



Flexoresist
Isolate Every Leak

Flexoresist Technologies Pvt. Ltd.
Metal Seals Catalogue

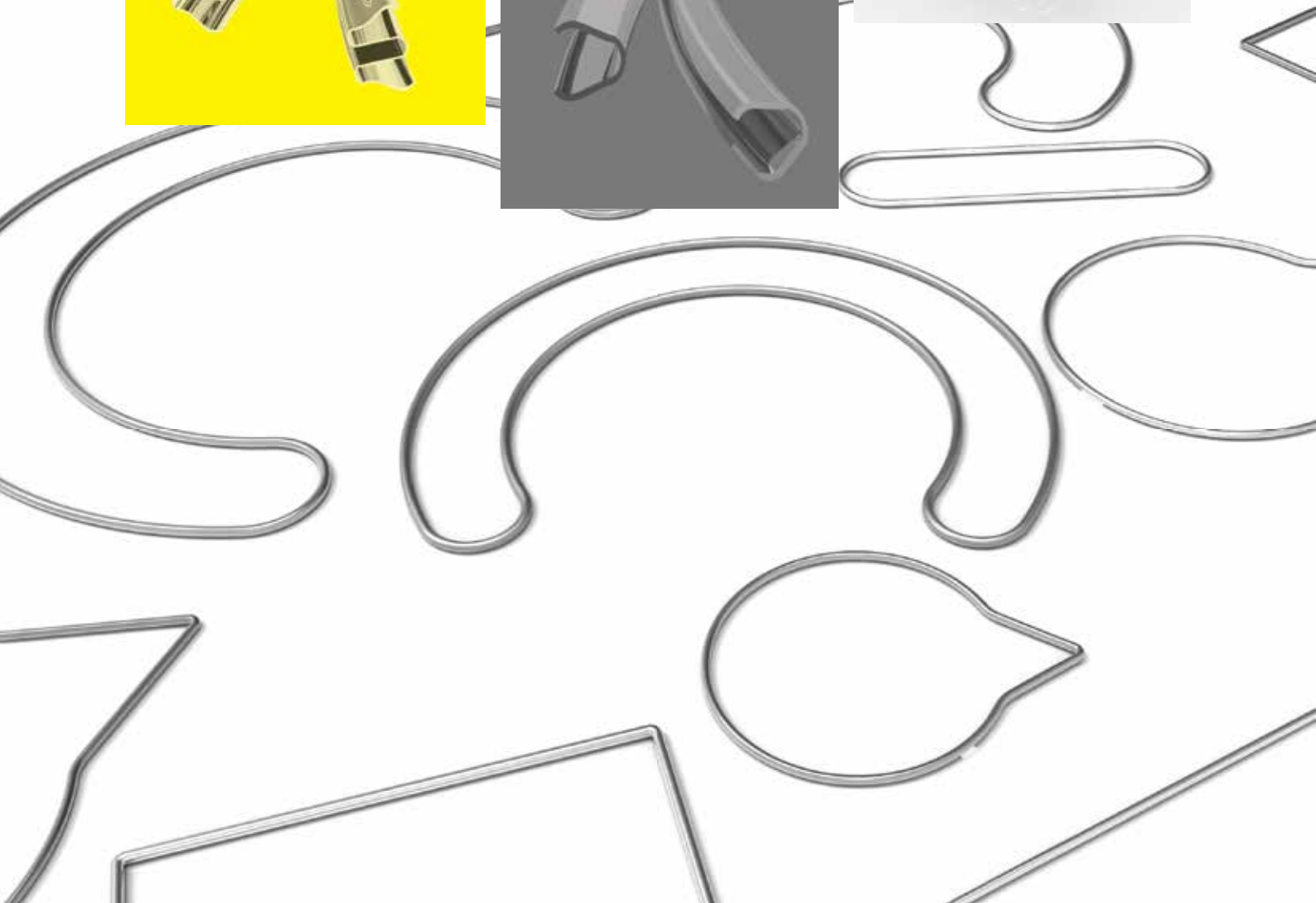
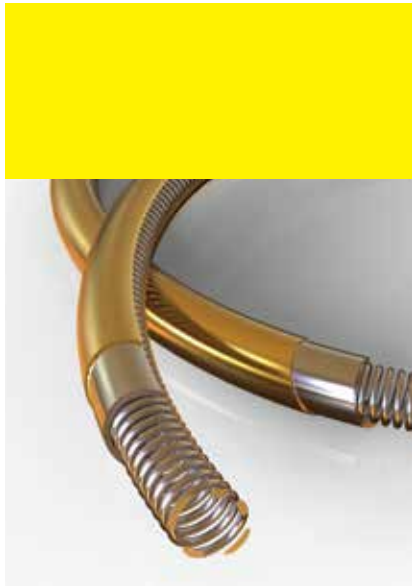





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The company





Flexoresist Technologies Pvt. Ltd. is a pioneering entity in the Indian market, specializing in the design and manufacturing of innovative products previously unavailable domestically. Founded with the vision to fill the gap in the market, Flexoresist embarked on its journey under the leadership of Mr. Anand Uttarkar, an esteemed Industrial engineer with a Master's degree from Texas, USA.

Mission and Vision: At Flexoresist, our mission is to revolutionize the Indian engineering landscape by introducing cutting-edge products that cater to the evolving needs of various industries. We envision a future where indigenous innovation drives technological advancement and economic growth.

Core Values

- **Technical Excellence:** With a culture deeply rooted in technical proficiency, Flexoresist prioritizes excellence in design, engineering, and manufacturing processes.
- **Customer Satisfaction:** We are committed to exceeding customer expectations by delivering superior quality products and unparalleled service.
- **Innovation:** Flexoresist fosters a culture of innovation, encouraging creativity and out-of-the-box thinking to develop groundbreaking solutions.
- **Integrity:** We uphold the highest standards of integrity, transparency, and ethical conduct in all our business dealings.

Products and Services:

Flexoresist Technologies Pvt. Ltd. stands as a leading authority in the design and manufacturing of the following products:

- 1. Metal O rings- Made from Tube**
- 2. C Rings – Made from Sheet**
- 3. Spring Energised C Rings – Made from Sheet**

Other Products:

1. Metal Bellows and Expansion Joints

Customer Satisfaction:

With a growing clientele of more than 50 satisfied customers and counting, Flexoresist has earned a reputation for reliability, quality, and innovation. Our commitment to understanding and addressing customer needs sets us apart in the market, fostering long-lasting partnerships built on trust and mutual success.

Future Outlook:

As we continue to expand our product portfolio and reach, Flexoresist remains dedicated to pushing the boundaries of technological advancement in India. With a relentless focus on innovation and customer satisfaction.

Infrastructure

- State of the art machines to manufacture seals
- Established and proven inspection facility
- In-house plating plant
- Laser welding facility
- In-house LP test facility
- In-house ultrasonic cleaning facility
- Licensed design software's

Key Features

- Short lead times
- Procedure for rush production
- Quick response time
- Custom-made sealing solutions
- Dedicated staff
- In stock inventory for certain sizes
- Trained and qualified manpower

Production Capabilities

- Seal diameter range from 5 mm up to 1500 mm
- Cross sections from 0.79 mm up to 12.70 mm
- Shaped seals, race track, rectangular and other shapes on request
- Tailor-made seals as per customer specifications
- In-house plating facilities

Other Capabilities

- Helium leak detection of seals
- Seal destructive testing capabilities
- Hydro-test facilities
- ISO 9001 certified company





Metal Seal Introduction and Selection:

Metal Seals

Why we use metal seals? Metal seals are mainly used in extreme conditions where you cannot use regular elastomeric seals. Specially in the extremes of Temperature – from cryogenic to above 300 deg C, Pressure – above 100 bar, ultra high vacuum – 1×10^{-9} mbar.lit/sec and above, Radioactive environment and so on. One should go for the metal seals only in the case when regular elastomeric seals do not do the job. Commonly used material for these seals are, SS321, Alloy 600, Alloy 718, Alloy 750.

Seal Functioning

How does a metal seal work? A metal seal is placed in the groove of a flange. The other mating flange compresses the seal by 20% (15 – 25% is the range of compression) in to the groove. Once the seal is compressed a seating load is created which is a direct function of seal material, size and its wall thickness. The flange waviness creates an impression on the seal surface. This impression/foot print is the leak prevention zone. The wider the foot prints better the sealing. To achieve higher leak tightness the seals are altered by adding springs, surface coating/plating. Higher the seating load accompanied with surface coatings/plating will give better leak tightness.

Requirements of Metal Seals

Metal seals need to avoid permanent deformation. To avoid this deformation seals are placed in the grooves of the flange. These grooves are made 80% deep of seal height. On complete compression of these seals they can get maximum 20% compressed, which is optimum to achieve max leak tightness. If grooves cannot be made then retainers are required to prevent over compression. The flange Ra value i.e. the roughness plays a very important role in achieving the desired leak tightness. Enough bolt load is required to compress the seal for creating sufficient seating load. The number of bolts used for clamping plays an important load in applying load on the circumference of the seal.

Seal Selection

Selecting the optimum seal for any application is often a tradeoff between available load, required tightness, surface finish and cost. Temperature, Pressure and type of medium are important criteria's in seal selection.

Though following can be the guidelines

Select the biggest possible cross-section for a given diameter. A bigger cross section always gives higher spring back. The impact of the weld region is smaller. The variations in operating temperatures are better compensated.

The material and plating/coating of seal also plays an important role in the performance of the seal. It is important for the designer to understand what material is suitable for the application along with the plating type. In case any help is required Flexoresist can provide guidance based on our experience.

Available load is very important in deciding the seal sealing criteria. If load available is high enough one should go for seal with bigger cross section. Higher the cross sections better the spring back range..

