METAL SEALS

INTERNAL, EXTERNAL & RADIAL PRESSURE SEALING SOLUTION HANDBOOK

Omniseal Solutions
SAINT-GOBAIN

BEYOND the boundaries of POSSIBLE

Welcome to the Omniseal Solutions' World, Part of Saint-Gobain Group

Saint-Gobain has a rich tradition of excellence that dates back more than 360 years. Today, it is among the world's top 100 industrial corporations and a leader in the development of light and sustainable construction as well as in the manufacturing of engineered components and materials.

In 1665, King Louis XIV signed the letters patent, leading to the creation of Saint-Gobain on an industrial basis. Among the company's earlier and more notable projects was the manufacturing of 357 mirrors for the Hall of Mirrors in the Palace of Versailles. From these glassmaking origins, Saint-Gobain continues its long history of developing new and innovative materials and products through arduous research.

With more than 161,000 employees, operations in 80 countries, and eight major cross-business research centers that serve all Activities, Saint-Gobain provides complete and thorough service to our customers, beginning with our experienced design engineering team, moving to our high-tech labs for testing and research and development, and continuing onto the manufacturing floor.

Much of our global resources are focused on creating strong research and development centers and establishing partnerships with prestigious universities and laboratories. Our commitment to innovation has resulted in the rapid progression of new Saint-Gobain products that did not exist five years ago.

Saint-Gobain is among the global leaders in each of its businesses: construction products, building distribution and innovative materials, including high-performance seals and advanced materials. Our precision sealing and material solutions are manufactured throughout the world with sites located in the Americas, Europe and Asia.

Saint-Gobain Group Headquarters, France

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About Omniseal Solutions' Manufacturing & Engineering Expertise

Omniseal Solutions is proud of our more than 65 years of manufacturing expertise, and most of all, customer focus in all the industries supported and protected. Our global team includes engineers who have been supporting customers at the beginning of America's race to space and man's first footprint on the Moon.

The "Omniseal" namesake pays homage to the sealing pioneers (Bill Reid, Charles Tanner and Roy Creath) and their relentless dedication to solve what seemed impossible in space applications and to overcome critical challenges.

We are relentlessly dedicated to the design and manufacture of precision sealing and wear control solutions that protect critical applications in the most demanding environments and passionately driven to push "Beyond the Boundaries of Possible."

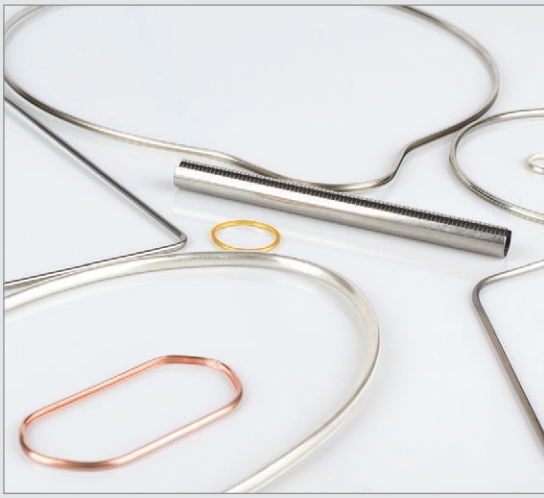
As part of Saint-Gobain — a company with 360 years in manufacturing and technical innovation, Omniseal Solutions has been able to build a strong infrastructure that is not only successful on a global scale but also within local communities that need manufacturing, engineering, sales, and technical expertise. Customers can buy locally and quickly, while having the comfort of knowing they are collaborating with skilled technical teams who support research, development, design, prototyping and testing around the globe.

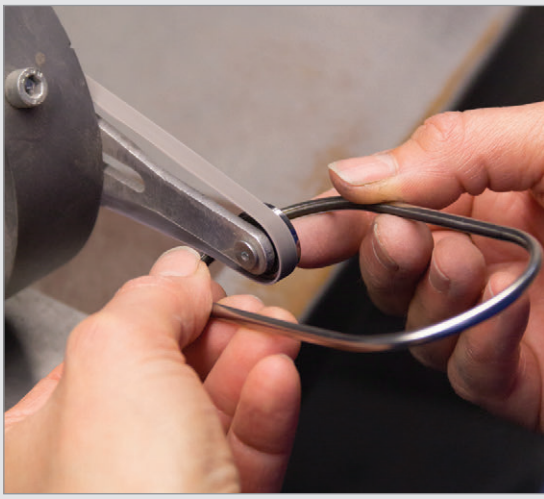
In 2020, Omniseal Solutions acquired High Tech Metal Seals (HTMS), a designer and manufacturer of engineered metal seals, founded in 1999 and serving industrial, energy, aviation, space and nuclear markets. HTMS has developed a unique expertise by providing very advanced metal sealing solutions for use under extreme temperature and pressure conditions. About 50 people are employed at Kontich's site in Belgium.

These metal sealing solutions complement our robust range of tailor-made solutions in the sealing industry, strengthened by the acquisition of American Seal and Engineering Co. (ASE), a leader in technical sealing solutions also used in the energy and aerospace industries, at the start of 2019.

For more than 20 years we have been designing, developing, and manufacturing elastic or resilient metal sealing solutions for the most demanding applications in numerous markets. As a result of our passionate and committed teams who have built reliable designs and production expertise throughout the years makes Omniseal Solutions one of the global leaders in the metal sealing industry.

Driven by operational excellence and the common goal to find and deliver the best possible solution on the market is what makes Omniseal Solutions the preferred partner for our customers. Together we develop metal sealing solutions of the highest quality standard meeting customer specifications.





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A Tour of Our Capabilities

Expertise

- Co-development with customers in many critical industries: Aviation, Space, Energy: Carbon-Free, Nuclear & Science Research, Industrial, Semiconductor, Energy: Oil & Gas, and Life Science.
- In-house testing
- R&D for new products
- Close cooperation with universities
- Development of new production methods and new sealing solutions

Production Capabilities

- Seal diameter range from 5 mm up to 6 m (0.2" up to 236")
- Cross sections from 0,79mm up to 12,70mm (0,031" up to 0,500")
- Non-standard cross sections available on request
- Shaped seals, racetrack, rectangular and other shapes on request
- Tailor-made seals per customer specifications
- In-house plating and coating facilities
- In-house heat treatment facilities
- In-house laboratory for testing purposes
- In-house cleanroom

Flexibility

- Short lead times
- Procedure for rush production
- Quick response
- Custom-made sealing solutions
- Dedicated staff

AS 9100 Rev.D

EN 9100:2016

IATF 16949:2016

ISO 9001:2015

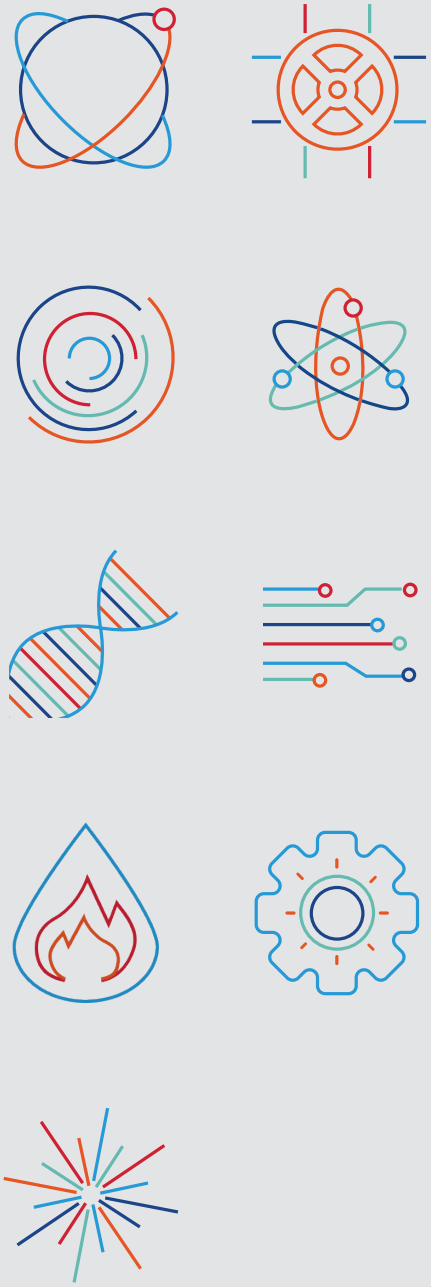
ISO 14001:2015

ISO 19443:2018

ISO 45001:2018

Quality & Certificates

Omniseal Solutions is dedicated to produce resilient metal seals under the most stringent quality procedures. The company is AS & EN 9100, ISO 9001, 14001, 19443, 45001 and IATF 16949 certified.

