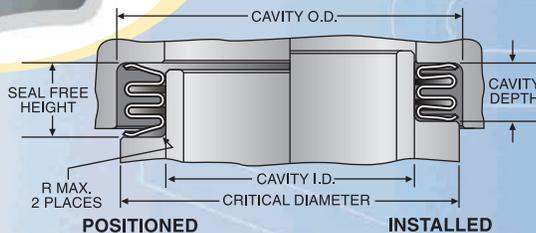
E-Seals are designed for low to moderate force conditions and high spring back. They are manufactured for high cyclic deflections, temperatures and pressures. E-Seals are capable of sealing both liquids and gases in almost any diameter and are available in single or two-ply cross sections with a single convolution. E-Seals are intended for sealing hot combustion gas and aggressive acid or base liquids.

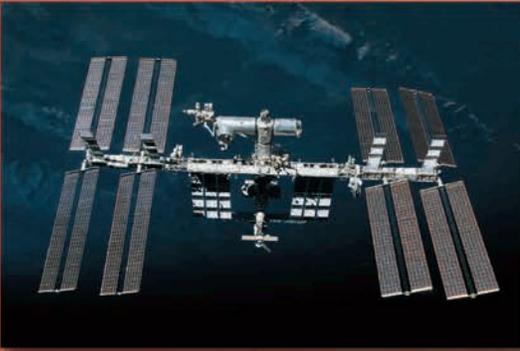


Multi-Convolution Seal

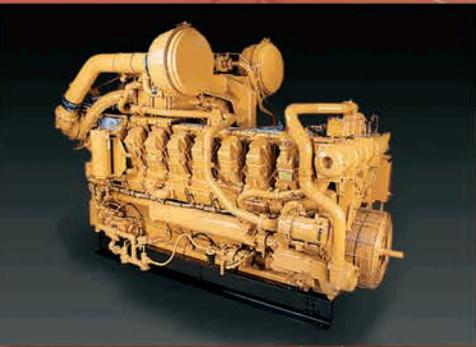


Multi-Convolution Seals are designed for low to moderate sealing force conditions and high spring back. JETSEAL manufactures Multi-Convolution Seals for high cyclic deflections, high temperatures and high pressures. Our Multi-Convolution Seals are capable of sealing both liquids and gases in almost any diameter and in single or two-ply cross section.





Space is the most demanding of all sealing environments where extreme temperature and pressure variations are encountered in high pressure and vacuum environments. JETSEAL is an experienced seal design specialist and manufacturer of metal seal solutions for space. Our high performance metal seals provide solutions to difficult sealing issues.

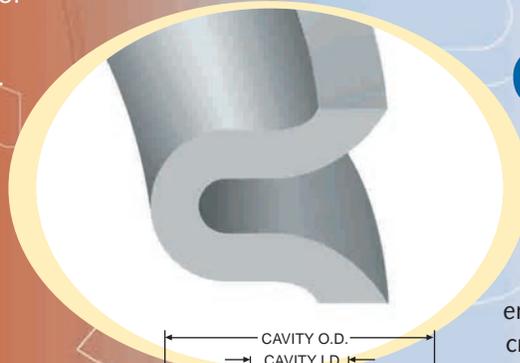
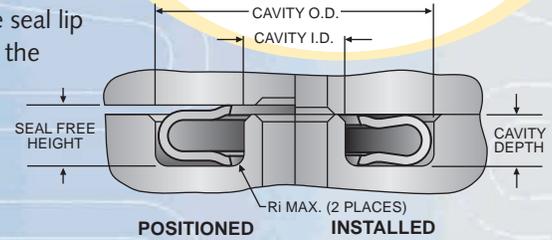


Power generation equipment manufacturers rely on JETSEAL's resilient metal seals to increase the efficiency of their products. Custom designed seals can minimize high pressure gas losses resulting in increased power output.



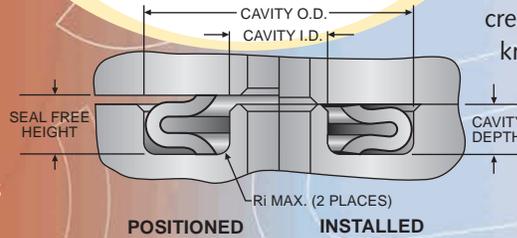
U-Mega Seal

U-Mega Seals combine the load performance of the Omega Seal and the sealing characteristics of the C-Seal to achieve high reliability for an extremely low leakage seal. The U-Mega Seal requires no special machining or lapping at the edges to meet flatness requirements. The seal lip is turned inward to reflect the performance of a C-Seal.



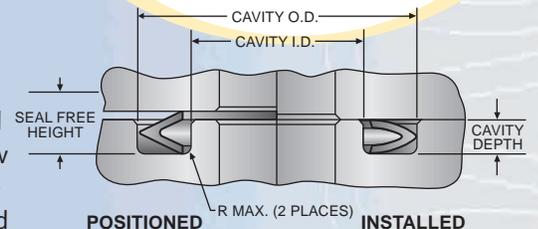
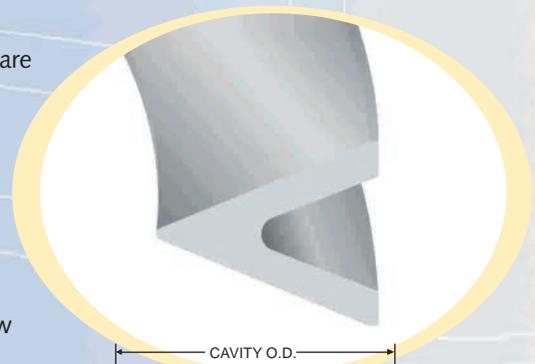
Omega Seal

Omega Seals are best suited for critical high pressure gas or liquid applications requiring extremely low leakage rates. These extremely high load seals are best suited for equipment having enough available bolt load to effectively create an extremely leak tight joint. Its knife-edge seal contact feature concentrates load force to create an effective seal.

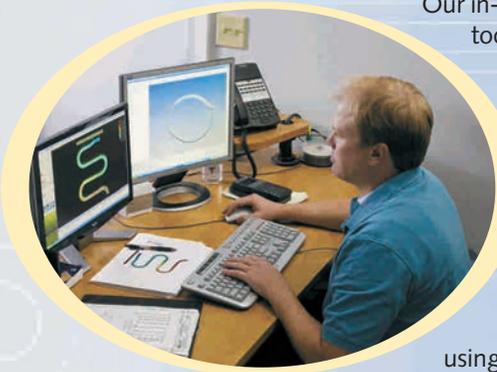


V-Seal

The most demanding applications are best served by JETSEAL's V-Seals which combine the advantages of compactness, very low leakage rates, high pressure capability and high spring back. Precision machined or roll-formed, V-Seals can be custom designed for high force loads and hard metals or low force loads and soft metals like aluminum. Because the V-Seal may be designed to generate high contract stress, it is a good solution for very demanding, low leakage rate applications where the joint will remain undisturbed for long periods.