Plating / Coating:

Plating/Coating is done on the seal surface. The purpose of plating/coating is to provide high leak tightness. The soft layer of plating is created so that it flows into the waviness of the flanges. Due to this the unevenness of flanges is filled and high leak tightness is achieved. The type of plating is decided based on application. Following are the types of plating/coating done on the seal.

a. Silver

b. Gold

c. Copper

d. Nickel

e. PTFE

f. Tin

g. Aluminium



Applications:



Aerospace:



Metal seals are used in a wide variety of application in aerospace, specially the turbine engine section. Since the temperature in engine crosses the limits of elastomeric seals the only optimum solution is metal seals. For high temperature applications exotic materials like Hastelloy, Haynes, Inconel and Elgiloy can be used.

TYPE OF SEALS USED



METAL O-RING

- Shaped as well as circular seals.

GAS FILLED METAL O-RING

- Shaped as well as circular seals.

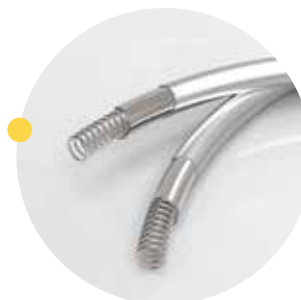


C-RING

- Shaped as well as circular seals.

SPRING ENERGIZED C-RINGS

- Shaped as well as circular seals.



Oil & Gas, Power Generation:



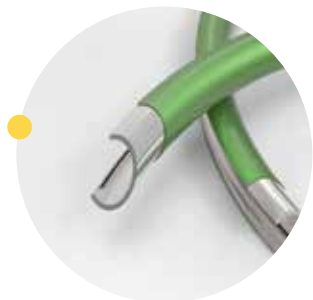
In oil and gas applications metal seals are highly preferred. In applications like deep sea where the pressures are extreme and the environment is corrosive special seals are made. At times they are gold plated for excellent performance. In power generation these seals are used to seal various parts of turbine section.

TYPE OF SEALS USED



METAL O-RING

- Shaped as well as circular seals.



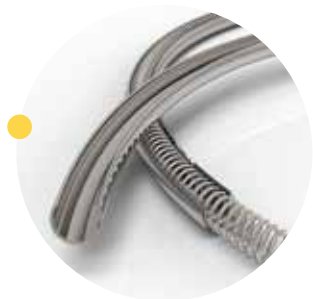
C-RING

- Shaped as well as circular seals.



SPRING ENERGIZED C-RINGS

- Shaped as well as circular seals.



RADIAL / CA SEALS

- circular in shape

Military:



Metal seals are used in a wide variety of areas in military and defense field. C-seals are used in the night vision systems which is a crucial part of today's defense technology. Also metal seals play an important part in space application. PTFE coated c-seals and spring energized c-seals are used in cryogenic applications.

TYPE OF SEALS USED



METAL O-RING

- Shaped as well as circular seals.

GAS FILLED METAL O-RING

- Shaped as well as circular seals.

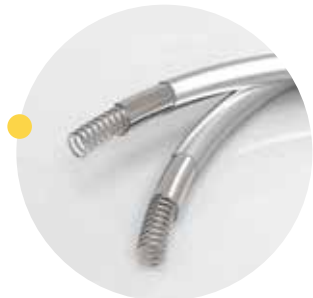


C-RING

- Shaped as well as circular seals.

SPRING ENERGIZED C-RINGS

- Shaped as well as circular seals.



Metal O-Rings for Moulds:



We manufacture metal o-ring seals used in sealing the leakage path between nozzle and manifold of Hot Runner systems. The seal (SS321/SS304 material) is hollow with a small vent hole on the ID. Due to its hollow structure the polymer enters in through the vent hole and provides internal resilience. This internal resilience keeps the seal inflated which prevents the leak.

TYPE OF SEALS USED



METAL O-RING

- Circular seals, Plastic mould seals

Reactor and Nuclear Seals:



As we are aware that Nuclear energy is the best source to produce energy w.r.t. the cost involved and its return on investment. With the ever increasing no. of nuclear installations and the risk of radiation it is important to seal the vessels at its highest limit. In achieving the goal of optimum sealing metal seals like, c-rings and spring energized c-ring seals play a very crucial role. To achieve the desirable leak tightness for extended period of time spring energized c- seals with Nimonic 90 spring and 2 layers of jackets, viz – Inconel and Aluminum are used. Metal seals are also used in the nuclear waste containment. Seals with various shapes, like race track, oval, square are manufactured for special applications.

TYPE OF SEALS USED



METAL O-RING

- Shaped as well as circular seals.

GAS FILLED METAL O-RING

- Shaped as well as circular seals.

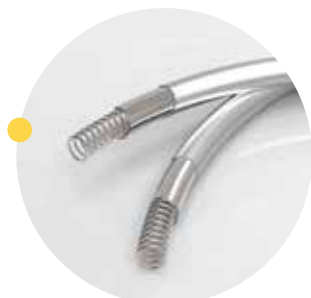


C-RING

- Shaped as well as circular seals.

SPRING ENERGIZED C-RINGS

- Shaped as well as circular seals.



Heavy Duty Mobile, Transportation Automotive:



C-ring seals have been accepted as a good solution for sealing turbochargers. Also shaped seals have been accepted in sealing the engines of high end sports cars.

TYPE OF SEALS USED

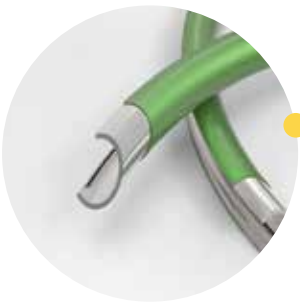


METAL O-RING

- Shaped as well as circular seals.

GAS FILLED METAL O-RING

- Shaped as well as circular seals.

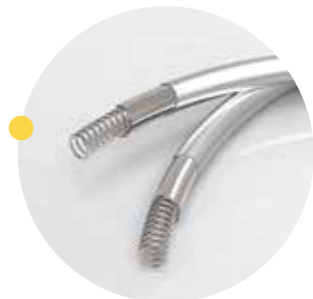


C-RING

- Shaped as well as circular seals.

SPRING ENERGIZED C-RINGS

- Shaped as well as circular seals.



Frequently asked Question:

- ? Should one replace elastomeric seals by metal seals?**

 - ▶ One should replace elastomeric seals only if leakage issues cannot be resolved by it. Metal seals will increase the cost and requirements of the setup. Usage of metal seals is much more difficult and requires proper knowledge beginning from design phase.

- ? Where are metal seals used?**

 - ▶ Metal seals are used in the extreme environment of temperature, pressure, radiation and so on. Almost all the applications where elastomeric seals fail.

- ? Can metal seals be used in Aluminum flanges?**

 - ▶ Yes they can be used in Aluminum flanges. Low seating load seals are used for these applications.

- ? Is plating necessary for seals?**

 - ▶ Plating is only done when high leak tightness is required e.g. 1×10^{-9} mbar.lit/sec.

- ? Is groove essential for the placement of seals?**

 - ▶ Grooves are not essential one can have retainer rings or spacer rings. But there has to be some method to avoid compression of ring beyond the specified limit.

- ? Can soft solid wires be used instead of metal o rings?**

 - ▶ One should not use soft solid wires especially in the applications involving high pressure and temperature. Due to high pressure the flange lifts off and due to high temperature thermal expansion of flanges takes place. This movement can only be compensated me resilient metal seals.

- ? What maximum pressure Flexoresist seal can withstand?**

 - ▶ Flexoresist seal can withstand 3000 bar pressure provided the setup is up to mark. Though theoretically it is said that metal seals can withstand pressures up to 10000 bars. We at Kquality Products we have not tried pressures up to 10000 bars.

- ?** **Can these seals be used for cryogenic applications?**
- ▶ Yes they can be used for cryogenic application, most of the times they are PTFE coated.
- ?** **Can one use these seals multiple times?**
- ▶ Metal seals after compression gets a footprint on its surface due to waviness/roughness of flanges. These footprints do not match the mating surfaces once removed and can lead to leakage. So reuse of metal seals is never advised.
- ?** **What is the shelf life of metal seals?**
- ▶ The shelf life of metal seals is unlimited.
- ?** **What surface finish of flanges should is suggested?**
- ▶ The surface finish of flanges depends upon the requirement of leak tightness. The most important parameter is the flanges should be turned in circular manner with a uniform feed rate. The flanges should not have any vibration/chatter marks in the sealing area.
- ?** **Are the seals available only in circular form?**
- ▶ No they are available in various shapes; shaped seals are designed as per the requirements. One has to take in to consideration the turn radius of the seal as drastic turn in seal is not possible.
- ?** **Is constant torquing of flanges required?**
- ▶ No, the max torque has to be applied only once, but it is essential to select the right seal. A seal with maximum cross section should be selected, so that it can have maximum resilience and compensate the flange lift off due to high pressure or bolt relaxation.
- ?** **Can the same seal be used for internal/external pressure applications?**
- ▶ It depends on pressure difference between the internal and external pressure along with the application. If the pressure difference is negligible one can use it but in few applications like vacuum only certain seals can be used.

Metallurgical Treatment:

Heat treatment plays a very important role in the performance of the seal. It increases the yield strength with heat treatment the seating load of the seal increases which provides better sealing. Also the spring back quality of the seal improves which enhances the contact between the seal and the contact surface. These improved characteristics help the seal to sustain improved leak tightness especially in cyclic thermal applications. This heat treatment is mainly carried out on C-seals, V-seals and E-seals.