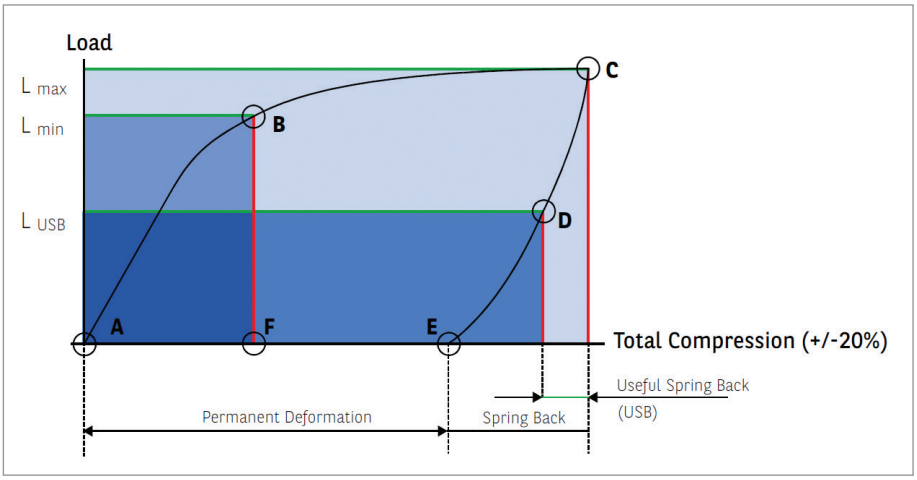


Introduction to Omniseal® Metal Seals

General Metal Seals Properties

- Unlimited shelf life (if stored under the correct conditions and/or in appropriate packaging)
- Radiation and corrosion resistance
- Low load compared to Ring Type Joints (RTJ's) and similar flat gaskets
- High elastic recovery over and extended service life
- Temperature from -269°C (-452°F) up to +1000°C (+1832°F) – higher temperatures on request
- Pressure from ultra-high vacuum up to 100,000 psi (6894 bar)*
- Leakage rates better than 1E-10 mbar*l/s possible with proper design
- No explosive decompression issues

GENERIC COMPRESSION-DECOMPRESSION GRAPH



Seal Dynamics

The sealing performance of any elastic metal seal is based on the relatively high specific contact load between the seal and the mating surface. This linear load or seating load is generated by the reaction of the seal (with or without spring) against its deformation by compressing the seal to a well-defined groove depth. The graph above represents the compression and decompression characteristics of a standard metal seal. The curve "A-B-C" gives the increasing linear load by compression rate, whereas the curve "C-D-E" represents the reduction of linear load when the seal flanges separate, and compression is reduced. The curve shows a plastic deformation of the metal seal. Point "B" on the compression curve is the transition point between elastic and plastic deformation. As a rule of thumb, in this point, almost 80% of the maximum linear load is achieved. Point "C" indicates the point of maximum compression (min. groove depth). Metal seals should be compressed approximately 20%, as higher compression rates can lead to seal failure due to heavy plastic deformation.

** Pressure resistance may vary with material, geometry, and operating conditions.*

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Introduction to Omniseal® Metal Seals

The total spring back or elastic recovery is represented between point “C” and “E”. As a rule of thumb, the spring back varies between 4 and 6% of the original cross section of the seal. It must be clear that as soon as the flange separation equals the total spring back, the seal’s performance is over. Therefore, it is strongly advised to always avoid flange movement or rotation. If this movement or rotation cannot be avoided, it should not exceed 30% of the total spring back. This is called the useful spring back and is influenced by multiple factors:

- Acceptable leak rate
- Seal design
- Hardware

Spring Back of a Seal

For a given seal cross section and seal type, it is generally true that with maximum load the spring back is lowest. Consequently, a low load seal will generate the highest spring back because of its higher flexibility.

Seating Stress

The initial line contact between the seal and the mating surface will gradually increase with the rate of compression to form a footprint. The width of the footprint depends on the seal type, the cross section, and the compression rate. The seating stress (MPa/PSI) will approximately equal the linear load (N/mm) divided by the footprint width. (MPa =N/mm?)

Linear loads vary from as low as 20 N/mm (lbf/inch) to more than 500 N/mm seal circumference. The seal width or footprint usually varies from less than 0.3 m to about 3 mm for the bigger cross section seals. Based on this, the seating stress varies from a minimum of 30 MPa to over 150 MPa. With a heavy-duty spring, the seating stress can be increased to above 300 MPa. The high seating stress is required to make the selected plating or coating flow into the irregularities of the flanges, thereby sealing off all leak paths.

Non-Standard Designs

Resilient metal seals must often perform under extreme conditions. Standard solutions as given in this catalogue may not always fulfill these requirements. In case the application requires seal properties outside the scope of the standard designs, Omniseal Solutions can develop a seal with the necessary physical properties. Close cooperation with universities and material suppliers allows Omniseal Solutions to optimize the seal characteristics in no time. At all times it is recommended to select the biggest possible cross section for a given diameter. By doing so, the useful spring back will be at its largest, enabling performance within the widest possible tolerance range for that given diameter (line C-D) and as such creating a more robust sealing solution. A higher spring back allows more flange movement/rotation due to internal or external loads.

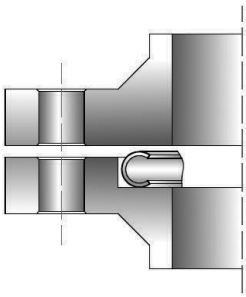
Metal Seal Selection & Considerations

The selection of the most suitable seal for any service condition is often a delicate trade-off between load and spring back of the seal. The higher the requested load to compress the seal the better the tightness level, whereas the useful spring back of the seal will determine how well this tightness will be maintained with varying temperatures and pressures.

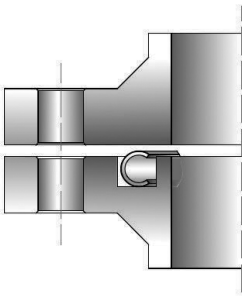
For a given seal cross section and seal type, it is generally true that with maximum load the spring back is lowest. And of course, a seal with minimum load will generate the highest spring back.

However, there are other parameters and circumstances that will influence the performance of a selected metal seal, e.g., type of flanges and fitting method, pressure and temperature cycles, bolt grade, bolt tension and method to stress the bolts.

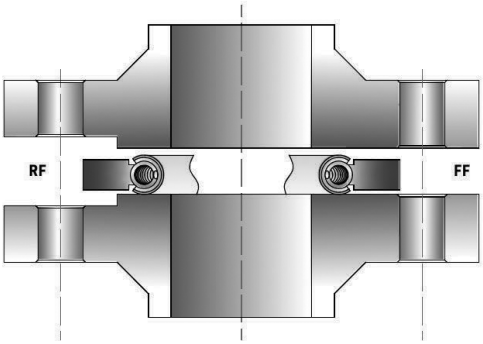
Types of Standard Flanges



Metal seal fitted in "OPEN GROOVE". Cfr. "Male-female assembly"



Metal seal fitted in "CLOSED GROOVE" Cfr. "Spigot-recess assembly"



Metal seal + retainer fitted between RF- or FF-flanges
RF: Raised Face flange
FF: Full-Face flange

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Metal Seal Selection & Considerations

Flange Rotation / Lift-off

In all cases, the goal should be to achieve a construction as rigid as possible to overcome movements (lateral and/or axial) caused by varying pressure and/or temperature changes and external loads. Flanges, bolts, and seal can all be considered “spring elements” within the system of which the seal is often a highly non-linear element in its load recovery behavior. Therefore, an assembly where metal-to-metal-contact between flanges occurs after bolting is the most rigid and stable one. After the seal has been compressed in its groove, further tightening of the bolts against the system pressure does not have any negative effect on the seal.

Bolted Seal Assembly

The initial bolt load will generate the initial load (cfr seating stress) on the seal. Because of the system pressure the hydrostatic load tends to “unload” the seal, resulting in flange lift-off. The degree of residual stress (energy) left, will determine the final leak rate.

Stress Relaxation

Stress relaxation can be caused, among other reasons, by:

- Flange rotation / flange lift-off
- Flow (creep of the seal material)
- Bolt relaxation
- Cycling application conditions
- External load

Conclusion

To obtain the target leak rate, it is recommended to: design the assembly as stiff and rigid as possible Select the flange type Select bolts of suitable strength and quantity go for the seal requiring the best ratio load vs. elastic spring back use soft plating types if allowed and possible select the biggest possible cross section for the given diameter use metal seal grades having the best mechanical properties even at high temperatures

Metal Seal Selection Criteria

The table below shows per subject a couple of parameters and questions to be considered before choosing a sealing solution. Note that there are not all possible parameters or questions but a selection of the most common and important ones.