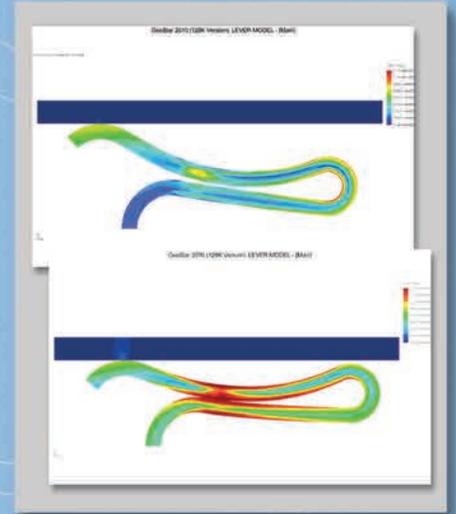
Custom Design



Our in-house engineering staff has the experience, tool-making capabilities and raw materials inventory necessary to complete new designs and specialty parts quickly. We'll work with our customers early in the design process to develop appropriate solutions for each application.

Call on us for custom design capabilities such as:

- Complete application evaluation for both seal and cavity recommendations using finite element analysis (FEA)
- Concurrent design and development
- Prototype development
- Products built to customer specifications
- Helium leak detection to $1 \times 10^{-10} \text{ cm}^3 \text{ s}^{-1}$



Quality

- ISO 9001:2008 Certified
- AS9100 Rev C Certified
- NADCAP approved for Fluid Distribution
- NADCAP approved for Welding
- FPI, Mag-particle, X-Ray, visual and dimensional



Testing

- Pressure to 1360 bar
- Helium leakage for vacuum applications
- Cyclic temperature to 650 °C
- High cycle fatigue to 1 million cycles
- Load deflection and spring back
- Wear and friction

Customer/Technical Support

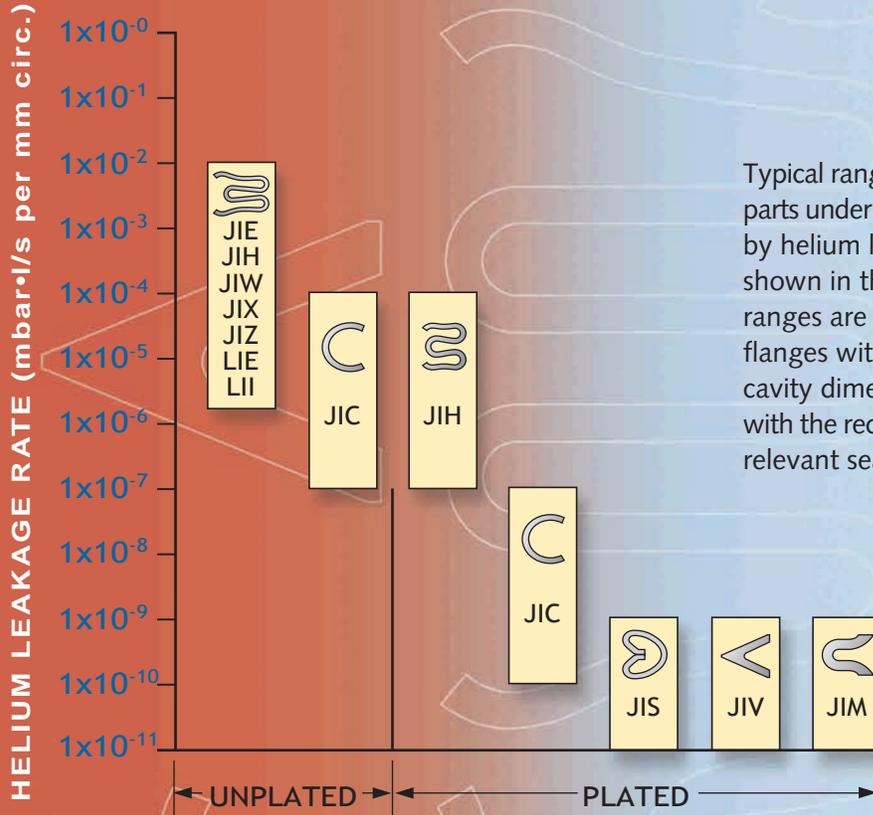


- Highly trained and technically oriented customer service personnel
- Single direct point of contact for the customer
 - Coordinates all internal functions such as:
 - Engineering support
 - Pricing
 - Order tracking (real time)
 - Lead-times / delivery
 - Shipping
 - Inspection



High Performance Metal Sealing Technology

TYPICAL LEAKAGE RATES



Typical ranges of leakage rates for parts under vacuum and measured by helium leak detection are shown in the bar chart. These ranges are obtained using test flanges with surface finishes and cavity dimensions in accordance with the recommendations in each relevant seal design section.

Leakage Rates:

$\text{cm}^3 \text{ s}^{-1}$	Approximate Equivalent	Water Immersion, Test Bubbles Observed
1×10^2	6 liters/minute	Strong flow - water turbulent
1×10^1	0.6 liters/minute	Strong continuous stream
1×10^0	60 cm^3 /minute	Intermittent strong stream
1×10^{-1}	6 cm^3 /minute	Fine stream
1×10^{-2}	36 cm^3 /hour	10 small bubbles per second
1×10^{-3}	3.6 cm^3 /hour	1 per second
1×10^{-4}	1 cm^3 in 3 hours	1 in 10 seconds
1×10^{-5}	1 cm^3 in 30 hours	1 in 100 seconds
1×10^{-6}	1 cm^3 in 2 weeks	3 in one hour
1×10^{-7}	3 cm^3 in 1 year	Observation impractical
1×10^{-8}	1 cm^3 in 3 years	
1×10^{-9}	1 cm^3 in 30 years	
1×10^{-10}	1 cm^3 in 300 years	
1×10^{-11}	1 cm^3 in 3000 years	

Bolt Load Calculation

$F_{\text{Bolt/Clamp}}$, without axial loading or bending moment loads:

In order for each sealing system or joint to attain its maximum sealing efficiency, it is essential that the compressive force applied to the seal, through threaded fasteners or other means (ie, clamps), exceed the sum of the seal reaction force (F_{Seal}) at full compression and the product of the maximum system pressure (P_{max}) and the projected area (A) enclosed.

$$F_{\text{Total}} = F_{\text{Seal}} + F_{\text{Proj Area(A)} \cdot \text{Max Sys Pressure (Pmax)}}$$

$$F_{\text{Bolt/Clamp}} > F_{\text{Total}}$$

$F_{\text{Bolt/Clamp}}$, with axial loading or bending moment loads:

If bending moments and/or axial loads are applied to the joint, their effects must be computed. The calculation of total force (F_{Total}) then becomes;

$$F_{\text{Total}} = F_{\text{Seal}} + F_{\text{Proj Area(A)} \cdot \text{Max Sys Pressure (Pmax)}} + F_{\text{Axial}} + N \cdot F_{\text{Bending Moment Reaction Force}}$$

$$F_{\text{Bolt/Clamp}} > F_{\text{Total}}$$

If it is not possible to generate the required closing force, or if transitory conditions sometimes reduce it, the seal may be subjected to partial unloading, through static or cyclic deflections. In this case, analysis must be performed to ensure that the unloading of the seal does not result in excess leakage and that if it is cyclic, that the fatigue life of the seal is not exceeded. JETSEAL can provide support and assist with this analysis.

F_{Seal} , Force Applied as a Result of Seal Line Load Distributed over Seal Circumference

$$F_{\text{Seal}} = \pi D_{\text{Seal}} \cdot L_{\text{Seal Line Load}}$$

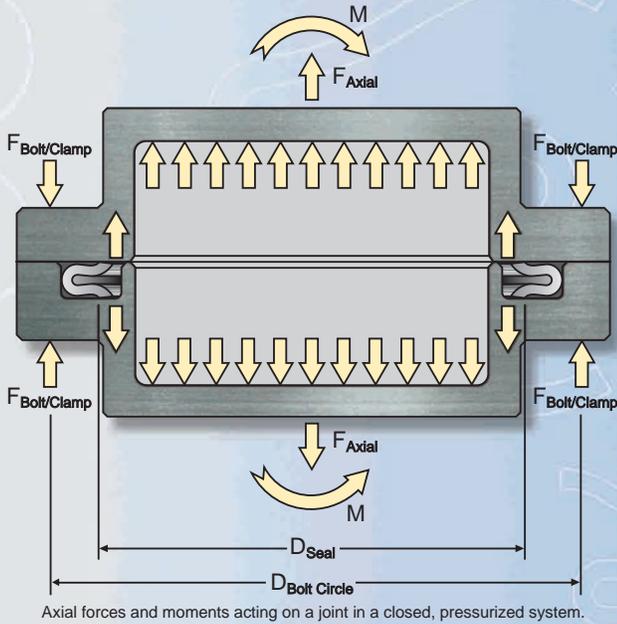
D_{Seal} = Diameter of Seal
 $L_{\text{Seal Line Load}}$ = Seal Line Load

$F_{\text{Proj Area(A)} \cdot \text{Max Sys Pressure (Pmax)}}$, Force Applied as a Result of Maximum Internal Pressure

$$F_{\text{Proj Area(A)} \cdot \text{Max Sys Pressure (Pmax)}} = A \cdot P_{\text{Max}}$$

$$A = \pi \cdot (D_{\text{Seal}})^2 / 4$$

D_{Seal} = Diameter of Seal
 P_{Max} = Maximum Internal Pressure



Axial forces and moments acting on a joint in a closed, pressurized system.

F_{Axial} , Force from External Axial Load

$F_{\text{Bending Moment Reaction Force}}$, Force Required to React Bending Moment

$$F_{\text{Bending Moment Reaction Force}} = 4M / ND_{\text{Bolt Circle}}$$

N = Number of Bolts, $N \geq 3$
 M = Bending Moment
 $D_{\text{Bolt Circle}}$ = Diameter of Bolt Circle

Coefficient of Thermal Expansion Data for Seal and Cavity Material

Temp °C	Alloy 718	Alloy X-750	Alloy 625	Waspaloy	Cres 300	Alloy 286	Titanium 6-4	Hastelloy X
100	12,81	13,36	12,79	12,28	16,16	16,58	9,02	13,54
150	13,06	13,69	12,87	12,61	16,57	16,69	9,18	13,86
200	13,30	13,98	12,95	12,93	16,94	16,77	9,35	14,03
250	13,59	14,11	13,11	13,23	17,27	16,89	9,46	14,34
300	13,73	14,26	13,27	13,44	17,55	16,98	9,59	14,49
350	13,94	14,37	13,43	13,67	17,83	17,12	9,74	14,67
400	14,09	14,40	13,59	13,89	18,07	17,26	9,88	14,81
450	14,21	14,44	13,76	14,03	18,29	17,38	9,98	14,93
500	14,37	14,52	13,93	14,12	18,52	17,52	10,07	15,09
550	14,55	14,62	14,15	14,26	18,73	17,69	-	15,27
600	14,78	14,80	14,37	14,42	18,92	17,88	-	15,50
650	14,95	15,13	14,59	14,59	19,09	18,10	-	15,66
700	15,19	15,45	14,83	14,91	-	-	-	15,83
750	15,65	15,78	15,07	15,24	-	-	-	15,99
800	16,07	16,16	15,38	15,69	-	-	-	16,15

Coefficient of Thermal Expansion, a: $1 \times 10^{-6} / K$, between 20 °C and temperature shown.

Differential thermal expansion between seal and cavity may result in excessive radial interference, giving rise to higher leakage rates.

Please advise JETSEAL's technical support staff if this occurs in your application.

JETSEAL Part Numbering System



1. Signifier: **JI** indicates seal P/N defines seal in SI metric system units.

2. Seal Section Geometry

- | | |
|---|---|
| CI = C-Seal, Internal Pressure | MI = Omega Seal, High Performance, Internal |
| CE = C-Seal, External Pressure | VI = V-Seal, Internal |
| CA = C-Seal, Coaxial (Radial Interference.) | VE = V-Seal, External |
| EI = E-Seal, High Deflection, Internal | SI = Super C-Seal, Internal |
| EE = E-Seal, High Deflection, External | SE = Super C-Seal, External |
| HI = E-Seal, High Pressure, Internal | WI = Two-Convolution, E-Seal, Internal |
| HE = E-Seal, High Pressure, External | WE = Two-Convolution, E-Seal, External |
| ME = Omega Seal, High Performance, External | |

3. Diameter Code: Expressed in hundredths of a millimeter, e.g. 002707 = 27,07 mm.

For internal pressure seals, the maximum external diameter is encoded. For all others, the minimum internal diameter is used. Example P/N JICI 002707-080101-SSA, above, defines an internal pressure C-Seal, 27,07 mm outside diameter, 3,20 mm free height, material thickness 0,4 mm, Alloy 718, solution and precipitation heat treated and plated with silver ,02 mm thick.