Following treatments are carried out on metal seals:

- Work hardened
- Age hardening (precipitation hardened)
- Soft annealing
- Solution annealing + precipitation hardened
- Solution annealing
- Stress annealing



Flexoresist Technologies

Code sheet

Material code	Material
1	SS 321
2	Inconel 718
3	Inconel 750
4	Inconel 600
5	Inconel 625
6	SS 302
7	SS 304
8	SS 304L
9	SS 316Ti
10	Aluminum 1050
11	Aluminum IS 19500
12	Aluminum 6060
13	Elgiloy/Phynox
14	Nimonic 90
15	Hastealloy C - 276

Coating / Layer types		Coating Thickness μm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened - X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

T-I / T-O

(without any drill holes on ID/OD)



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-8} mbar.l/s

T-DI / T-DO

(with drill holes on ID/OD)



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-8} mbar.l/s

T-SI / T-SO



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-10} mbar.l/s

T-GI / T-GO



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-8} mbar.l/s

S-I / S-O



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-8} mbar.l/s

S-SI / S-SO



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-12} mbar.l/s

LS-SI / LS-SO



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-10} mbar.l/s

V-I / V-O



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-5} mbar.l/s

E-I / E-O



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-5} mbar.l/s

A



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-5} mbar.l/s

A-S



Internal Pressure / External Pressure

Max Leak Tightness: 10^{-7} mbar.l/s



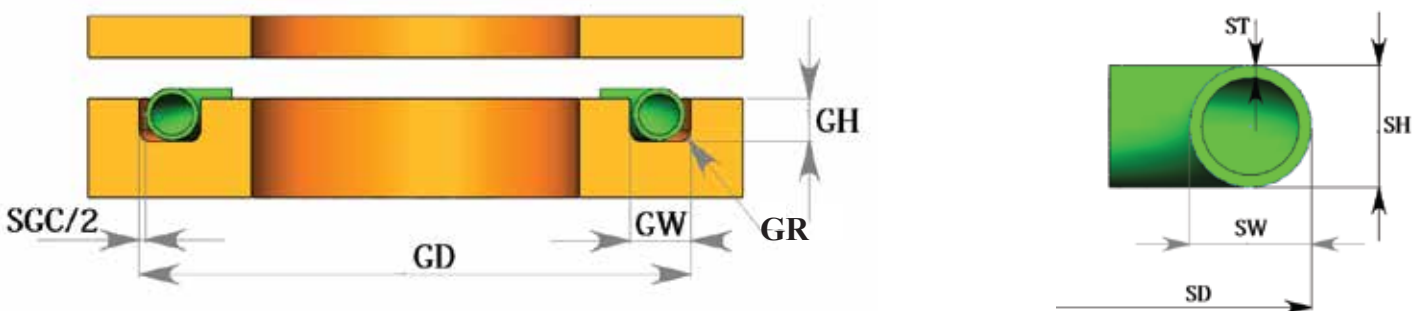
Metal O-Rings made from tube - Internal Pressure

T-I / T-DI / T-GI / T-SI

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Seal Tolerance	Seal Diameter Range	Wall Thickness		Seal & Groove Clearance	Groove Height	Groove Corner Radius	Groove Width	Spring Back Values (mm)		Load Values N/mm Circumference	
			ST						L	T	L	T
			L	T								
00.89	(+0.08/-0.03)	6 - 25	0.15	-	0.20	0.64 - 0.69	0.25	1.40	0.01	-	67	-
01.19	(+0.08/-0.03)	10 - 50	-	0.20	0.25	0.94 - 1.02	0.30	1.78	0.03	-	-	81
01.57	(+0.08/-0.03)	12 - 200	0.25	0.36	0.28	1.14 - 1.27	0.38	2.29	0.03	0.03	102	222
02.39	(+0.08/-0.03)	25 - 220	0.25	0.46	0.33	1.88 - 2.01	0.51	3.18	0.05	0.03	57	202
03.18	(+0.08/-0.03)	50 - 400	0.25	0.51	0.43	2.54 - 2.67	0.76	4.06	0.07	0.04	36	161
03.96	(+0.10)	75 - 650	0.41	0.51	0.61	3.18 - 3.30	1.27	5.08	0.10	0.08	72	114
04.78	(+0.13)	100 - 800	0.51	0.64	0.71	3.84 - 3.99	1.27	6.35	0.10	0.08	91	151
06.35	(+0.13)	200 - 1200	0.64	0.81	0.76	5.05 - 5.28	1.52	8.89	0.20	0.10	102	182
09.53	(+0.13)	300 - 2000	0.97	1.24	1.02	8.26 - 8.51	1.52	12.70	0.15	0.12	163	281
12.70	(+0.15)	800 - 3000	1.27	1.65	1.27	11.05 - 11.43	1.52	16.51	0.22	0.18	202	366

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



T-I/0100.00/3-0/00.89-L/H0/Si80

Type of Seal

- T-I Seal for internal pressure with no hole drilled
- T-DI Seal for internal pressure with hole drilled on ID
- T-GI Seal for internal pressure with Gas filled
- T-SI Seal for internal pressure with spring inside

Commonly used Material Type

Material Code	Material
1	SS 321
3	Inconel 750
7	SS 304

Seal External Diameter

(without plating)
0100.00 = 100.00 mm

Tube Sizes

Tube Diameter = 0.89 mm
Refer SH column on adjacent page
L- Tube wall thickness
(Refer adjacent table for value of "L")

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness µm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		



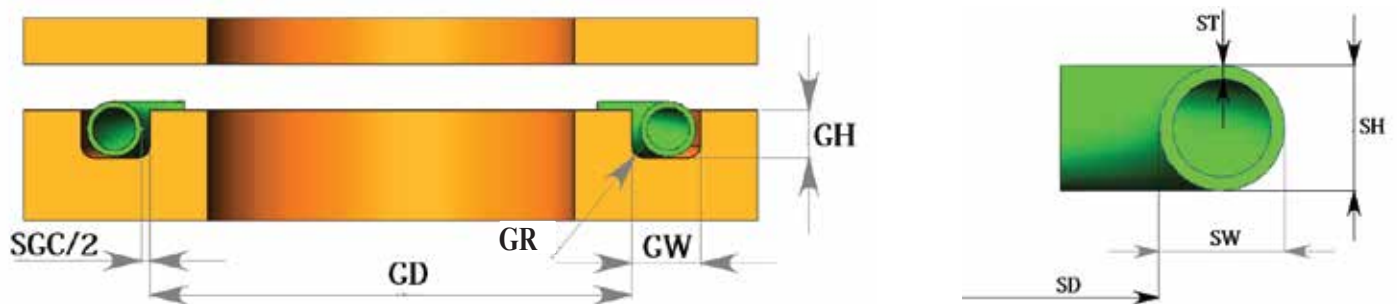
Metal O-Rings made from tube - External Pressure

T-O / T-DO / T-GO / T-SO

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Seal Tolerance	Seal Diameter Range	Wall Thickness		Seal & Groove Clearance	Groove Height	Groove Corner Radius	Groove Width	Spring Back Values (mm)		Load Values N/mm Circumference	
			L	T					L	T	L	T
00.89	(+0.08/-0.03)	6 - 25	0.15	-	0.20	0.64 - 0.69	0.25	1.40	0.01	-	67	-
01.19	(+0.08/-0.03)	10 - 50	-	0.20	0.25	0.94 - 1.02	0.30	1.78	0.03	-	-	81
01.57	(+0.08/-0.03)	12 - 200	0.25	0.36	0.28	1.14 - 1.27	0.38	2.29	0.03	0.03	102	222
02.39	(+0.08/-0.03)	25 - 220	0.25	0.46	0.33	1.88 - 2.01	0.51	3.18	0.05	0.03	57	202
03.18	(+0.08/-0.03)	50 - 400	0.25	0.51	0.43	2.54 - 2.67	0.76	4.06	0.07	0.04	36	161
03.96	(+0.10)	75 - 650	0.41	0.51	0.61	3.18 - 3.30	1.27	5.08	0.10	0.08	72	114
04.78	(+0.13)	100 - 800	0.51	0.64	0.71	3.84 - 3.99	1.27	6.35	0.10	0.08	91	151
06.35	(+0.13)	200 - 1200	0.64	0.81	0.76	5.05 - 5.28	1.52	8.89	0.20	0.10	102	182
09.53	(+0.13)	300 - 2000	0.97	1.24	1.02	8.26 - 8.51	1.52	12.70	0.15	0.12	163	281
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Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



T-O/0100.00/3-0/00.89-L/H0/Si80

Type of Seal

- T-O Seal for external pressure with no hole drilled
- T-DO Seal for external pressure with hole drilled on ID
- T-GO Seal for external pressure with Gas filled
- T-SO Seal for external pressure with spring inside

Commonly used Material Type

Material Code	Material
1	SS 321
3	Inconel 750
7	SS 304

Seal Internal Diameter

(without plating)
0100.00 = 100.00 mm

Tube Sizes

Tube Diameter = 0.89 mm
Refer SH column on adjacent page
L- Tube wall thickness
(Refer adjacent table for value of "L")

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
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H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness µm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		

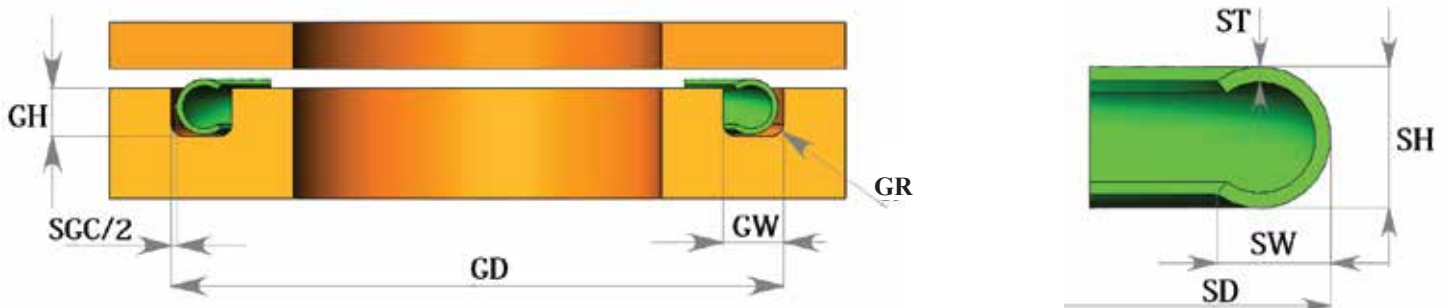
Metal O-Rings (w/o spring) made from sheet - Internal Pressure