PARAMETERS AND QUESTIONS

Subject	Parameters	Questions to be considered
Seal Type	Semi-dynamic (C(S)A, Commaseal®, Lip seal) or static (all other seal types)	—
Metal Grades (seal)	—	Which material is compatible / incompatible?
Application Data	Medium to Seal	Liquid, gaseous, viscosity...
	Temperature	Cryogenic, high temperature, cycles
	Pressure	UHV, high pressure, cycles , duration
	Leake Rate	Measured at: · Standard conditions · Operating conditions
Flanges / Bolting	Type of Flange	· Material grade · Surface finish · Geometry
	Bolts / Clamps	· Material grade · Number and dimensions · Max bolt load/available force · Position of bolts
	Movement / displacement of the flange	Axial and / or radial displacement (useful spring back of the seal)

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Omniseal® Metal Seals Portfolio

Omniseal Solutions' resilient metal seals are used in a wide variety of applications where other seals cannot cope with extremes of temperature, pressure, medium or combinations thereof.

Metal Face Seals

- O-Ring
- C-Seal
- E-Seal
- Turbo Seal
- V-Seal
- Aluminum Jacket Spring-Energized Seal
- Omega Seal
- Oysterseal®

Metal Axial Seals

- Axial C-Seal
- Lip Seal
- Axial V-Seal

Metal Seals for Market Standards

- Boss Seal
- AS1895/7 & /23 E-Seals

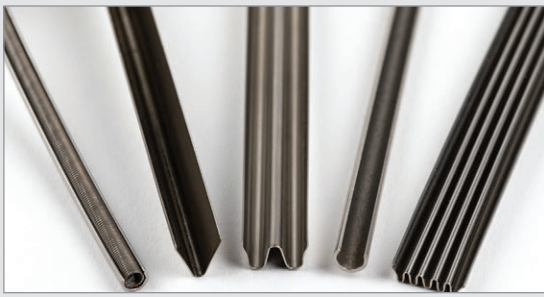
Custom and Specific Designs

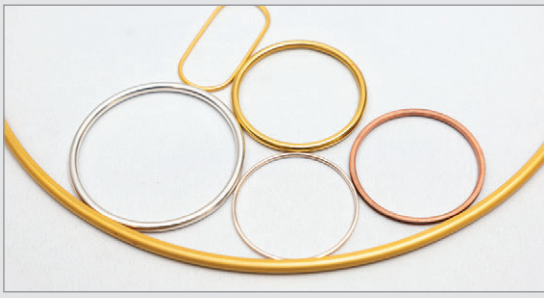
- Multi-convoluted E-Seal
- Shaped Seal
- Machined Seal

Omniseal Solutions' resilient metal seals are used in a wide variety of applications where normal seals cannot cope with extremes of temperature, pressure, medium or combinations thereof.

Markets

Omniseal Solutions specializes in metal seals, serving all markets including aviation, space, nuclear, energy, automotive, industrial, life sciences, semiconductors...





Space Market: Case Study

Launch Vehicle Combustion Chamber

Application Challenges

- Prevent escape of propellants and maintain a hermetic barrier
- Manage constant variation of temperature and pressure
- Handle required low load and stringent tightness level

Our Solution

Omniseal® Metal C-Seals

Product:	Metal C-Seals in Inconel 718 / 750
Specifications:	Meets demanding leak rate as well as low load/high spring back requirements
Typical Temperature:	600°C to 1200°C (1100°F to 2200°F)
Typical Pressure:	Up to 300 bar (4350 psi)
Media:	Propellant

Our Technology Advantages

High-performance metal C-Seals create a tight seal between the combustion chamber walls and the injector plate that is responsible for releasing propellants into the chamber. By selecting our optimal metal seal, this area is protected with the necessary resilience, conforming to irregularities in mating surfaces and ensuring a tight seal

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Nuclear Market: Case Study

Nuclear Spent Fuel Transport & Storage

Application Challenges

- Ability to withstand a borated water environment
- Needs to seal against light gasses such as helium
- Provide reliable radiation resistance
- Be leak tight to 200°C (392°F) for up to 50 years

Our Solution

Omniseal® Metal Spring-Energized C-Seal

Product:	Dual Metal Spring-Energized Seals in Alloy X750, Silver Coated with Retainer Assembly
Specifications:	Inner and outer lid seals for spent fuel cask with tight leakage requirements and intended for storage for up to 50 years including qualification.
Typical Temperature:	-40°C minimum (-40°F) 438°C maximum (820°F)
Typical Pressure:	Vacuum minimum) 55 bar maximum (800 psi)
Media:	Air, Borated Water, Spent Fuel

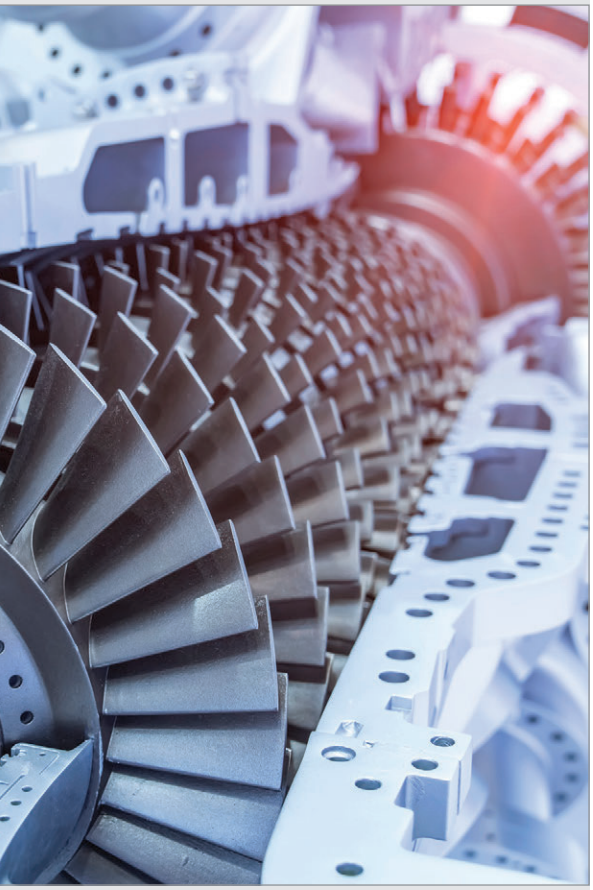
Our Technology Advantages

Metal Spring-Energized C-Seals provide exceptional durability, temperature resilience, and radiation resistance, making them well-suited for static nuclear applications that require robust performance and long-term reliability.

Other conventional sealing products often have restricted radiation tolerance, whereas metal seals lack this limitation, positioning them as an effective alternative for static nuclear applications.

Energy Market: Case Study

Power Generation Natural Gas Turbine



Application Challenges

- Withstand extreme temperature, i.e., up to 1427°C (2600°F)
- Ensure that fuel supplies, as well as air flow, are properly sealed to ensure highest possible efficiency
- Provide sealing reliability in certain sections of the turbine such as the combustion system; damaged hardware could cost millions of dollars to repair, along with cost of downtime

Our Solution

Omniseal® Metal Seals

Product:	For combustion system: E-Seals, Spring-energized C-Seals, and Lip Seals; For turbine system: Segmented E-Seals, C-Seals, Lip Seals, V-Seals, Turbo Seals
Specifications:	Ultra low leakage rate High temperature gas Long lifetime expectancy
Typical Temperature:	Up to 1010°C (1850°F)
Typical Pressure:	6895 bar (100,000 psi)
Media:	Thermal expansion & hot air

Our Technology Advantages

Omniseal® Metal Axial Seals

Extreme pressure turbine rotor bucket dovetail joints, to maximize the cooling performance of the air flow.