4. Cross-Section Codes

JETSEAL's cross-sections are not only limited to those shown in the following tables. We have many other cross-sections available and will work with you and your design team to obtain the best cross-section for your specific application.

4.1 C-Seal Cross-Section Codes

Cross Section Code	Seal Free Height [mm]	Material Thickness [mm]	Cavity Depth [mm]	Maximum Cavity Corner Radius [mm]
01	1,17 - 1,22	0,10	0,91 - 0,97	0,40
02	1,17 - 1,22	0,15	0,91 - 0,97	0,40
03	1,57 - 1,63	0,20	1,24 - 1,30	0,50
04	1,57 - 1,63	0,25	1,24 - 1,30	0,50
05	2,36 - 2,41	0,20	1,85 - 1,96	0,75
06	2,36 - 2,41	0,30	1,85 - 1,96	0,75
07	3,14 - 3,23	0,25	2,49 - 2,59	1,15
08	3,14 - 3,23	0,40	2,49 - 2,59	1,15
09	4,72 - 4,83	0,40	3,78 - 3,89	1,75
10	4,72 - 4,83	0,50	3,78 - 3,89	1,75
11	6,30 - 6,40	0,50	5,03 - 5,13	2,30
12	6,30 - 6,40	0,65	5,03 - 5,13	2,30

4.2 Super C-Seal Cross-Section Codes

Cross Section Code	Seal Free Height [mm]	Material Thickness [mm]	Cavity Depth [mm]	Maximum Cavity Corner Radius [mm]
13	3,14 - 3,23	0,30	2,49 - 2,59	1,15
14	4,72 - 4,83	0,43	3,78 - 3,89	1,80
15	6,30 - 6,40	0,51	5,03 - 5,13	2,30

4. Cross-Section Codes (continued)

4.3 E-Seal Cross-Section Codes

Cross Section Code	Seal Free Height ¹ [mm]	Material Thickness/ply [mm]	Cavity Depth [mm]	Maximum Cavity Corner Radius [mm]
01	2,62 - 2,87	0,25	2,18 - 2,27	0,50
02	3,43 - 3,68	0,31	2,95 - 3,05	0,75
03	2,54 - 2,64	0,25	2,18 - 2,24	0,50
06	5,96 - 6,22	0,25	4,75 - 4,90	0,50

¹ Free height can be adjusted to suit application. Consult JETSEAL technical support staff.

4.4 Omega Seal Cross-Section Codes

Cross Section Code	Seal Free Height [mm]	Material Thickness/ply [mm]	Cavity Depth [mm]	Maximum Cavity Corner Radius [mm]
01	1,17 - 1,22	0,30	1,09 - 1,14	0,40
02	1,63 - 1,68	0,43	1,27 - 1,32	0,40
03	2,29 - 2,34	0,64	1,93 - 1,98	0,40
04	3,15 - 3,20	0,79	2,72 - 2,77	0,40

4.5 V-Seal Cross-Section Codes

Cross Section Code	Seal Free Height [mm]	Material Thickness/ply [mm]	Cavity Depth [mm]	Maximum Cavity Corner Radius [mm]
01	0,84 - 0,89	0,20	0,71 - 0,76	0,40
02	1,52 - 1,60	0,30	1,27 - 1,32	0,40
03	2,26 - 2,34	0,46	1,93 - 1,98	0,40
04	3,10 - 3,18	0,56	2,69 - 2,74	0,40

5. Material Codes

Code	Material	Specification	Temperature Limit °C ¹	Remarks
01	Alloy 718	AMS 5596, AMS 5589, AMS 5662	650 °C	Superior performance [NACE approved H.T. available]
02	Alloy X-750	AMS 5598, AMS 5582, AMS 5667	600 °C	Excellent performance Lower load
03	Waspaloy	AMS 5544, AMS 5706, AMS5586	730 °C	Superior Resistance to creep Stress relaxation above 650 °C
04	Cres 304	AMS 5511, AMS 5560, AMS 5639	430 °C	Effective within reduced temp. range. Low spring back
05	Elgiloy	AMS 5876	425 °C	Excellent H ₂ embrittlement resistance
06	Haynes 282	AMS 5951	925 °C	Superior for high temperature applications
07	Hastelloy X	AMS 5754, AMS 5587, AMS 5530	815 °C	High temperature oxidation resistance
08	Rene 41	AMS 5545, AMS 5712	760 °C	High temperature & corrosion resistance

¹ Temperatures may be exceeded for certain applications; especially short duration.

6. Heat Treatment Codes For All Seals

Code	Heat Treatment	Remarks
00	None	Strain hardened - not generally recommended
01	Solution & Precipitation	Alloy 718: General applications
02	Solution Only	Hastelloy X: Optimum corrosion resistance
03	Solution & Precipitation [NACE] ¹	Special H.T. for sour gas [Hydrogen Sulfide] service
04	Solution, Stabilization & Precipitation	Waspaloy: Creep & relaxation resistance
05	Solution & Precipitation [H ₂]	Alloy 718: High temperature H ₂ gas service
06	Precipitation only	Interstage annealing may be employed

¹ NACE only applies to Alloy 718.

7. Plating and Coating Codes For All Seals:

Code	Plating/Coating	Thickness [mm] ¹	Code	Plating/Coating	Thickness [mm] ¹
---	None	NA	NIC	Soft nickel	0,04
SSA	Silver	0,02	NAA	Soft nickel w/gold u/lay	0,02
SSB	Silver	0,03	NAB	Soft nickel w/gold u/lay	0,03
SSC	Silver	0,04	NAC	Soft nickel w/gold u/lay	0,04
SSD	Silver	0,06	AAA	Gold	0,02
SAA	Silver w/gold u/lay	0,02	AAB	Gold	0,03
SAB	Silver w/gold u/lay	0,03	TFB	PTFE	0,04
SAC	Silver w/gold u/lay	0,04	TFD	PTFE	0,05
NIA	Soft nickel	0,02	TIN	Tin	0,08
NIB	Soft nickel	0,03	IND	Indium	0,08

¹ Tolerances of Thicknesses +/- 0.01 mm

Selection of Plating and Coating Materials:

Platings and coatings are applied to the contact surfaces of metal seals in order to provide them with the ability to extrude into mating surface imperfections to block leakage paths. The materials employed and their standard thicknesses are tabulated in the chart above.