S-I

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Tolerance	Seal Width	Seal Diameter Range	Sheet Thickness		Seal & Groove Clearance	Groove Height	Groove Corner Radius	Groove Width	Spring Back Values (mm)		Load Values N/mm Circumference	
				L	T					L	T	L	T
SH	T	SW	SDR	ST		SGC	GH	GR	GW	L	T	L	T
00.79	(+/-0.05)	0.71	6-25	0.13	0.18	0.08	0.65 - 0.70	0.25	1.02	0.04	0.03	31	66
01.19	(+/-0.05)	0.96	8-50	0.13	0.20	0.13	0.94 - 1.02	0.30	1.40	0.05	0.04	22	52
01.57	(+/-0.05)	01.26	10-200	0.15	0.25	0.15	1.27 - 1.37	0.38	1.91	0.08	0.06	22	62
02.00	(+/-0.05)	01.60	13-200	0.25	O.R	0.20	1.60 - 1.68	0.45	2.30	0.06	O.R	44	O.R
02.20	(+/-0.05)	01.76	13-200	0.25	O.R	0.22	1.76 - 1.85	0.47	2.50	0.08	O.R	45	O.R
02.39	(+/-0.05)	01.91	13-400	0.25	0.38	0.24	1.91 - 2.01	0.51	2.67	0.10	0,08	46	97
02.79	(+/-0.05)	02.25	20-400	0.38	O.R	0.28	2.23 - 2.34	0.55	3.10	0.12	O.R	71	O.R
03.18	(+/-0.08)	02.54	30-600	0.38	0.51	0.32	2.54 - 2.67	0.76	3.43	0.15	0.13	56	107
03.60	(+/-0.08)	02.88	45-600	0.41	O.R	0.36	2.88 - 3.02	0.90	3.90	0.12	O.R	51	O.R
03.96	(+/-0.08)	03.17	45-750	0.41	0.61	0.39	3.18 - 3.30	1.27	4.32	0.20	0.17	46	117
04.40	(+/-0.08)	03.52	75-800	0.41	O.R	0.44	3.52 - 3.69	1.27	4.70	0.21	O.R	41	O.R
04.78	(+/-0.10)	03.82	75-900	0.51	0.76	0.47	3.84 - 3.99	1.27	5.08	0.22	0.18	81	147
05.00	(+/-0.10)	04.01	75-900	0.51	O.R	0.50	4.00 - 4.20	1.27	5.30	0.23	O.R	56	O.R
05.20	(+/-0.10)	04.16	75-900	0.51	O.R	0.52	4.16 - 4.37	1.27	5.50	0.23	O.R	57	O.R
05.60	(+/-0.10)	04.50	75-1000	0.51	O.R	0.56	4.48 - 4.70	1.27	5.90	0.22	O.R	51	O.R
06.35	(+/-0.10)	05.08	100-1200	0.64	0.97	0.64	5.08 - 5.28	1.52	6.60	0.30	0.27	66	177
07.90	(+/-0.10)	06.32	100-1500	0.97	O.R	0.79	6.32 - 6.58	1.52	8.22	0.30	O.R	131	O.R
09.53	(+/-0.10)	07.62	300-2000	0.97	1.27	0.96	7.62 - 8.03	1.52	9.65	0.40	0.32	102	187
012.70	(+/-0.13)	10.16	600-3000	1.27	1.65	01.27	10.16 - 10.67	1.52	12.70	0.55	0.48	126	231

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



S-I/0100.00/2-0/01.57-L/H0/Si80

Type of Seal

S-I Seal for internal pressure

Commonly used Material Type

Material Code	Material
2	Inconel 718
3	Inconel 750
7	SS 304

Seal External Diameter

(without plating)
0100.00 = 100.00 mm

Seal Sizes

Seal Height = 1.57 mm

Refer SH column on adjacent page

L- Sheet wall thickness
(Refer adjacent table for value of "L")

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness μm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		

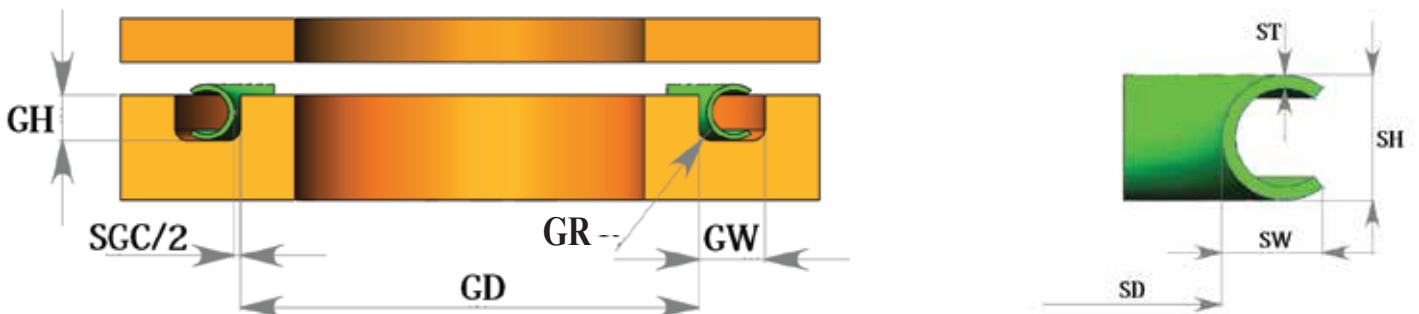
Metal O-Rings (w/o spring) made from sheet - External Pressure S-O

S-O

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Tolerance	Seal Width	Seal Diameter Range	Sheet Thickness		Seal & Groove Clearance	Groove Height	Groove Corner Radius	Groove Width	Spring Back Values (mm)		Load Values N/mm Circumference	
				ST						L	T	L	T
				L	T								
00.79	(+/-0.05)	0.71	6-25	0.13	0.18	0.08	0.65 - 0.70	0.25	1.02	0.04	0.03	31	66
01.19	(+/-0.05)	0.96	8-50	0.13	0.20	0.13	0.94 - 1.02	0.30	1.40	0.05	0.04	22	52
01.57	(+/-0.05)	01.26	10-200	0.15	0.25	0.15	1.27 - 1.37	0.38	1.91	0.08	0.06	22	62
02.00	(+/-0.05)	01.60	13-200	0.25	O.R	0.20	1.60 - 1.68	0.45	2.30	0.06	O.R	44	O.R
02.20	(+/-0.05)	01.76	13-200	0.25	O.R	0.22	1.76 - 1.85	0.47	2.50	0.08	O.R	45	O.R
02.39	(+/-0.05)	01.91	13-400	0.25	0.38	0.24	1.91 - 2.01	0.51	2.67	0.10	0,08	46	97
02.79	(+/-0.05)	02.25	20-400	0.38	O.R	0.28	2.23 - 2.34	0.55	3.10	0.12	O.R	71	O.R
03.18	(+/-0.08)	02.54	30-600	0.38	0.51	0.32	2.54 - 2.67	0.76	3.43	0.15	0.13	56	107
03.60	(+/-0.08)	02.88	45-600	0.41	O.R	0.36	2.88 - 3.02	0.90	3.90	0.12	O.R	51	O.R
03.96	(+/-0.08)	03.17	45-750	0.41	0.61	0.39	3.18 - 3.30	1.27	4.32	0.20	0.17	46	117
04.40	(+/-0.08)	03.52	75-800	0.41	O.R	0.44	3.52 - 3.69	1.27	4.70	0.21	O.R	41	O.R
04.78	(+/-0.10)	03.82	75-900	0.51	0.76	0.47	3.84 - 3.99	1.27	5.08	0.22	0.18	81	147
05.00	(+/-0.10)	04.01	75-900	0.51	O.R	0.50	4.00 - 4.20	1.27	5.30	0.23	O.R	56	O.R
05.20	(+/-0.10)	04.16	75-900	0.51	O.R	0.52	4.16 - 4.37	1.27	5.50	0.23	O.R	57	O.R
05.60	(+/-0.10)	04.50	75-1000	0.51	O.R	0.56	4.48 - 4.70	1.27	5.90	0.22	O.R	51	O.R
06.35	(+/-0.10)	05.08	100-1200	0.64	0.97	0.64	5.08 - 5.28	1.52	6.60	0.30	0.27	66	177
07.90	(+/-0.10)	06.32	100-1500	0.97	O.R	0.79	6.32 - 6.58	1.52	8.22	0.30	O.R	131	O.R
09.53	(+/-0.10)	07.62	300-2000	0.97	1.27	0.96	7.62 - 8.03	1.52	9.65	0.40	0.32	102	187
012.70	(+/-0.13)	10.16	600-3000	1.27	1.65	01.27	10.16 - 10.67	1.52	12.70	0.55	0.48	126	231

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



S-O/0100.00/2-0/01.57-L/H0/Si80

Type of Seal

S-O Seal for external pressure

Commonly used Material Type

Material Code	Material
2	Inconel 718
3	Inconel 750
7	SS 304

Seal Internal Diameter

(without plating)
0100.00 = 100.00 mm

Seal Sizes

Seal Height = 1.57 mm

Refer SH column on adjacent page

L- Sheet wall thickness
(Refer adjacent table for value of "L")

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness μm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		

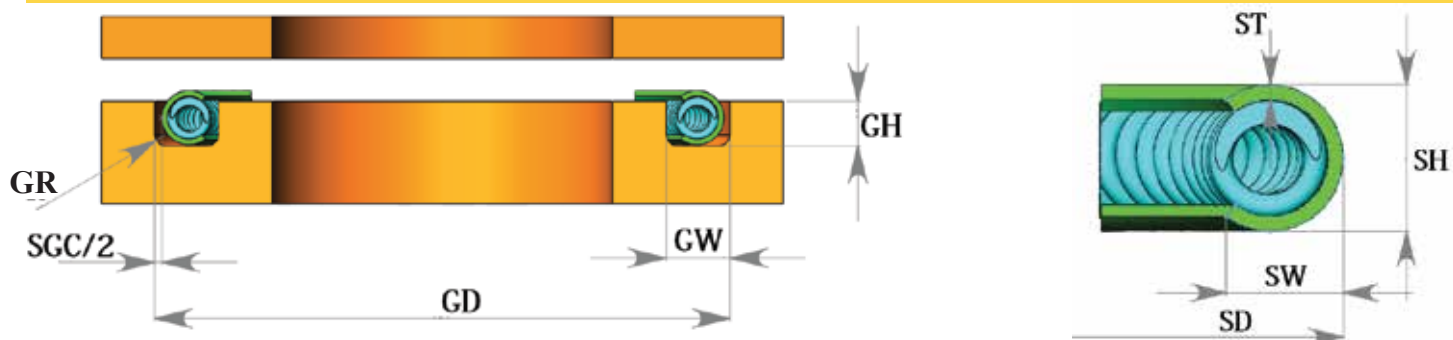
Metal O-Rings with spring made from sheet - Internal Pressure