Large Diameter Turbine Shroud & Nozzle Seals

- For use in hot section of the turbine
- Large deflection and high springback capabilities
- Serve as flow restrictors
- Combined with NCCM coating for wear resistance

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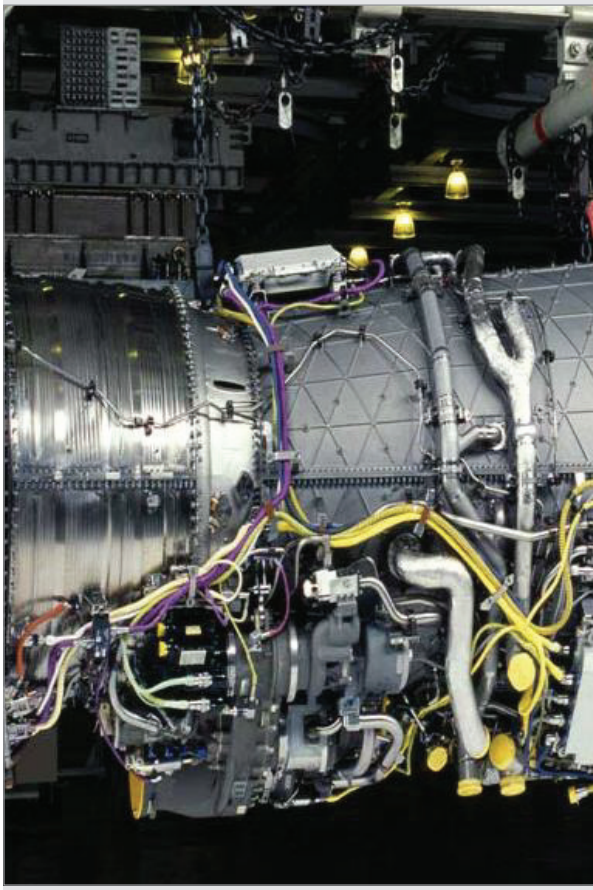
Aviation Market: Case Study

Bleed Air & Cool Air Systems

Application Challenges

- Thermal fatigue and creep in ducts and seals
- Maintaining tight seals under vibration, thermal cycling, and pressure changes
- High maintenance burden and inspection frequency



Our Solution

Omniseal® Metal Seals

Product:	For combustion system: E-Seals, Spring-energized C-Seals, and Lip Seals; For turbine system: Segmented E-Seals, C-Seals, Lip Seals, V-Seals, Turbo Seals
Specifications:	Sealing of hot air channel standards compliance (AS/MS 9202, 9371, AS1895/7 and AS1895/23) High vibration environment
Typical Temperature:	Up to 650°C (1202°F) (higher temperatures reachable)
Typical Pressure:	27 bar (400 psi)
Media:	Compatible with any aerospace fuel

Our Technology Advantages

Longevity & Tight Tolerance

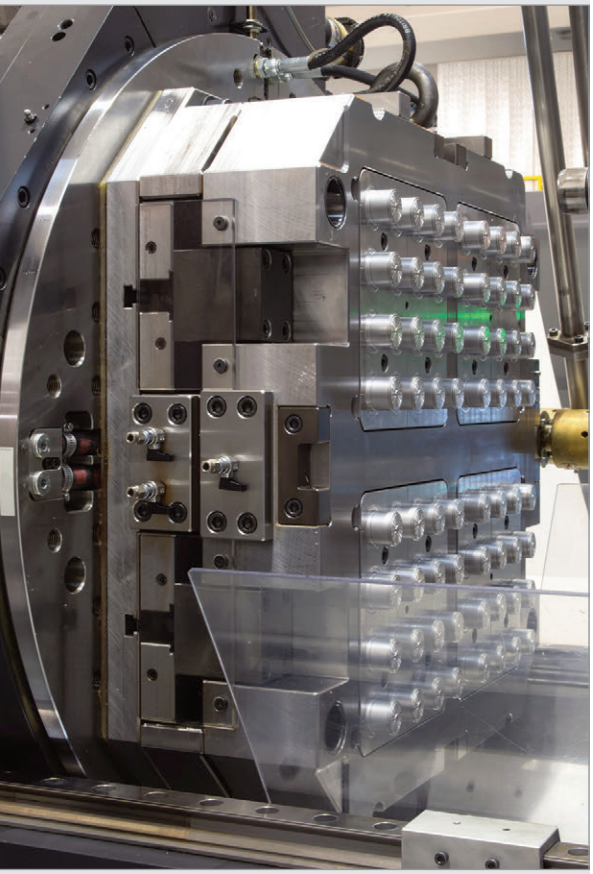
- Hot air management in the engine for highest temperatures and highest oxidation conditions
- Lower bolt force required allow softer materials for flange
- Proprietary plating against fretting increases part lifetime and protects casing with tight tolerances

Omniseal® Metal E-Seal, C-Seal, & Omega Seal

- Proprietary NCCM coating for wear resistance
- High sealing capability at low compression load
- Good capability to withstand backpressure stress
- Asymmetric shape possible for better flange fit

Industry Market: Case Study

Hot Runner & Injection Molding Systems



Application Challenges

In a hot runner system, the internal tool temperature ranges between 400 to 600°F. Seals must be able to withstand these temperatures, otherwise there will be leakage through the seal interface. If stacked tool plates are misaligned due to unsupported guide pin movement, leakage will occur in the parting line, ruining part quality and possibly damaging the entire mold. A leak in a hot runner can be detrimental to the functionality of the tool, resulting in clogged nozzles or worse, a clogged manifold.

Our Solution

Omniseal® Metal Spring-Energized C-Seal

Product:	Metal Spring-energized C-Seal
Specifications:	Metal seals are applied at the interface between the manifold block and nozzle body, which is a critical juncture in the mold flow path.
Typical Temperature:	Between 200 to 315°C (400 to 600°F)
Typical Pressure:	Up to 1400 bar (20,000 psi)
Media:	Molten material, Air

Our Technology Advantages

Metal Spring-Energized C-Seals

The metal seals can be compressed under higher loads due to higher mechanical strength and improved sealing traits of the metal coating. Along with hot runner technology and the automated injection molding process, metal seals deliver long term benefits for many different customers.

Our metal seals and composites can be used in many other applications, including injection pin spacers, pivot bushings, and manifold seals.

They handle higher loads due to high mechanical strength, maximize uptime and minimize scrap due to proven sealing and leakage control.

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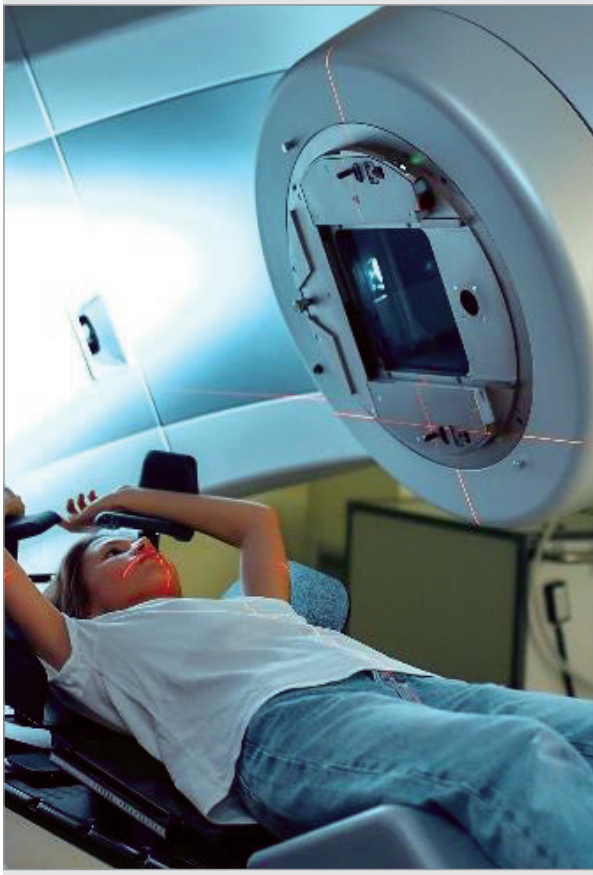
Life Science Market: Case Study

Nuclear Medical Linear Accelerator

Application Challenges

A critical application with a pressure easily achieved with any seal, but the temperature and radiation dose were too high for polymers or elastomers



Our Solution

Omniseal® Shaped Metal C-Seals

Product:	Shaped, silver-plated, Metal C-Seal (Internal Pressure) in alloy X750
Specifications:	A linear accelerator used in the production of medical radioisotopes where radiation levels are too high for elastomeric seals.
Typical Temperature:	100°C (212°F) with water cooling jacket 650°C (1202°F) without
Typical Pressure:	1 bar operating (15 psi)
Media:	Air

Our Technology Advantages

Shaped Metal C-Seal

Standard industry sealing products typically have limited radiation tolerance. In contrast, metal seals do not exhibit this limitation, making them a compelling alternative for static nuclear applications.

Metal seals offer superior durability, temperature and radiation tolerance, making them ideal for static nuclear applications with demanding conditions and extended service life.

Part Numbering System

Part Number Selection (Metric)

Seal Type

Pressure Direction

I = Internal
E = External
A = Axial

Seal Diameter

The seal diameter is specified in millimeters, with two decimal places. For seal types marked with “I” (e.g., CI, CSI, OI), the diameter shown in the product code refers to the outer diameter of the seal. For seal types marked with “E” (e.g., CE, CSE, OE), the diameter in the product code refers to the inner diameter of the seal.