Electrodeposited metallic coatings such as silver, gold, soft nickel, copper and lead are metallurgically bonded to nickel and cobalt alloy substrate materials in thicknesses proportional to the surface roughness of the mating surfaces. The following limitations should be noted:

- Platings are permeable to various degrees. The temperature limitation of 425° C on the use of silver, which has a melting temperature of 960° C, in air, is due to oxidation at the plating-to-substrate interface caused by the permeation of an oxidizing agent, in this case air, through the silver plating.

Material	Characteristics	Load Limit	Temperature Limit ¹
Gold (MIL-G-45204)	Excellent corrosion resistance and temp capabilities	Usually unlimited	815 °C
Soft Nickel (AMS 2424)	Excellent for very high temperatures. Best Corrosion resistance	Usually unlimited	815 °C
Silver w/Gold Underlay (AMS 2410)	Better corrosion resistance	Usually unlimited	705 °C
Silver (AMS2410)	Good corrosion resistance	Usually unlimited	425 °C
Tin (ASTM 8545)	Soft plating	50 N/mm	205 °C
PTFE/PFA (AMS 2515)	Softer coating	300 N/mm	205 °C
Indium (Vendor Spec)	Softest plating	300 N/mm.	40 °C

Plating is RoHS Compliant

NOTE: Plating optional and may be incomplete inside seal section and on inward folds [non-sealing contact areas], except where specified as corrosion barrier.

¹ Consult JETSEAL's technical support staff for higher temperature exceptions.

Surface roughness, Ra [µm]	Recommended plating thickness [mm]
0,8 [N6] or better	0,02
1,6 [N7] or better	0,03
3,2 [N8] or better	0,04
6,3 [N9] or better	0,07
12,5 [N10] or better	0,09

C-Seal – Typical Performance¹

Cross Section Code	Max Operating Pressure [bar]	Compression [mm]	Typical Seating Force ^{2,3} [N/mm]	Spring Back ² [mm]
01	2500	0,25	30	0,05
02	3950	0,25	45	0,05
03	2700	0,30	20	0,05
04	4300	0,30	50	0,05
05	1900	0,45	25	0,10
06	3200	0,45	50	0,10
07	1800	0,60	35	0,15
08	3000	0,60	45	0,10
09	1700	0,95	45	0,20
10	2700	0,95	60	0,20
11	1800	1,25	50	0,25
12	2300	1,25	70	0,20

Super-C Seal – Typical Performance¹

Cross Section Code	Max Operating Pressure [bar]	Compression [mm]	Typical Seating Force ^{2,3} [N/mm]	Spring Back ² [mm]
13	2200	0,60	105	0,30
14	2000	0,95	90	0,35
15	1800	1,25	90	0,45

E-Seal – Typical Performance¹

Cross Section Code	Max Operating Pressure [bar]	Compression [mm]	Seating Force ^{2,3} [N/mm]	Spring Back ² [mm]
01	150	0,50	5	0,50
02	140	0,55	5	0,55
03	520	0,40	20	0,30
06	150	1,25	5	1,00

Omega Seal – Typical Performance¹

Cross Section Code	Max Operating Pressure [bar]	Compression [mm]	Seating Force ^{2,3} [N/mm]	Spring Back ² [mm]
01	1700	0,15	50	0,05
02	2250	0,35	60	0,10
03	2600	0,35	50	0,15
04	1900	0,40	115	0,20

V-Seal – Typical Performance¹

Cross Section Code	Max Operating Pressure [bar]	Compression [mm]	Seating Force ^{2,3} [N/mm]	Spring Back ² [mm]
01	2500	0,10	40	0,05
02	1700	0,25	50	0,10
03	2650	0,35	90	0,20
04	1600	0,40	80	0,25

¹ Values listed are for Alloy 718. Contact JETSEAL technical staff for correction factors for other materials and elevated temperatures.

² Seating force increases and spring back may decrease for small diameter to cross-section ratios. If these parameters are critical for your application, please consult JETSEAL's technical support staff for further information.

³ Unpressurized, at nominal deflection.

Seals with Non-Circular Geometry

JETSEAL metallic seals may be supplied shaped to match the contour of virtually any groove, provided that practical restraints on corner radius form are respected. Contact JETSEAL's technical support staff for more information.

JETSEAL's Additional Sealing Products

AS1895 Seals

AS1895 metal seals meet or exceed aerospace industry specifications. AS1895 metal seals are available in both the AS1895/7 and AS1895/23 profiles. JETSEAL provides all 19 sizes of AS1895/7 seals from AS1895/7-100 to AS1895/7-750, as well as all 19 sizes of the AS1895/23 seals from AS1895/23-100 to AS1895/23-750. NADCAP approved for Fluid Distribution.

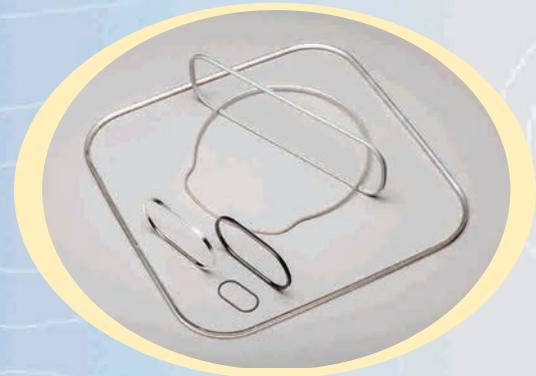


Limiter Plates

Limiter Plates provide accurate seal positioning for correct compression and optimum seal performance. Limiter Plates eliminate the need to modify hardware for proper seal placement. Various JETSEAL profiles can employ a Limiter Plate for tough assembly situations. Operating pressures and temperatures for seals with Limiter Plates depend on seal profile, construction and plating material.

Non-Circular Seals

JETSEAL takes great pride in the expertise of our in-house engineering staff to develop non-circular shaped sealing solutions that meet our customer's unique applications. In addition, we have the testing capabilities to verify leak rate, compression loads and spring back. The non-circular shapes currently manufactured by JETSEAL include: Square, Oval, Rectangular, Racetrack, Teardrop & Trapezoid.