S-SI

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Tolerance	Seal Width	Seal Diameter Range	Sheet & Spring Thickness		Seal & Groove Clearance	Groove Height	Groove Corner Radius	Groove Width	Spring Back Values (mm)		Load Values N/mm Circumference	
				L/T	ST					L	T	L	T
SH	T	SW	SDR			SGC	GH	GR	GW				
01.57	(+/-0.05)	01.42	15-280	L/T	0.15	0.15	1.27 - 1.37	0.35	2.05	0.08	0.07	76	177
02.00	(+/-0.05)	01.75	20-300	L	0.25	0.20	1.60 - 1.68	0.40	2.50	0.08	O.R	181	246
02.20	(+/-0.05)	01.95	25-300	L	0.25	0.32	1.76 - 1.85	0.45	2.86	0.08	O.R	156	212
02.39	(+/-0.05)	02.14	25-400	L/T	0.25	0.24	1.91 - 2.01	0.50	3.10	0.13	0.11	142	312
02.79	(+/-0.05)	02.41	25-500	L/T	0.38	0.28	2.23 - 2.34	0.50	3.60	0.12	0.10	217	347
03.18	(+/-0.08)	02.80	25-600	L/T	0.38	0.32	2.54 - 2.67	0.75	4.10	0.15	0.12	142	287
03.60	(+/-0.08)	03.19	32-750	L	0.41	0.36	2.88 - 3.02	0.75	4.63	0.12	O.R	161	351
03.96	(+/-0.08)	03.55	32-750	L/T	0.41	0.39	3.18 - 3.30	1.20	5.10	0.20	0.15	146	322
04.40	(+/-0.08)	03.99	50-800	L	0.41	0.44	3.52 - 3.69	1.20	5.72	0.20	O.R	182	267
04.78	(+/-0.10)	04.37	75-900	L/T	0.51	0.47	3.84 - 3.99	1.20	6.20	0.28	0.20	187	421
05.00	(+/-0.10)	04.49	75-900	L	0.51	0.50	4.00 - 4.20	1.20	6.50	0.35	O.R	176	396
05.20	(+/-0.10)	04.69	75-900	L/T	0.51	0.52	4.16 - 4.37	1.20	6.76	0.29	O.R	237	377
05.60	(+/-0.10)	05.09	75-1000	L/T	0.51	0.56	4.48 - 4.70	1.20	7.30	0.30	O.R	217	342
06.35	(+/-0.10)	05.71	100-1800	L/T	0.64	0.64	5.08 - 5.28	1.50	8.30	0.35	0.30	326	557
07.90	(+/-0.10)	06.93	150-3000	L/T	0.97	0.79	6.32 - 6.58	1.50	10.40	0.40	O.R	337	676
09.53	(+/-0.10)	08.56	300-3000	L/T	0.97	0.96	7.62 - 8.03	1.50	12.40	0.43	0.35	507	806
12.70	(+/-0.13)	11.43	600-7600	L/T	1.27	1.27	10.16 - 10.67	1.50	16.50	0.56	O.R	634	916

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



S-SI/0100.00/2-2/01.57-L/H0/Si80

Type of Seal

S-SI Seal with spring internal pressure

Commonly used Material Type

Material Code	Material	Jacket	Spring
2	Inconel 718	✓	✓
3	Inconel 750	✓	
6	SS 302		✓
7	SS 304	✓	✓
13	Elgiloy		✓
14	Nimonic 90		✓

Seal External Diameter

(without plating)
0100.00 = 100.00 mm

Seal Sizes

Seal Height = 1.57 mm

Refer SH column on adjacent page

L- Spring thickness light

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness µm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		

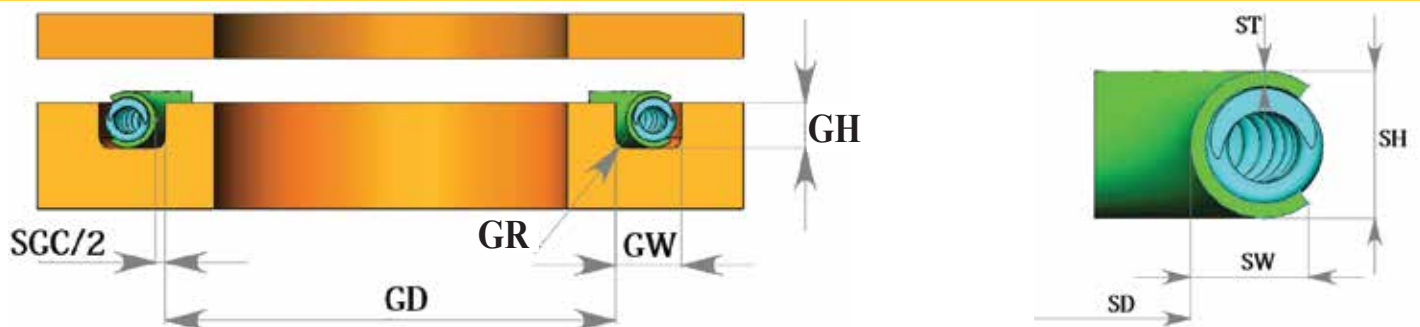
Metal O-Rings with spring made from sheet - External Pressure

S-SO

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Tolerance	Seal Width	Seal Diameter Range	Sheet & Spring Thickness		Seal & Groove Clearance	Groove Height	Groove Corner Radius	Groove Width	Spring Back Values (mm)		Load Values N/mm Circumference	
				L/T	ST					L	T	L	T
SH	T	SW	SDR			SGC	GH	GR	GW				
01.57	(+/-0.05)	01.42	15-280	L/T	0.15	0.15	1.27 - 1.37	0.35	2.05	0.08	0.07	76	177
02.00	(+/-0.05)	01.75	20-300	L	0.25	0.20	1.60 - 1.68	0.40	2.50	0.08	O.R	181	246
02.20	(+/-0.05)	01.95	25-300	L	0.25	0.32	1.76 - 1.85	0.45	2.86	0.08	O.R	156	212
02.39	(+/-0.05)	02.14	25-400	L/T	0.25	0.24	1.91 - 2.01	0.50	3.10	0.13	0.11	142	312
02.79	(+/-0.05)	02.41	25-500	L/T	0.38	0.28	2.23 - 2.34	0.50	3.60	0.12	0.10	217	347
03.18	(+/-0.08)	02.80	25-600	L/T	0.38	0.32	2.54 - 2.67	0.75	4.10	0.15	0.12	142	287
03.60	(+/-0.08)	03.19	32-750	L	0.41	0.36	2.88 - 3.02	0.75	4.63	0.12	O.R	161	351
03.96	(+/-0.08)	03.55	32-750	L/T	0.41	0.39	3.18 - 3.30	1.20	5.10	0.20	0.15	146	322
04.40	(+/-0.08)	03.99	50-800	L	0.41	0.44	3.52 - 3.69	1.20	5.72	0.20	O.R	182	267
04.78	(+/-0.10)	04.37	75-900	L/T	0.51	0.47	3.84 - 3.99	1.20	6.20	0.28	0.20	187	421
05.00	(+/-0.10)	04.49	75-900	L	0.51	0.50	4.00 - 4.20	1.20	6.50	0.35	O.R	176	396
05.20	(+/-0.10)	04.69	75-900	L/T	0.51	0.52	4.16 - 4.37	1.20	6.76	0.29	O.R	237	377
05.60	(+/-0.10)	05.09	75-1000	L/T	0.51	0.56	4.48 - 4.70	1.20	7.30	0.30	O.R	217	342
06.35	(+/-0.10)	05.71	100-1800	L/T	0.64	0.64	5.08 - 5.28	1.50	8.30	0.35	0.30	326	557
07.90	(+/-0.10)	06.93	150-3000	L/T	0.97	0.79	6.32 - 6.58	1.50	10.40	0.40	O.R	337	676
09.53	(+/-0.10)	08.56	300-3000	L/T	0.97	0.96	7.62 - 8.03	1.50	12.40	0.43	0.35	507	806
12.70	(+/-0.13)	11.43	600-7600	L/T	1.27	1.27	10.16 - 10.67	1.50	16.50	0.56	O.R	634	916

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



S-SO/0100.00/2-2/01.57-L/H0/Si80

Type of Seal

S-SO Seal with spring - external pressure

Commonly used Material Types

Material Code	Material	Jacket	Spring
2	Inconel 718	✓	✓
3	Inconel 750	✓	
6	SS 302		✓
7	SS 304	✓	✓
13	Elgiloy		✓
14	Nimonic 90		✓

Seal Internal Diameter

(without plating)
0100.00 = 100.00 mm

Seal Sizes

Seal Height = 1.57 mm
Refer SH column on adjacent page
L- Spring thickness light

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness µm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		



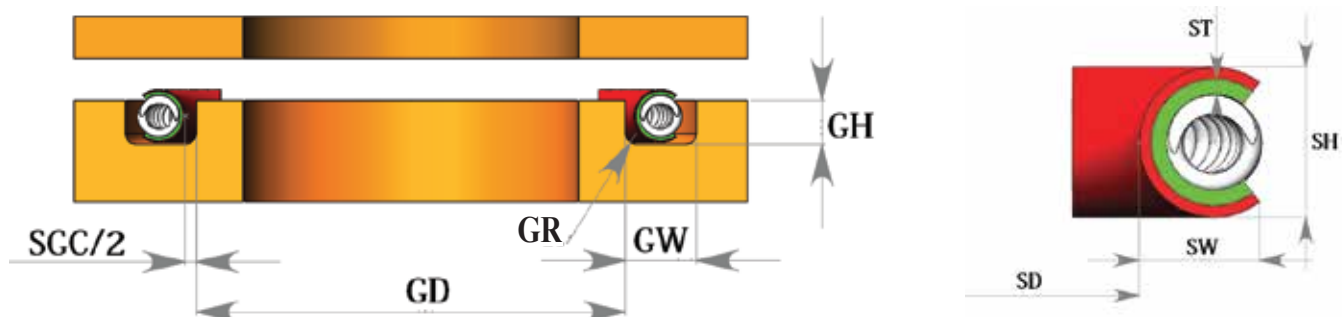
Metal O-Rings with spring made from 2 sheets – External Pressure