Axial Section and Wall Thickness

Material

The first digit designates the base material, the second the spring material. The second digit is “0” in case no spring is present.

Heat Treatment

The applied heat treatment with “1” being work hardened.

Plating Maximum Thickness

The letters designate the applied plating, the figures designate the plating maximum thickness in µm.

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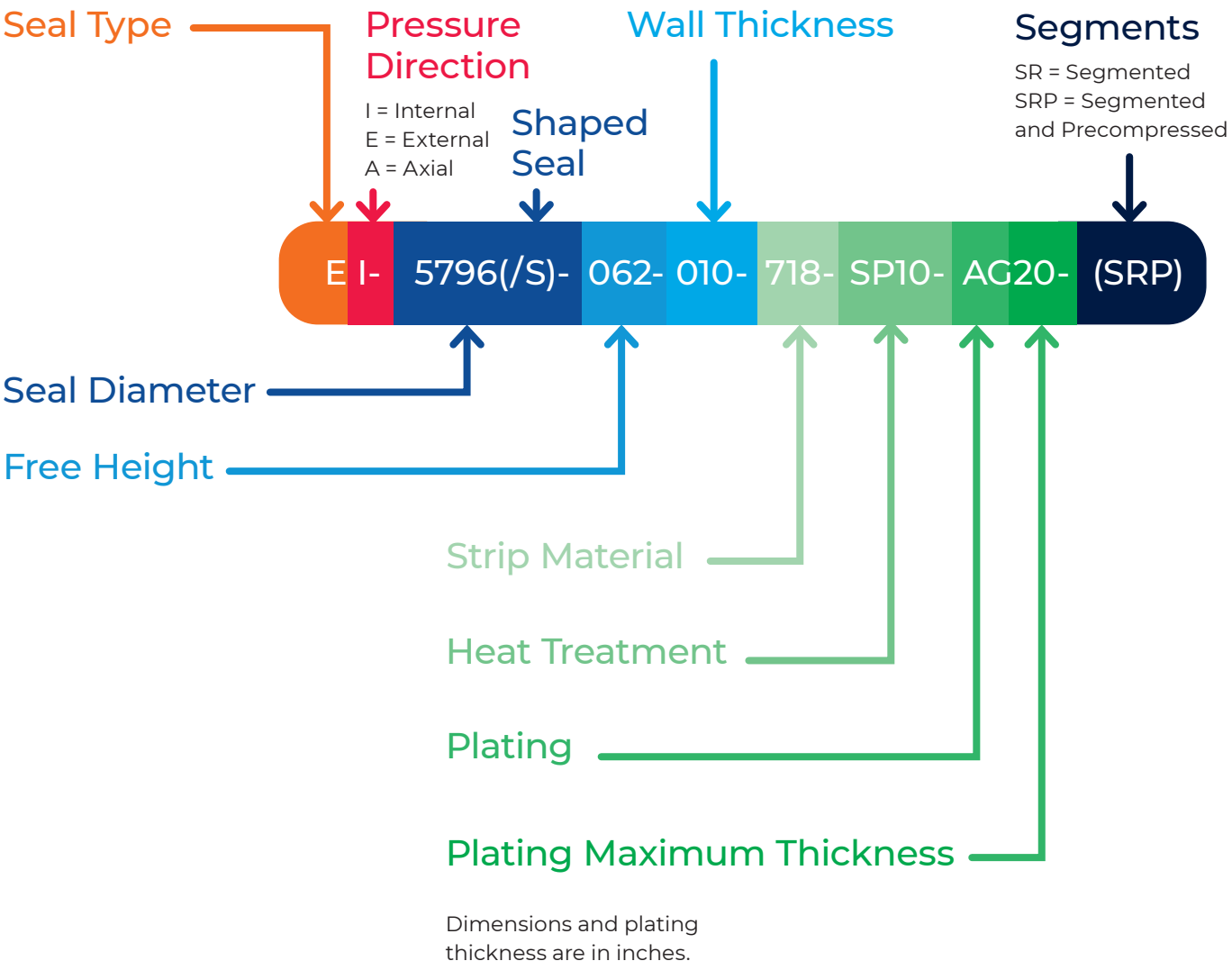
Part Numbering System

Part Numbering (Imperial)



Dimensions and plating thickness are in inches.

Part Numbering Calculation

To choose the right diameter it is important to consider both the diametrical clearance and the plating. The seal diameter in the product codeis always without plating.

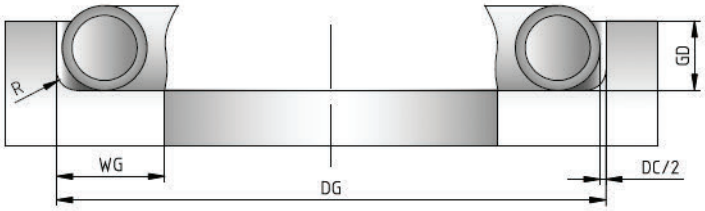
To select the right diameter for "* seals the following formula must be applied: DSI = Groove Diameter (DG) + Diametrical Clearance (DC) + Plating Thickness × 2

To select the right diameter for "" seals the following formula must be applied: DSO = DG - DC - Plating Thickness x 2

(See figure below)

Example:

This example starts out to choose the right seal dimension for a known flange. For the sake of the example an O-Ring made of Stainless Steel 321 without a heat treatment, with 50 µm silver plating is required. The groove diameter (DG) of the flange below is 100.00 mm. The groove depth is 2.60 mm.



OI- ____ - ___ / ___ -___ - ___

For an internal pressure seal the diameter of the seal is the outside diameter. To determine the right diameter for the seal the following formula must be applied: OD = DG - DC - 2 x maximum plating thickness The diametrical clearance depends on the chosen axial section of the seal. In this case the groove depth of 2.60 mm corresponds to the groove depth of a seal with an axial section of 3.18 mm, for the sake of the example the M version of the section is chosen. The diametrical clearance for a seal with this axial section is 0.25 mm. (see pages 36-37)

As stated above the maximum plating thickness will be 50 µm. This gives us: 100.00 mm - 0.25 mm - 2 × 50 um = 99.65 mm.

OI-009965-3.18M- ___ / ___ -___ - ___

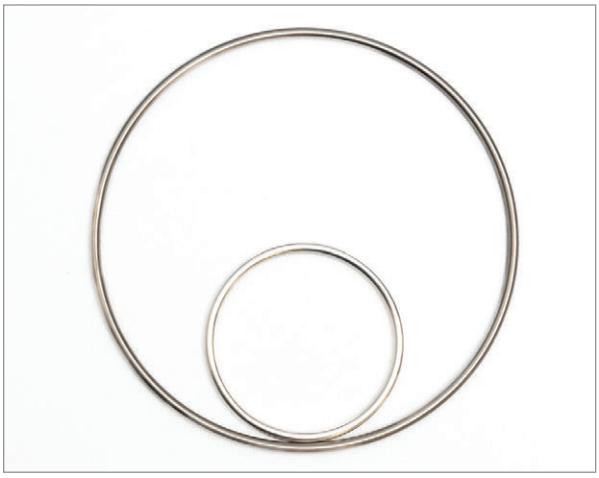
The information given in the first paragraph of this page is needed to complete the part number. The code that corresponds with Stainless Steel 321 is "3". The O-Ring does not contain a spring, hence the spring code is "0". Seals in cold worked condition get the code "1" for heat treatment. The plating code for a seal with 50 µm of silver is "S50".

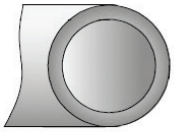
This results info the following part number for this specific setup:

OI-009965-3.18M-3/0-1-S50

Omniseal® Metal O-Rings: Internal & External Pressure

OI – OE





Performance Indicators

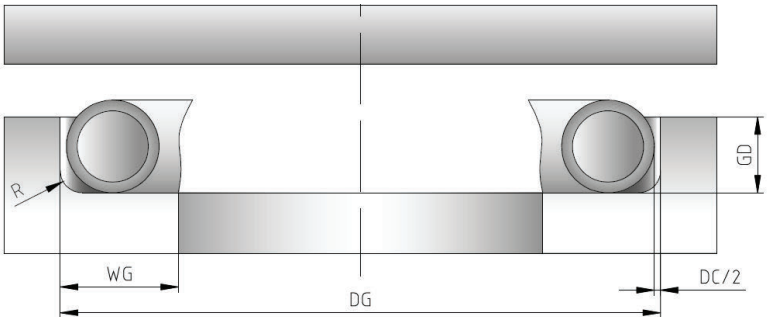
- Unplated 1E-2 to 1E-3 mbar*l/s
- Plated 1E-3 to 1E-7 mbar*l/s
- Plated + Spin polished 1E-5 to 1E-10 mbar*l/s

Typical Applications

- Hot mold equipment
- Nuclear (reactor vessel and connection seals)
- Gas turbines
  - Fuel systems
  - Exhaust connectors
  - Heat exchangers

OG- & OS-Seals (Custom-Design O-Rings)

Some O-Rings can be gas filled for used in combination with a spring for very rare applications. Please contact Omniseal Solutions for the feasibility if you consider one of these specific O-Rings.