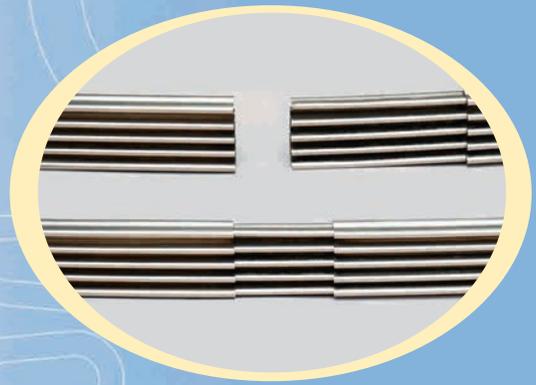


Labyrinth Seals

Our build-to-print Labyrinth Seals provide the optimum sealing solution for rotating applications in high temperature and pressure situations. These seals are designed to operate in air and gas environments with extremely tight tolerances. JETSEAL's Labyrinth Seals are custom manufactured to your specifications from forgings, flash-butt welded rings or bar stock.

Multi-Ply Seals

Multi-Ply Seals are most often used when thermal or pressure cycles cause high flange movement. The deflection capability of a multi-ply seal is double that of a single-ply seal within the same cavity space. Because no circumferential welding is used in its construction, the stresses within the seal are significantly reduced.



ISO-KF Centering Rings

Centering Rings provide accurate seal positioning for correct compression and optimum seal performance. Centering Rings eliminate the need to modify hardware for proper seal placement. Various JETSEAL profiles can employ a Centering Ring for accurate assembly situations. Operating pressures and temperatures for seals with Centering Rings depend on seal profile, base material type and selected plating material.

Piston Rings

Metal Piston Rings are designed for enhanced sealing performance in high temperature environments with superior wear resistance. JETSEAL manufactures Piston Rings in various metal, plating and size configurations, while offering assorted gap designs. Operating pressures and temperatures for Piston Rings depend on ring configuration.



Machined Seals

Machined seals, like the innovative Jet-X™ profile (shown), are able to provide a superior long-term seal for standard bolted flanged joints. Held in the proper position by a metal positioning ring, the patented Jet-X™ Seal is able to effectively seal against flange thermal and pressure movements in all types of environments. The Jet-X™ Seal's high spring back properties allows it to provide better thermal and pressure cycling performance and lower long-term leak rates than spiral wound gaskets. Other machined seal profiles are developed by JETSEAL's engineers to solve application specific sealing problems. We will work with you and your design team to obtain the best cross-section for your specific application.



JETSEAL's Sensor Pass-Through Fittings

JETSEAL's Standard Sensor Pass-Through Used in High Volume Data Monitoring



Allows Convenient Data Monitoring in High Temperature and High Pressure Environments

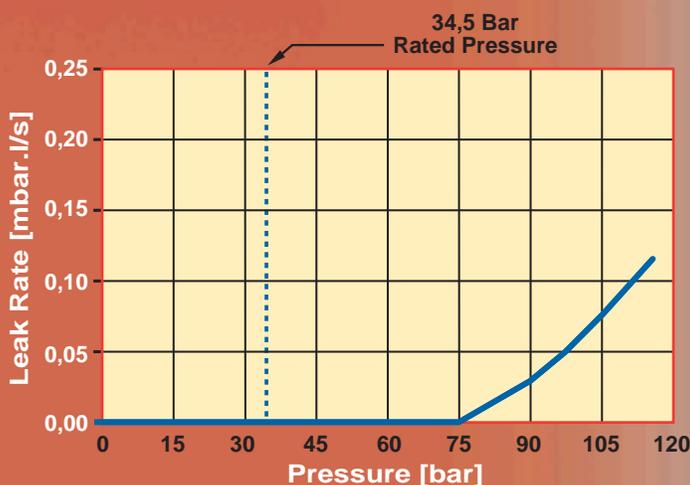
For monitoring and testing with as many as 168 sensor wires or tubes – of multiple diameters, the patented Sensor Pass-Through quickly and easily passes multiple sensor wires, thermocouples, pressure tubes, data cables, etc., through a pressure vessel or test rig opening quickly and easily for a leak tight fit. The Sensor Pass-Through eliminates the long cure times of cement or epoxies. Our Sensor Pass-Throughs are ASME Boiler & Pressure Vessel Code compliant to 450 °C and 34,5 bar.

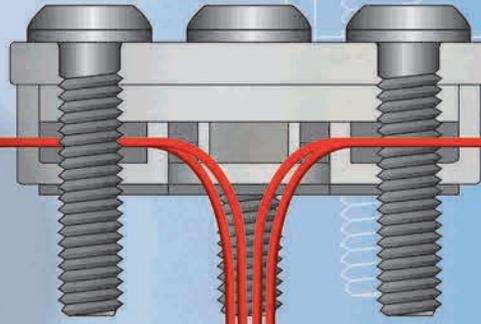
Installation of instrumentation wires or tubing is simple using the Sensor Pass-Through. Fasten the unit to a pressure vessel with a standard BSP threaded connection (other connection types are available). Feed the wires or tubes through without removing the sensor end fittings. Torque the grade-8 bolts to seat the seals around the wires.

Sensor Pass-Through Fittings:

- Require no time-consuming threading of sensor wires or tubes through individual holes.
- Superior design ensures a low leak rate with each use.
- Accepts thermocouples with connectors.
- Eliminates the need for hole plugs in unused ports.
- Prevents crushing to failure sensor wires, pressure tubes, or thermocouples.
- Allows easy adaptation to pressure vessel openings with a range of standard BSP connections.
- Alternate connection styles are available.
- Accommodates customization for different connection methods and changes in the number of wires or tubes.
- Permits quick replacement of broken sensor wires or tubes without disturbing other wires.
- Features nickel plating to resist corrosion in extreme environments up to 450 °C and 34,5 bar.
- Contains no sharp edges to damage sensor wires or tubes.
- Designed to use with ASME Boiler and Pressure Vessel Code compliant test chambers.
- Compatible with solid metal jacketed sensor wire or tubing.
- Not for use with braided steel jacketed sensors.