LS-SO

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Seal Tolerance	Seal Width	Seal Diameter	Seal Details			Seal & Groove Clearance	Groove Height	Groove Width	Groove Radius
				Spring Code	Inner Jacket Thickness	Alu Jacket Thickness				
SH		SW	SD		ST	AST	SGC	GH	GW	GR
2.00	(-0.10/+0.20)	01.65	20-180	L	0.15	0.20	0.20	1.60-168	2.50	0.40
2.60	(-0.10/+0.20)	02.20	20-180	L	0.25	0.20	0.25	2.08-2.18	3.50	0.50
3.50	(-0.10/+0.20)	02.92	35-300	L	0.38	0.20	0.35	2.80-2.94	4.60	0.75
4.00	(-0.10/+0.20)	03.39	40-400	L	0.41	0.20	0.40	3.20-3.36	5.10	1.20
4.50	(-0.10/+0.20)	03.79	50-500	L	0.41	0.30	0.45	3.60-3.78	5.80	1.20
4.80	(-0.10/+0.20)	04.19	60-600	L	0.41	0.20	0.48	3.84-4.03	6.20	1.20
5.60	(-0.10/+0.20)	04.79	80-750	L	0.51	0.30	0.56	4.48-4.70	7.30	1.20
6.20	(-0.10/+0.20)	05.39	100-750	L	0.51	0.30	0.62	4.96-5.20	8.10	1.40

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



LS-SO/0100.00/2-2/02.00-L/H0/AI200

Type of Seal

LS- Seal with spring
SO and extra layer -
external pressure

Commonly used Material Types

Material Code	Material	Outer Jacket	Inner Jacket	Spring
2	Inconel 718		✓	✓
7	SS 304		✓	✓
10	Aluminum 1050	✓		
11	Aluminum IS 19500	✓		
12	Aluminum 6060	✓		
14	Nimonic 90			✓

Outer Jacket can be of any of the mentioned material code based on availability of raw material: 10/11/12

Seal Internal Diameter

(without plating)
0100.00 = 100.00 mm

Seal Sizes

Seal Height = 2.00 mm

Refer SH column on adjacent page

L- Spring thickness light

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness µm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		

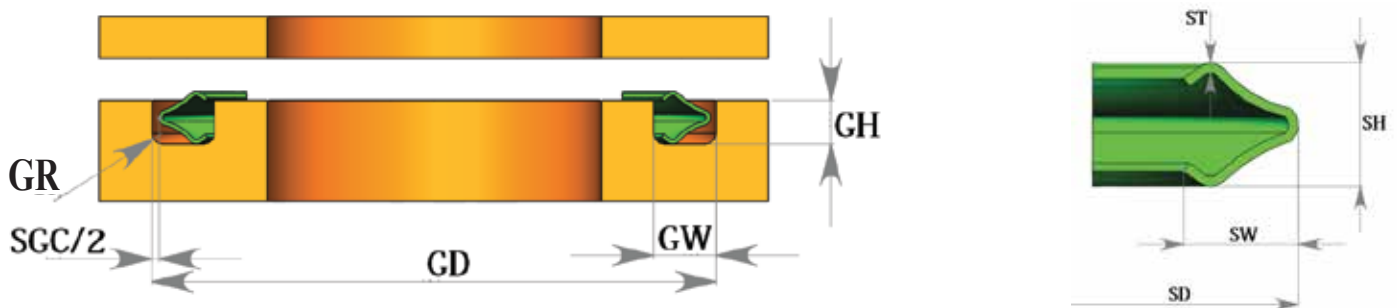
V-Shaped Metal O-Rings (w/o spring) made from sheet – Internal Pressure

V-I

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Seal Tolerance	Seal Width	Seal Diameter	Seal Details		Seal & Groove Clearance	Groove Width	Groove Height	Groove Radius	Load Values N/mm Circumference	Spring Back Values (mm)
				ST	ST						
SH		SW	SD	ST	ST	SGC	GW	GH	GR	LO	SB
2.39	(+/-0.05)	02.63	30-400	L	0.25	0.14	3.10	1.91-2.01	0.50	23	0.28
3.18	(+/-0.08)	03.50	45-600	L	0.38	0.19	4.10	2.54-2.67	0.75	32	0.27
3.96	(+/-0.08)	04.36	65-750	L	0.41	0.24	5.10	3.18-3.30	1.20	22	0.37
4.78	(+/-0.10)	05.26	70-900	L	0.51	0.29	6.20	3.84-3.99	1.20	23	0.56
5.60	(+/-0.10)	06.16	80-1000	L	0.51	0.34	7.30	4.48-4.70	1.20	21	0.60
6.35	(+/-0.10)	06.99	120-1800	L	0.64	0.38	8.30	5.08-5.28	1.50	31	0.60
9.53	(+/-0.10)	10.49	300=3000	L	0.97	0.57	12.40	7.62-8.03	1.50	46	0.90
12.70	(+/-0.13)	13.98	600-7600	L	1.27	0.76	16.50	10.16-10.67	1.50	58	1.20

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



V-I/0100.00/2-0/02.39-L/H0/Si80

Type of Seal

V-I Seal for internal pressure

Commonly used Material Type

Material Code	Material
2	Inconel 718

Seal External Diameter

(without plating)
0100.00 = 100.00 mm

Seal Sizes

Seal Height = 2.39 mm

Refer SH column on adjacent page

L- Sheet wall thickness

(Refer adjacent table for value of "L")

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness μm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		

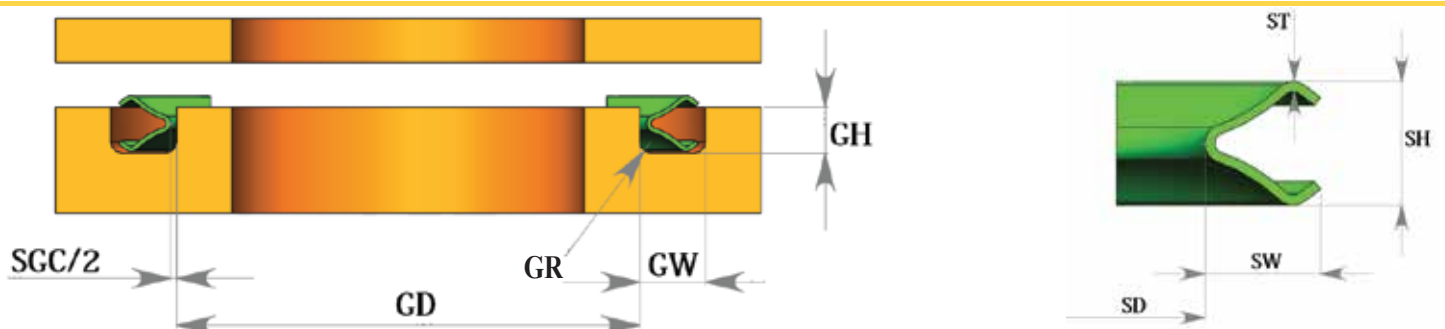
V-Shaped Metal O-Rings (w/o spring) made from sheet – External Pressure

V-O

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Seal Tolerance	Seal Width	Seal Diameter	Seal Details		Seal & Groove Clearance	Groove Width	Groove Height	Groove Radius	Load Values N/mm Circumference	Spring Back Values (mm)
				ST	ST						
SH		SW	SD	ST	ST	SGC	GW	GH	GR	LO	SB
2.39	(+/-0.05)	02.63	30-400	L	0.25	0.14	3.10	1.91-2.01	0.50	23	0.28
3.18	(+/-0.08)	03.50	45-600	L	0.38	0.19	4.10	2.54-2.67	0.75	32	0.27
3.96	(+/-0.08)	04.36	65-750	L	0.41	0.24	5.10	3.18-3.30	1.20	22	0.37
4.78	(+/-0.10)	05.26	70-900	L	0.51	0.29	6.20	3.84-3.99	1.20	23	0.56
5.60	(+/-0.10)	06.16	80-1000	L	0.51	0.34	7.30	4.48-4.70	1.20	21	0.60
6.35	(+/-0.10)	06.99	120-1800	L	0.64	0.38	8.30	5.08-5.28	1.50	31	0.60
9.53	(+/-0.10)	10.49	300=3000	L	0.97	0.57	12.40	7.62-8.03	1.50	46	0.90
12.70	(+/-0.13)	13.98	600-7600	L	1.27	0.76	16.50	10.16-10.67	1.50	58	1.20

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



V-O/0100.00/2-0/02.39-L/H0/Si80

Type of Seal

V-O Seal for external pressure

Commonly used Material Type

Material Code	Material
2	Inconel 718

Seal Internal Diameter

(without plating)
0100.00 = 100.00 mm

Seal Sizes

Seal Height = 2.39 mm

Refer SH column on adjacent page

L- Sheet wall thickness

(Refer adjacent table for value of "L")

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness μm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		