Features & Benefits

Features / Requirements
Easy and approved design
No cavity
Lower spring back
Medium to high load
Adaptable to specific applications: • Vented (OVI – OVE) • Gas filled (OGI – OGE) • Spring energized (OSI – OSE)
Wide sealing surface, low seating stress

Benefits
Feasibility of complex shapes
Functionality not influenced by medium (plastic, abrasives, pollution,...)
Higher pressure
High temperature (+600°C / +1112°F)
Extremely high pressure
Chamfer joints (three-point sealing)

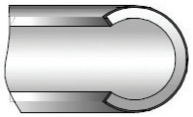
Omniseal® Metal C-Seals: Internal & External Pressure

CI & CE

Features & Benefits

Features / Requirements
Low to moderate sealing load
Increased spring back
Small sealing surface (line contact) compared to an O-Ring
Moderate seating stress
Critical circular surface finish required

Benefits
Suitable for softer flange materials (Aluminum...)
Lower bolt force required
Allows flange lift-off
Higher sealing contact pressure
High sealing capability at low compression force
Pressure activated
Enhancement of sealing performance

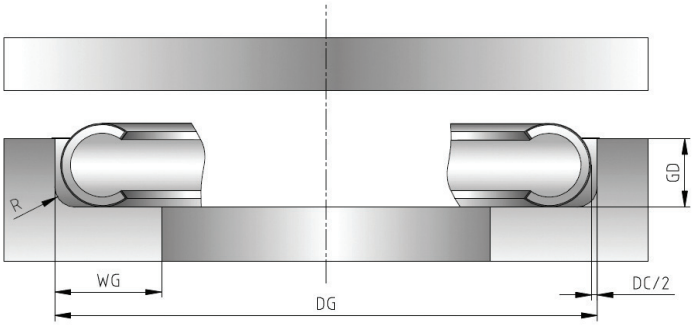


Performance Indicators

- Unplated 1E-2 to 1E-4 mbar*l/s
- Plated 1E-4 to 1E-9 mbar*l/s
- Plated & Spin polished 1E-5 to 1E-10 mbar*l/s

Typical Applications

- Aerospace (gas turbine, fuel systems, hydraulics, satellites, propulsion)
- Oil & gas and power generation
  - Gas turbine, ST-casing, injection systems, heat exchangers
  - Valves
  - Subsea couplings
- High-end industrial applications
  - Valves
  - Cryocoolers
  - Turbo chargers
  - Exhaust systems
- Lasers for semi-conductor industry
- Vacuum applications
  - Remote handling (subsea)



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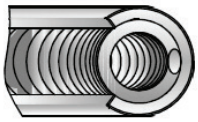
Omniseal® Metal Spring-Energized C-Seals: Internal & External Pressure

CSI & CSE (metric), SI & SE (imperial)

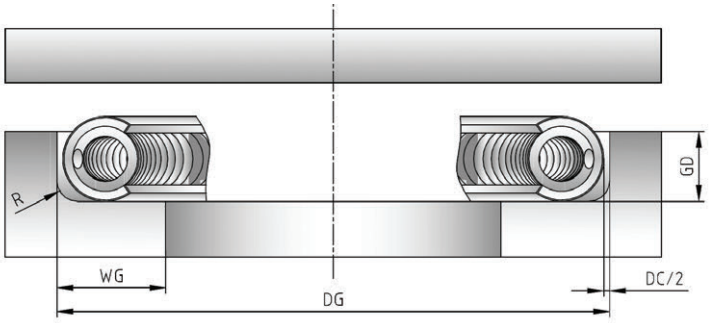


Performance Indicators

- Unplated 1E-2 to 1E-5 mbar*l/s
- Plated 1E-2 to 1E-10 mbar*l/s
- Plated + Spin polished 1E-5 to 1E-12 mbar*l/s

Typical Applications

- Aerospace (fuel systems, hydraulics, satellites, propulsion)
- Oil & gas and power generation
  - Gas turbine, steam turbine casing
  - Injection systems
  - Heat exchangers
  - Valves
  - Subsea couplings
- Nuclear
  - Reactor vessel and connection seals
  - Nuclear waste (spent fuel cask seals)
- High-end industrial applications
  - Valves
  - Turbo chargers
  - Exhaust systems
- Lasers for semi-conductor industry
- Vacuum application
  - Double sealing solutions
  - Remote handling



Features & Benefits

Features / Requirements
Medium to high load seal design
Increased spring back
Wider sealing surface
Adaptable seal characteristics
Higher compression load
Self-energized internal spring

Benefits
Higher leakage performance
Allows flange lift-off
Can be used with rougher surface finish
Adaptable sealing performance (load, spring back, leak rate...)
Increased capabilities to withstand back pressure
Ability to resist higher temperature and pressure cycling

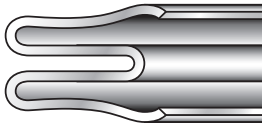
Omniseal® Metal E-Seals: Internal & External Pressure

EI – EE (imperial)

Features & Benefits

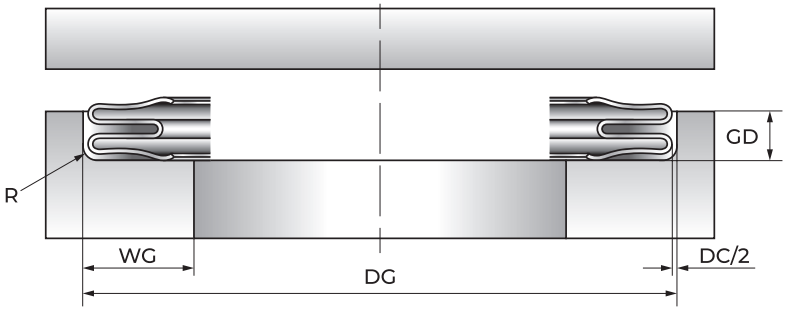
Features / Requirements
Superior flexibility or springback
High temperature capability
Light loading

Benefits
Operates primarily within the elastic limits of the material
Conforms to thermal deflection of hardware
Excellent load deflection
Very good fatigue resistance



Typical Applications

- High pressure turbine shrouds for aviation
- Hot air ducting
- Gas turbines engine housing
- Bleed air system (AS1895 joints)



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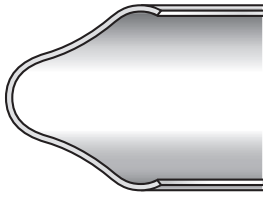
Omniseal® Metal V-Seals: Internal & External Pressure

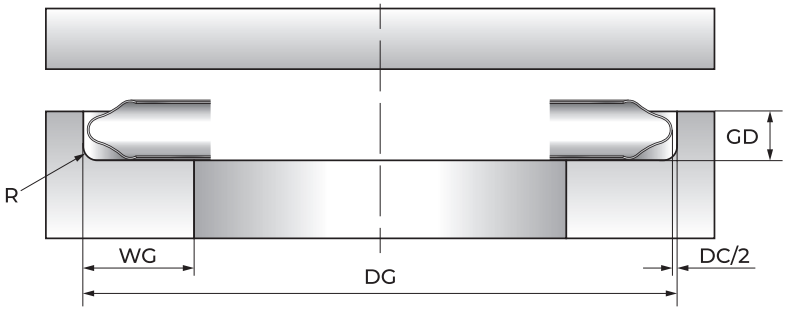
VI – VE



Typical Applications

- Shroud seals
- Fuel nozzle flanges
- Injection systems
- Pumps
- Valves

V-seals can also be designed for axial pressure applications (VA), and have enhanced sealing performance when energized with an optional spring. Please contact our team of experts to get more information.