LEAK RATE vs. PRESSURE

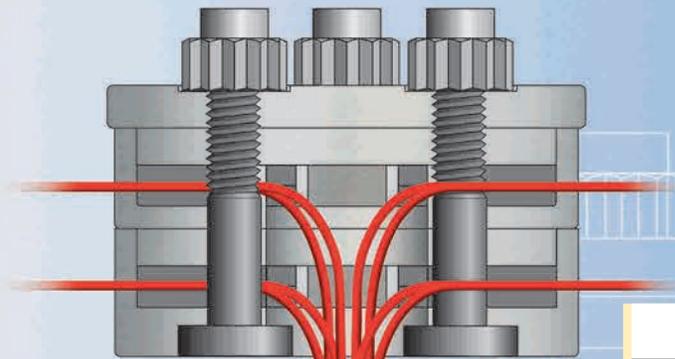




Aerospace Sensor Pass-Throughs

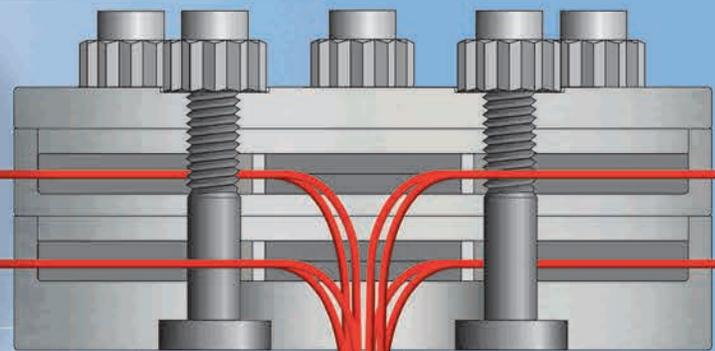
33mm Low Rise Sensor Pass-Through

Egress Opening [mm]	Number of Bolts	Recommended Maximum Number of Sensor Wires	Recommended Max. Sensor Diameter [mm]	Weight [g]	Tier
11,4	3	12	1,8	55	1



33mm Sensor Pass-Through

Egress Opening [mm]	Number of Bolts	Recommended Maximum Number of Sensor Wires	Recommended Max. Sensor Diameter [mm]	Weight [g]	Tier
11,4	3	12	1,8	70	1
11,4	3	24	1,8	95	2



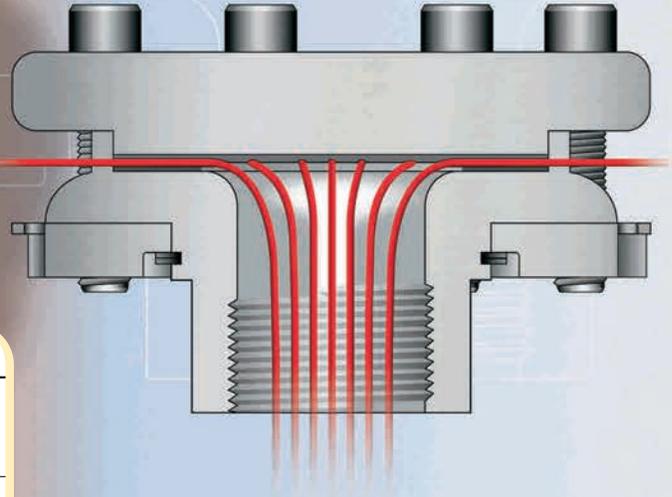
52mm Sensor Pass-Through

Egress Opening [mm]	Number of Bolts	Recommended Maximum Number of Sensor Wires*	Recommended Max. Sensor Diameter [mm]	Weight [g]	Tier
25,4	5	35	1,6	165	1
25,4	5	70	1,6	210	2
25,4	5	105	1,6	255	3

*10 spaces on each tier are capable of accepting 1,8 mm diameter wire



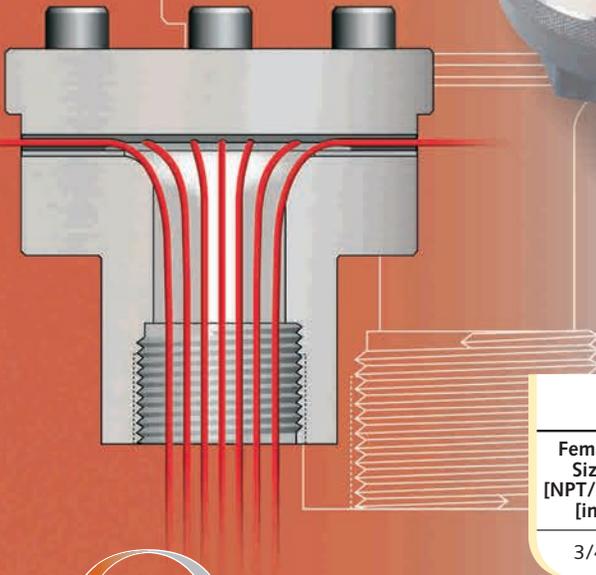
Industrial Sensor Pass-Through Medium Capacity



Standard Sensor Pass-Through

Female Size [NPT/BSP] [in]	Number of Bolts	Recommended Maximum Number of Sensor Wires	Recommended Max. Sensor Diameter [mm]	Weight [kg]
3/4	6	48	1,5	4
1-1/2	8	64	1,5	6
2	10	80	1,5	9

Light Capacity & Mini Capacity Sensor Pass-Through



Light Capacity Sensor Pass-Through

Female Size [NPT/BSP] [in]	Number of Bolts	Recommended Maximum Number of Sensor Wires	Recommended Max. Sensor Diameter [mm]	Weight [kg]
1	6	18	1,5	2

Mini Sensor Pass-Through

Female Size [NPT/BSP] [in]	Number of Bolts	Recommended Maximum Number of Sensor Wires	Recommended Max. Sensor Diameter [mm]	Weight [kg]
3/4	3	12	1,5	1

Wedge Sensor Pass-Through

Allows sensing wires or tubes to pass through the unit without bending

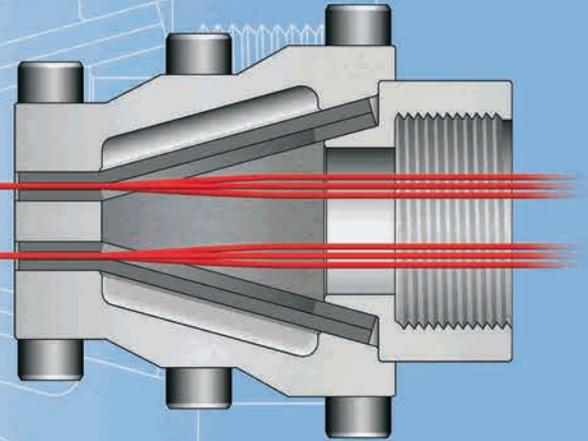


JETSEAL's largest sensor wire diameter capacity Pass-Through is able to accommodate up to 6,3 mm diameter wires. This unit is used in applications where it is important that the sensor wire must exit without bending. The sensor wires are easily egressed from a pressurized container or piece of equipment via a convenient NPT/BSP threaded fitting. The wires exit the unit and are fed directly through the Sensor Pass-Through without bending. This unit is built to operate over a wide range of conditions. It is capable of zero leakage up to 450 °C and 34,5 bar. These units are nickel plated for durability.