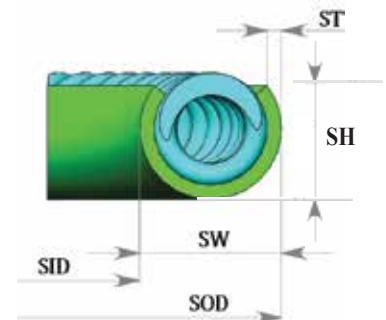
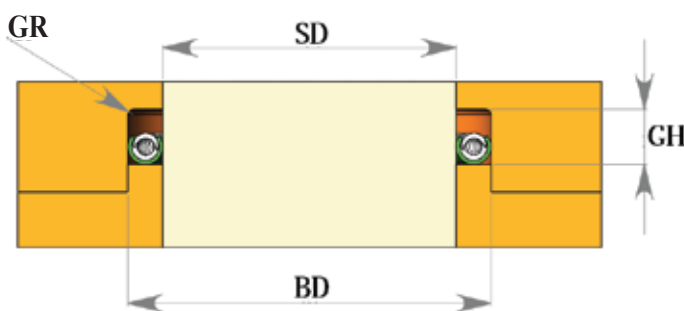
Metal O-Rings with and without spring made from sheet - Axial Pressure

A / A-S

Seal and Groove Dimensions in Millimeters (mm)

Diameter Range	Material Code	Seal Height	Tolerance on SH	Seal Width	Material Thickness	Diameter Seal Outside	Tolerance on SOD	Diameter Seal Inside	Tolerance on SID	Bore Diameter	Tolerance on BD	Shaft/Rod Diameter	Tolerance on SD	Groove Depth (min)	Radius (Max)
D	MC	SH		SW	ST	SOD		SID		BD	GW	SD		GH	GR
12 < 38	1.57M	1.35	+0.05/-0.10	1.64	0.15	BD+0.08	+0.06/-0.03	DSO-3.28	+0.03/-0.06	SD+3.12	+0.03	BD-3.12	-0.03	1.50	0.25
38 - 45	1.57M	1.35	+0.05/-0.10	1.64	0.15	BD+0.10	+0.06/-0.03	DSO-3.28	+0.03/-0.06	SD+3.07	+0.03	BD-3.07	-0.03	1.50	0.25
30 < 38	2.39M	1.99	+0.05/-0.10	2.42	0.25	BD+0.08	+0.06/-0.03	DSO-4.85	+0.03/-0.06	SD+4.70	+0.03	BD-4.70	-0.03	2.14	0.28
38 - 85	2.39M	1.99	+0.05/-0.10	2.42	0.25	BD+0.10	+0.06/-0.03	DSO-4.85	+0.03/-0.06	SD+4.65	+0.03	BD-4.65	-0.03	2.14	0.28
50 < 85	3.18M	2.65	+0.05/-0.15	3.22	0.38	BD+0.10	+0.06/-0.03	DSO-6.45	+0.03/-0.06	SD+6.25	+0.03	BD-6.25	-0.03	2.80	0.38
85 < 150	3.18M	2.65	+0.05/-0.15	3.22	0.38	BD+0.15	+0.08/-0.05	DSO-6.45	+0.05/-0.08	SD+6.15	+0.05	BD-6.15	-0.05	2.80	0.38
150 - 200	3.18M	2.65	+0.05/-0.15	3.22	0.38	BD+0.20	+0.08/-0.05	DSO-6.45	+0.05/-0.08	SD+6.05	+0.05	BD-6.05	-0.05	2.80	0.38
85 < 150	3.96M	3.30	+0.05/-0.20	4.01	0.38	BD+0.15	+0.08/-0.05	DSO-8.03	+0.05/-0.08	SD+7.72	+0.05	BD-7.72	-0.05	3.45	0.51
150 - 250	3.96M	3.30	+0.05/-0.20	4.01	0.38	BD+0.20	+0.08/-0.05	DSO-8.03	+0.05/-0.08	SD+7.62	+0.05	BD-7.62	-0.05	3.45	0.51
100 < 150	4.78M	3.96	+0.05/-0.20	4.81	0.51	BD+0.15	+0.08/-0.05	DSO-9.63	+0.05/-0.08	SD+9.32	+0.05	BD-9.32	-0.05	4.11	0.51
150 - 300	4.78M	3.96	+0.05/-0.20	4.81	0.51	BD+0.20	+0.08/-0.05	DSO-9.63	+0.05/-0.08	SD+9.22	+0.05	BD-9.22	-0.05	4.11	0.51
150 - 300	6.35M	5.27	+0.05/-0.25	6.40	0.64	BD+0.20	+0.08/-0.05	DSO-12.80	+0.05/-0.08	SD+12.40	+0.05	BD-12.40	-0.05	5.42	0.76

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



A-S/0100.00/2-2/01.57-L/H0/Si80

Type of Seal

- A Axial seal without spring
- A-S Axial seal with spring

Commonly used Material Type

Material Code	Material	Jacket	Spring
2	Inconel 718	✓	✓
3	Inconel 750	✓	
6	SS 302		✓
7	SS 304	✓	✓
13	Elgiloy		✓
14	Nimonic 90		✓

Seal Outside Diameter

SOD (without plating)
0100.00 = 100.00 mm

Seal Sizes

Seal Height = 1.57 mm
Refer SC column on adjacent page
L- Spring thickness light

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness µm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		



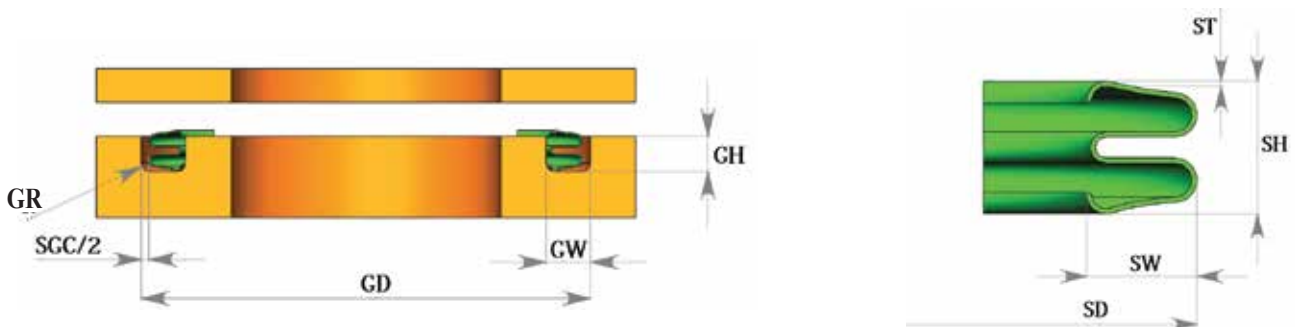
E-Shaped Metal O-Rings (w/o spring) made from sheet – Internal Pressure

E-I

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Seal Width	Seal Diameter Range	Sheet Thickness	Seal & Groove Clearance	Groove Height	Groove Corner Radius	Groove Width	Spring Back Values (mm)	Load Values N/mm Circumference
SH	SW	SD	ST	SGS	GH	GR	GW	SB	LO
			L						
01.88 (+/-0.08)	1.68	45 – 200	0.127	0.076	1.55 – 1.60	0.38	2.30	0.30	6
02.59 (+/-0.08)	2.31	50 – 300	0.25	0.076	2.15 – 2.21	0.50	2.95	0.38	6
02.74 (+/-0.08)	3.68	60 – 300	0.25	0.076	2.15 – 2.25	0.50	4.35	0.53	7
02.74 (+/-0.10)	2.31	50 – 300	0.25	0.076	2.15 – 2.25	0.50	2.95	0.46	16
03.56 (+/-0.10)	3.10	50 – 600	0.30	0.130	2.95 – 3.05	0.75	4.20	0.56	11
03.35 (+/-0.10)	3.10	50 – 600	0.38	0.130	2.95 – 3.05	0.75	4.20	0.36	13
05.54 (+/-0.13)	4.83	85 – 900	0.38	0.15	4.55 – 4.65	1.00	5.85	0.94	9
07.49 (+/-0.13)	6.78	150 – 1200	0.51	0.20	6.20 – 6.35	1.50	8.00	1.22	14

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



E-I/0100.00/2-0/02.74-L/H0/Si80

Type of Seal

E-I E-Seal for internal pressure

Commonly used Material Type

Material Code	Material
2	Inconel 718
3	Inconel 750

Seal External Diameter

(without plating)
0100.00 = 100.00 mm

Seal Sizes

Seal Height = 2.74 mm
Refer SH column on adjacent page
L- Sheet wall thickness light
(Refer adjacent table for value of "L")

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness μm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		

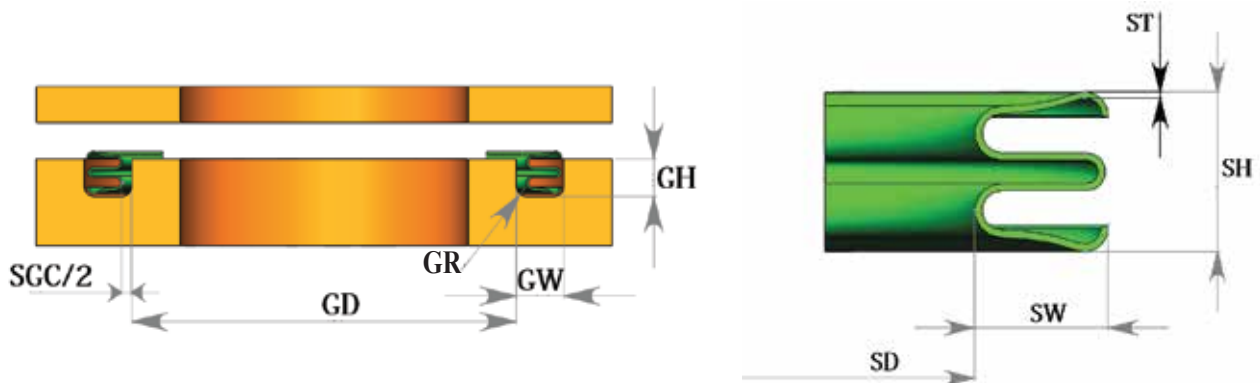
E-Shaped Metal O-Rings (w/o spring) made from sheet – External Pressure

E-O

Seal and Groove Dimensions in Millimeters (mm)

Seal Height	Seal Width	Seal Diameter Range	Sheet Thickness	Seal & Groove Clearance	Groove Height	Groove Corner Radius	Groove Width	Spring Back Values (mm)	Load Values N/mm Circumference
SH	SW	SD	ST	SGS	GH	GR	GW	SB	LO
			L						
01.88 (+/-0.08)	1.68	45 – 200	0.127	0.076	1.55 – 1.60	0.38	2.30	0.30	6
02.59 (+/-0.08)	2.31	50 – 300	0.25	0.076	2.15 – 2.21	0.50	2.95	0.38	6
02.74 (+/-0.08)	3.68	60 – 300	0.25	0.076	2.15 – 2.25	0.50	4.35	0.53	7
02.74 (+/-0.10)	2.31	50 – 300	0.25	0.076	2.15 – 2.25	0.50	2.95	0.46	16
03.56 (+/-0.10)	3.10	50 – 600	0.30	0.130	2.95 – 3.05	0.75	4.20	0.56	11
03.35 (+/-0.10)	3.10	50 – 600	0.38	0.130	2.95 – 3.05	0.75	4.20	0.36	13
05.54 (+/-0.13)	4.83	85 – 900	0.38	0.15	4.55 – 4.65	1.00	5.85	0.94	9
07.49 (+/-0.13)	6.78	150 – 1200	0.51	0.20	6.20 – 6.35	1.50	8.00	1.22	14

Note: Above given values are based on lab setup conditions especially the Load and Spring-Back values. Practically the values can differ based on the actual seal size, groove conditions, groove dimensions, surface finish and seal plating conditions.