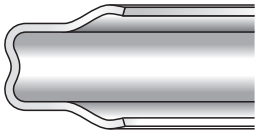
Features & Benefits

Features / Requirements
Designed for maximum springback
Low bolt force requirement
Highly pressure activated

Benefits
Low load sealing solution
High flange lift-off

Omniseal® Metal Turbo Seals: Internal & External Pressure

TI – TE (imperial)



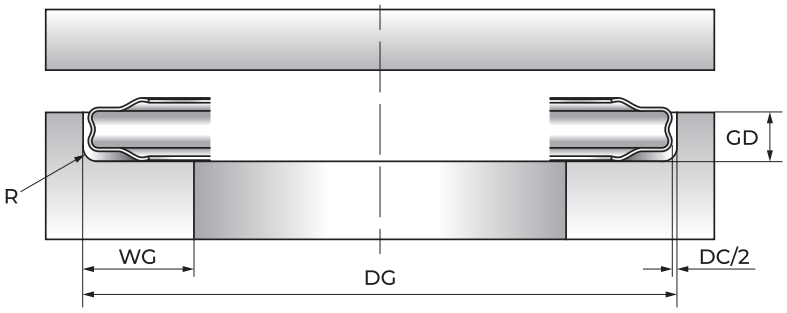
Features & Benefits

Features / Requirements
Superior flexibility or springback
High temperature capability
Light loading

Benefits
Operates primarily within the elastic limits of the material
Conforms to thermal deflection of hardware
Excellent load deflection
Very good fatigue resistance

Typical Applications

- Power generation gas turbines shroud
- Turbocharger ports



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Omniseal® Metal Aluminum Jacket Spring-Energized Seals: Internal & External Pressure

JCE (metric)

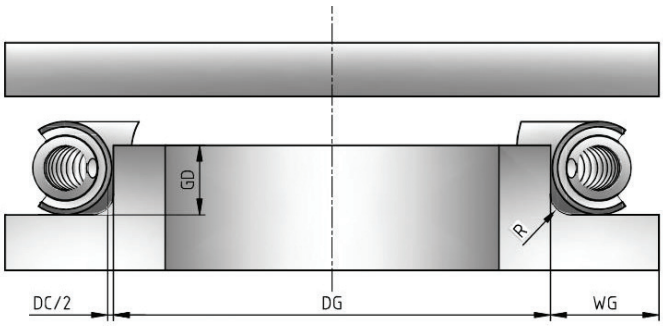
"JCE" stands for jacketed C-Seal for external pressure. A primary jacket, in a high alloy steel, transmits the spring load to the ultra-soft secondary aluminum layer. The extreme soft layer guarantees the best tightness for any kind of surface finish. JCE seals can be used in applications with internal or external pressure.

Performance Indicators

- 1E-5 to 1E-12 mbar*l/s

Typical Applications

- UHV (Ultra-High Vacuum)
- ANSI flanges
- Tritium environments
- Cryogenic applications
- Accelerators



Features & Benefits

Features / Requirements
Secondary soft outer layer
Medium to high load seal design Increased spring back
Wider sealing surface
Self-energized internal spring

Benefits
Capability to cope with higher surface finish
Ability to seal against soft flange material
Suitable for radioactive applications

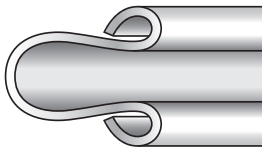
Omniseal® Metal Omega Seals: Internal & External Pressure

OMI & OME (imperial)

Features & Benefits

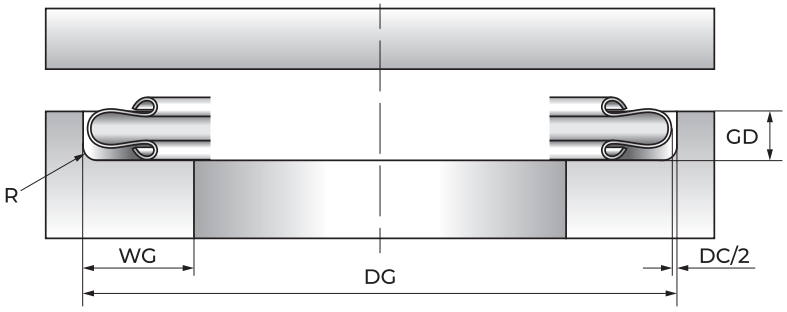
Features / Requirements
2 ply seal
Highest springback for small diameter seals
High fatigue resistance

Benefits
High deflections of the hardware allowed
Withstand lots of cycling
High temperature resistance



Typical Applications

- Gas turbines (hot air sealing)
- Remote handling (Nuclear)



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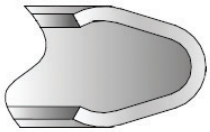
Omniseal® Metal Oysterseal® Seals: Internal & External Pressure

YI – YE (metric)

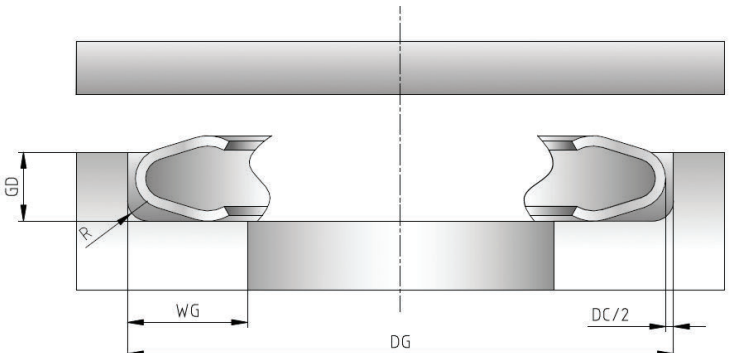


Performance Indicators

- Unplated 1E-1 to 1E-3 mbar*l/s
- Plated 1E-2 to 1E-4 mbar*l/s
- Plated + Spin polished 1E-3 to 1E-7 mbar*l/s

Semi-dynamic and Static Applications

- Gas and steam turbines
- Valves
- Swivels
- Turbochargers



Features & Benefits

Features / Requirements
Low load seal
High spring back
Limited leak tightness
Specific circular surface finish required

Benefits
Lower bolt force required
Allows higher flange lift-off
Highly pressure activated

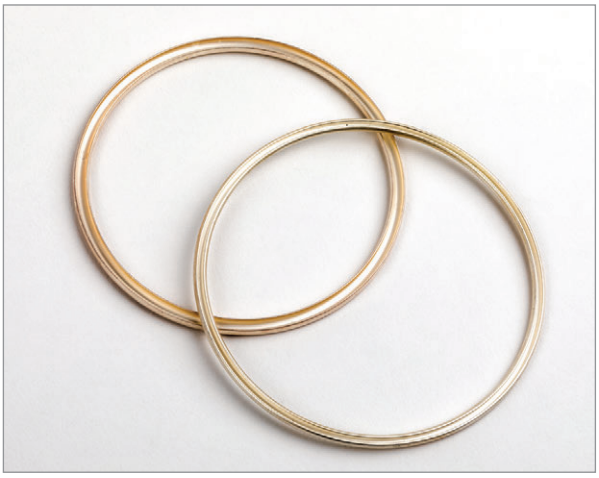
Omniseal® Metal Axial C-Seals: Axial Pressure

CA – CSA

Features & Benefits

Features / Requirements
Radial alignment of sealing position
Optionally with spring

Benefits
Allows to be used between two circular bodies
The spring stabilizes the design and prevents unwanted deformation of the seal, during assembly and operation. Increased capabilities to withstand back pressure.



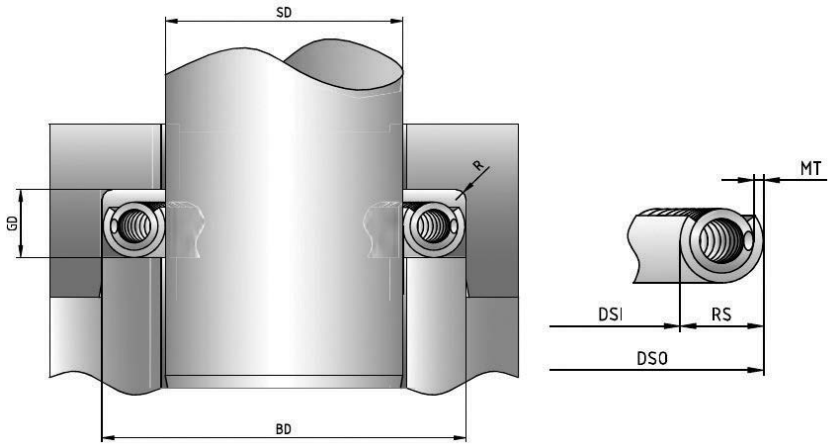
Axial C-Seals and spring-energized axial C-Seals are metal C-Seals being stretched on the ID and being compressed on the OD, thereby creating a certain seating stress. The elastic recovery is therefore limited. They do not feature relatively high elasticity as the C-Seals and spring-energized C-Seals used between two parallel planes.