Wedge Sensor Pass-Through

Female Size [NPT/BSP] [in]	Number of Bolts	Recommended Maximum Number of Sensor Wires	Recommended Max. Sensor Diameter [mm]	Weight [kg]
1	12	28	2,3	5
1-1/2	12	28	2,3	7
2	12	6	6,3	11

* Maximum number of sensor wires given for wires using maximum diameter. If wire diameter is less than recommended maximum, more sensor wires may be used.



Large Capacity Sensor Pass-Through

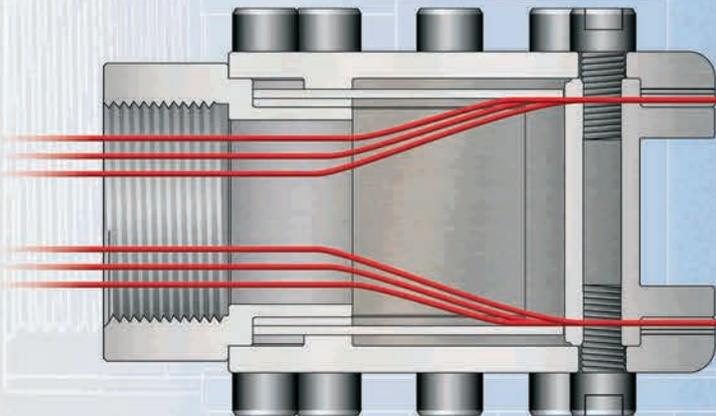
JETSEAL's largest wire count capacity Sensor Pass-Through, which is able to accommodate up to 168 individual 1,0 mm diameter wires. This unit is used in applications where conveniently exiting many sensor wires from a centralized location is required. The sensor wires are easily egressed from a pressurized container or piece of equipment via a convenient NPT/BSP threaded fitting. The wires exit the unit and are fed directly through the Sensor Pass-Through without bending. This unit is built to operate over a wide range of conditions. It is capable of zero leakage up to 450 °C and 34,5 bar. These units are nickel plated for durability.



Large Capacity Sensor Pass-Through

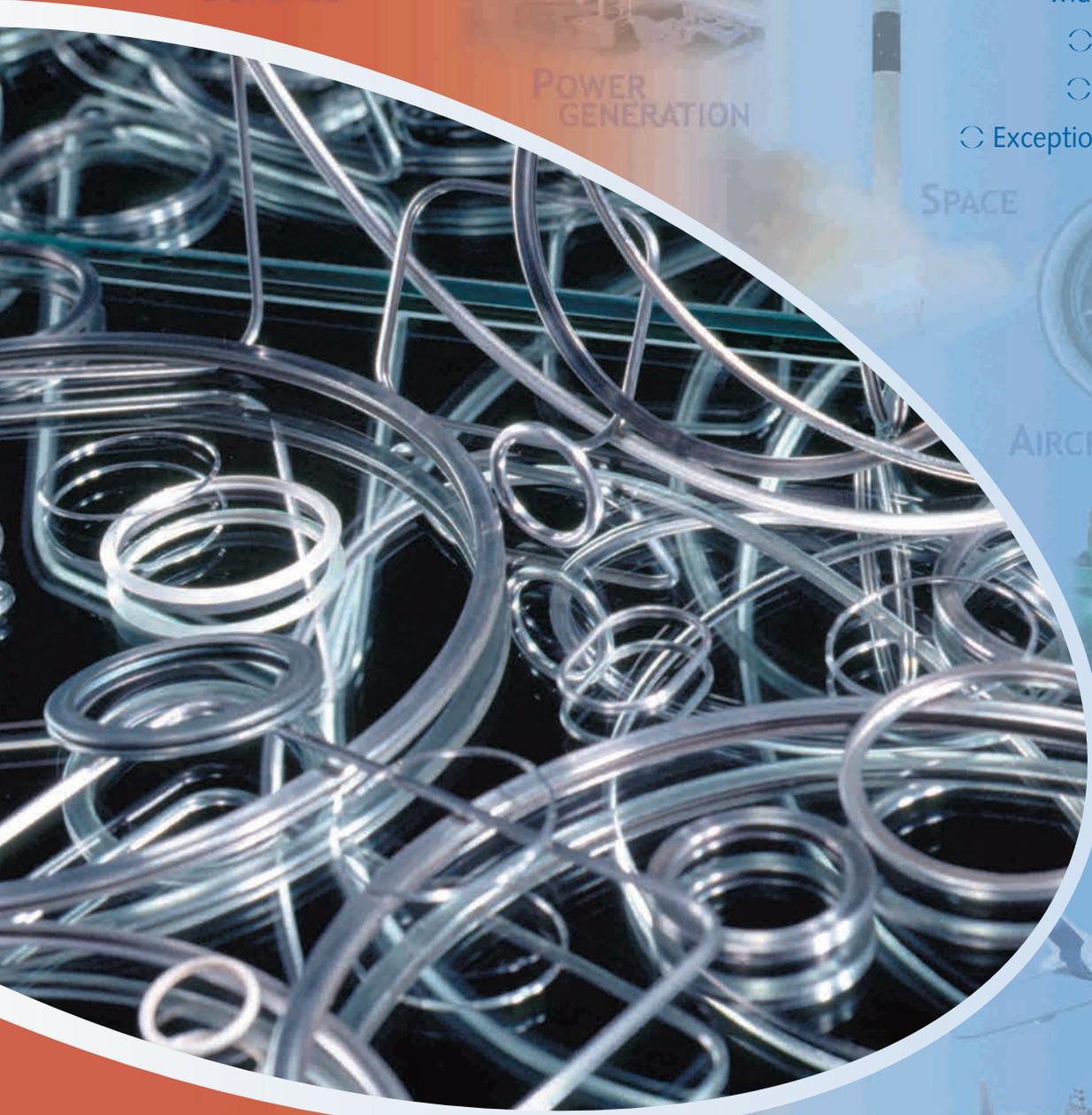
Female Size [NPT/BSP] [in]	Number of Bolts	Recommended Maximum Number of Sensor Wires	Recommended Max. Sensor Diameter [mm]	Weight [kg]
2-1/2	18	168	1,0	7
		144	1,5	7

* Number of wires and wire size depend on wire comb used.



Our Commitment

- Full line of quality, high performance sealing products
- Custom sealing solutions for a wide range of industries
 - Competitive pricing
 - Short delivery times
- Exceptional customer service



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