E-O/0100.00/2-0/02.74-L/H0/Si80

Type of Seal

E-O E-Seal for external pressure

Commonly used Material Type

Material Code	Material
2	Inconel 718
3	Inconel 750

Seal Internal Diameter

(without plating)
0100.00 = 100.00 mm

Seal Sizes

Seal Height = 2.74 mm
Refer SH column on adjacent page
L- Sheet wall thickness light
(Refer adjacent table for value of "L")

Heat Treatment

Heat Treatment Code	Heat Treatment Code Description
H0	No Heat Treatment i.e. work hardened
H1	Solution Annealing + Precipitation Hardened -X750 & X718
H2	Solution Annealing + Precipitation Hardened (NACE MR 0175) - X718
H3	Solution Annealing
H4	Stress Annealing
H5	Age Hardened - X750 & X718
H6	Soft Annealing - Alloy 600, Alu 1050, Alloy 625 & Alu 6060

Plating / Coating

Coating / Layer types		Coating Thickness μm	
0 (Zero)	No plating	30	10 to 30
Si	Silver	60	30 to 60
Go	Gold	80	60 to 80
Cu	Copper	200	150 to 200
Ni	Nickel		
Pt	PTFE		
Al	Aluminum		
Ti	Tin		

Non Circular Seals:

Flexoresist can manufacture various shaped seals depending on customer requirements. The shaped seals radius is the main limitation in the manufacturing of these seals. As the cross-section of the seal increases the seal turn radius will increase. Thus sharp radius should be avoided while designing the seal shapes.

Below is the table which can guide the minimum radius for corresponding seal size

Minimum Radius of Non Circular Seals									
Seal Height in mm	0.89	1.57	2.39	3.18	3.96	4.78	6.35	9.53	12.70
Metal O-Ring	5	10	15	25	50	75	100	200	300
Metal O-Ring with spring	-	-	15	25	50	75	100	200	300
Metal C-Ring	5	7	12	15	25	50	75	200	250
Metal C-Ring with spring	-	-	12	15	25	50	75	200	250

Bolt Torque Calculation:

The hereby proposed calculation method is a very simple one, showing the required elements to calculate the bolt-torque. As there are always many other parameters influencing an assembly and having their importance for a seal tight construction, the customer remains responsible for the flange design and the applied bolt load.

Calculate the hydrostatic area (biggest diameter of the seal)

$$- HA = 3.14 * D^2 / 4 \text{ (mm}^2\text{)}$$

Where D = OD of the seal

Calculate the hydrostatic force

$$- HF = HA * P \text{ (N)}$$

Where P = test pressure

Calculate the required force to compress the seal as prescribed

$$- RF = 3.14 * D * \text{linear load (N)}$$

Calculate the total force required

$$- TF = HF + RF \text{ (N)}$$

Calculate the force per bolt

$$- BF = TF / \text{number of bolts (N)}$$

Calculate the bolt stress area

$$- BA = (3.14 * (d_e + d_r / 2)^2 / 4 \text{ (mm}^2\text{)})$$

Where d_e = effective diameter of the tread / d_r = root diameter

Calculate bolt stress

$$- \text{Stress} = BF / BA \text{ (N/mm}^2\text{)}$$

Calculate the max allowable force / bolt

$$- F_{\text{max}} = \text{Max suggested bolt stress} * BA \text{ (N)}$$

Calculate bolt-torque

- In function of TF calculated above

$$- T = \text{Coefficient of friction} * ((d_e + d_r / 2)^2 / 4) * BF \text{ (Nm)}$$

- In function of max allowable bolt stress

$$- T = \text{Coefficient of friction} * ((d_e + d_r / 2)^2 / 4) * F_{\text{max bolt}} \text{ (Nm)}$$

Use the highest torque allowed

Seal and Groove Tolerances:

Seal and Groove Tolerances	
Seal Height / Crossection (SH)	Diameter Tolerance
0.89 to 4.78	+0.14
6.35	+0.20
9.53 to 12.70	+0.25

Groove Tolerances			C-Ring Tolerances		
Nominal Diameter	Groove ID	Groove OD	Nominal Diameter	Seal ID	Seal OD
0-3	0/-0.040	0/+0.040	0-3	0/+0.060	0/-0.060
3-6	0/-0.048	0/+0.048	3-6	0/+0.075	0/-0.075
6-10	0/-0.058	0/+0.058	6-10	0/+0.090	0/-0.090
10-18	0/-0.070	0/+0.070	10-18	0/+0.110	0/-0.110
18-30	0/-0.084	0/+0.084	18-30	0/+0.130	0/-0.130
30-50	0/-0.100	0/+0.100	30-50	0/+0.160	0/-0.160
50-80	0/-0.120	0/+0.120	50-80	0/+0.190	0/-0.190
80-120	0/-0.140	0/+0.140	80-120	0/+0.220	0/-0.220
120-180	0/-0.160	0/+0.160	120-180	0/+0.250	0/-0.250
180-250	0/-0.185	0/+0.185	180-250	0/+0.290	0/-0.290
250-315	0/-0.210	0/+0.210	250-315	0/+0.320	0/-0.320
315-400	0/-0.230	0/+0.230	315-400	0/+0.360	0/-0.360
400-500	0/-0.250	0/+0.250	400-500	0/+0.400	0/-0.400
500-760	0/-0.300	0/+0.300	500-760	0/+0.500	0/-0.500
760-1050	0/-0.400	0/+0.400	760-1050	0/+0.630	0/-0.630
1050-1425	0/-0.500	0/+0.500	1050-1425	0/+0.760	0/-0.760
1425-1940	0/-0.630	0/+0.630	1425-1940	0/+1.000	0/-1.000

Guidelines, Precautions and Installation

For proper functioning of metal seals following guidelines are to be followed.

Flange:

- Make sure the flanges are turned and not milled. The turning operation will create circular pattern which is good for sealing.
- In case of elliptical / square seals the milled groove needs to be properly polished to remove the circular pattern created in the groove by the cutter.
- Make sure the flanges have enough holes for proper clamping of seals.
- Make sure the bolt sizes are sturdy enough to create the seating load on the seals.
- Make sure the flanges are rigid enough to avoid bending.
- Make sure the seal is as close as possible to the bolting position.
- Check if the Ra value of the flanges is 0.4 μm .
- Grooves should be scratch free.

Seal:

- Make sure the seal packet is opened at the time of installation only.
- Once the seal is out of the packing make sure it directly goes in the groove.
- No surface scratches on the seal surface permitted.
- Make sure the groove is free from oil and other unwanted particles which will affect the seal performance.
- In case of high leak tightness requirement, one should use hand gloves.
- Make sure the seal is not in contact of any sharp object.

Installation:

- Before installing the seal, the groove should be cleaned properly with a dust free cloth. One can use acetone or isopropyl alcohol for a dust free groove.
- Avoid scratches on seal as well as grooves.
- Install the top flange on the seal avoiding rubbing on the seal surface.
- Tighten the bolts cross wise to create a uniform seating load on the seal.
- Do not use sharp objects to place or remove the seals.
- Open the seal packing only at the time of installation.
- Use hand for installation and avoid metal parts for handling.

Flexoresist DATASHEET

Website: www.metaloring.com | 9890977244 / 9890454224

Customer: **Date:**

Email id: **Mob. No.:**

Address:

Type of Seal	Circular:	Rectangular:	Other:
	Quantity:	Size:	Part No.:
Installation	Vertical:	Horizontal:	Universal:
Seal Material	Sheet/Tube Material:		Spring Material:
Plating/Coating	Yes:	No:	
	Material:	Plating/Coating Thk:	
Application			
Temperature	Operating:	Design:	
Pressure	Operating:	Design:	
Media	Media:	Flow Velocity:	
Load Available	No of Bolts:	Size of Bolts:	
Flange	Material:	Type:	
	Surface Finish:		
Leak Tightness	Required Leak Tightness:		
Groove Dimensions	Groove Width (WG):	Groove Height (GH):	
	Groove OD:	Groove ID:	
Notes			

Other Products

Flexoresist and its other group companies have range of products.



METAL BELLOWS

- Widely used in Valve, Gauges and Sensor applications.

METAL BELLOWS EXPANSION JOINTS
- Used in Oil and Gas, Piping, Vacuum, Chemical, Food and other industries.



AEROSPACE

- Vanes and Stator Assemblies for Aerospace Industry.

Flexoresist Technologies Pvt. Ltd.

Corporate Office:

Final plot no. 38/1 Ramtekdi
Industrial Estate, Hadapsar, Pune,
Maharashtra, India - 411013

Phone:

+91 98904 54224
+91 98909 77244

Email:

anand.uttarkar@flexoresist.com
admin@flexoresist.com

Website: www.metaloring.com