It is recommended to assure a best of of class surface finish on both the ID and OD mating surfaces. For assembly reasons, an entry slope on ID and OD is highly recommended.

Typical entry angles are around 5° and sufficiently long. Except for an excellent surface finish it is also important that the mating surface has a sufficient hardness. For high abrasive dynamic applications, a hardness higher than 60 HRC is recommended. Silver plating enhances tightness performance, and it lowers friction during assembly and operation.

Typical Applications

- Piston seal
- Rod seal
- Semi-dynamic, rotational, and reciprocating applications



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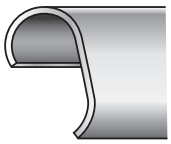
Omniseal® Metal Lip Seals: Axial Pressure

LI – LE (imperial)



Semi-dynamic and Static Applications

- Shaft housing
- Turbocharger
- Exhaust manifold

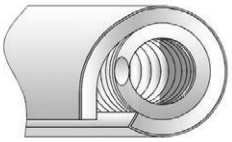
Features & Benefits

Features / Requirements
Shaft seal
Lip shape that fits around the shaft
Designed for use in high and low pressure and temperature

Benefits
Excellent sealing performance in thermal expansion applications
Good fit for limited rotational and reciprocating applications.
Long service life

Omniseal® Metal Commaseal® Seals: Axial Pressure

COI-COE (metric)



Our Commaseal® solution is an enhanced version of the axial C-Seal, designed for shaft sealing (COI) and bore sealing (COE). Effective sealing is achieved through the compression of the C-Seal section, which provides the required seating load. Our Commaseal® solution is available in sizes up to 200 mm.

Typical Applications

- Piston seal
- Rod seal
- Semi-dynamic applications, rotational and reciprocating

Features & Benefits

Features / Requirements
3-point sealing
Better controlled seal lip interference
High-quality surface finish and adequate hardness of the mating surface
For abrasive dynamic applications, a hardness above 60 HRC is recommended

Benefits
Better sealing towards housing compared to CA / CSA
Better control of the seating load, hence better seal performance
Increased capabilities to withstand back pressure

Metal Seals for Standard Applications

Metal Boss Seals for AS5202 fittings

This special design seal is also known as a metal boss seal and is our solution for the hydraulic standard AS5202 from SAE. With the best leakage rate, it is an excellent solution to replace an elastomer O-Ring that fails because of the conditions of the systems. Here are several technology advantages:

- **Ease of installation:** Our integrated seal design can be installed quickly and easily without any special tools or equipment. Aerospace manufacturers save time and money during the assembly process.
- **Lighter weight:** Omniseal Solutions' metal boss seal is significantly lighter than its machined competitor – a major technology advantage in aerospace applications where weight is critical. Made from high strength formed materials, the metal seal reduces overall weight and improves fuel efficiency.

Part Numbering

Seal Part Number should be written as follows:

Metal Boss Seal (OR) 1200XX-YY

(1) (2)

Select Base Material / Plating Number (XX)

(1)

06	Inconel® X750 – Bare
07	Inconel® X750 – Silver plated
27	Inconel® X750 – Teflon® coated
36	316 SS – Silver plated
37	316 SS – Bare
39	Inconel® 718 – Gold plated
43	Inconel® X750 – Silver with gold flash

Select Port Size (YY)

(2)

01	02	03	04	05	06	07	08
09	10	11	12	14	15	16	18
20	24	28	32				

Metal Boss Seal (GG) 10061-YY-X-Z

(2) (3) (4)

Select Coating Number (X)

(3)

0	Teflon®	4	Copper
1	Silver	5	Bare
2	Gold		
3	Nickel		

Select Crush Ring / Jacket (Z)

(4)

0	302 SS Cond. A	321 SS AMS 5510
1	Inconel® 718 Annealed	Inconel® 718 Annealed, AMS 5596

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Custom Designs & Metal Shaped Seals

Typical Applications

- Turbine shroud seals
- Fuel nozzle flanges on power generation turbines
- Exhaust manifold
- Turbocharger inlet and outlet
  - Ion beam lines
  - RF horns
  - Nuclear steam trap
  - Remote handling in Nuclear
  - Ports and plugs in vacuum vessels & cryostats

MINIMUM RADIUS FOR SHAPE SEALS (mm):

AS	O-Ring	OS-Ring	C-Seal	Spring-energized C-Seal
0,89	5	NA	5	NA
1,57	6	NA	7	7
2,39	12	12	15	15
3,18	20	20	20	20
3,96	40	40	25	25
4,78	60	60	50	50
6,35	100	100	75	75
9,53	200	200	200	200
12,7	300	300	250	250

For shaped seals measured in imperial units, the minimum radius must be at least three times the seal's free height.

Features & Benefits

Features / Requirements
Designed for maximum springback
Good tightness when used with soft plating or coating

Benefits
Higher flange lift-off
Lower bolt force requirement
Highly pressure activated

Omniseal Solutions has an Engineering Team that focuses on the design of custom-made seals. Custom-made seals can be seals with a non-standard axial section, base material, or spring or even seals with a retainer to avoid over compression and facilitate the installation, allow the connection with an additional seal and/or facilitate remote handling.

Non-circular seals or so-called shaped seals can be manufactured in O-Ring, C-Seal and Spring Energized C-Seal and from cross section 0,89 to 12,70 mm (0,035 to 0,5 in).

Omniseal® Metal O-Rings:
Seal & Groove Dimensions
(metric)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a significant impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS						GROOVE DIMENSONS			DATA*			
DG	AS		MT		DC	GD	WG	R	Average Load		Indicative Spring Back	
Diameter Groove (Range)	Axial Section	Tolerance on AS (Cross section)	Material Code / Thickness		Diametrical Clearance	Groove Depth (Min/Max)	Groove Width (Min)	Radius (Max)	N/mm Circumference		Spring Back in mm	
			M	H					M	H	M	H
10-25	0,89	+0,08/-0,03	0,15	NA	0,20	0,64-0,69	1,40	0,25	65	NA	0,02	NA
10-50	1,19	+0,08/-0,03	0,20	NA	0,25	0,94-1,02	1,78	0,30	NA	80	0,03	NA
12-200	1,57	+0,08/-0,03	0,25	0,36	0,28	1,14-1,27	2,29	0,38	110	220	0,03	0,02
25-200	2,39	+0,08/-0,03	0,25	0,46	0,33	1,88-2,01	3,18	0,51	45	180	0,05	0,03
50-400	3,18	+0,08/-0,03	0,25	0,51	0,43	2,54-2,67	4,06	0,76	40	160	0,07	0,04
75-650	3,96	+0,10	0,41	0,51	0,61	3,18-3,30	5,08	1,27	70	115	0,10	0.07
100-800	4,78	+0,13	0,51	0,64	0,71	3,84-3,99	6,35	1,27	90	150	0,10	0,08
200-1200	6,35	+0,13	0,64	0,81	0,76	5,05-5,28	8,89	1,52	100	180	0,20	0,10
300-2000	9.53	+0,13	0,97	1,24	1,02	8,26-8,51	12,70	1,52	145	350	0,19	0,12
800-3000	12,70	+0,15	1,27	1,65	1,27	11,05-11,43	16,51	1,52	185	365	0,25	0,18

For gas-filled, spring-energized standard dimension may vary – contact our technical service.
For diameter >1200 mm - non-standard packaging

*Seal data based on Inconel X-50 and only for O-Rings, OV (vented) and OG (gas-filled) – does not apply for spring-energized O-Rings.
Load and spring back figures are based on Inconel X-750 in the work hardened (HT1) condition.

Most common material and codes

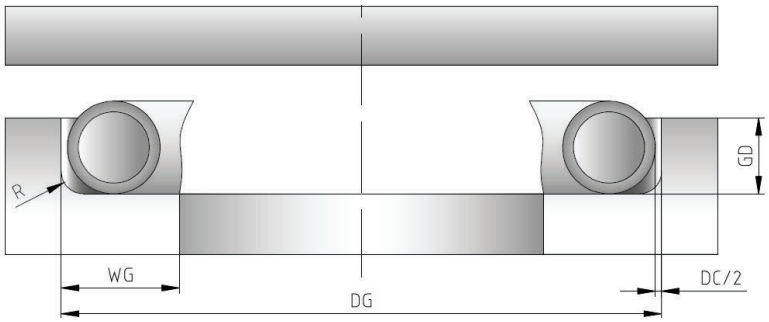
Jacket Material

- Alloy/Inconel X-750
- 321 SS
- Alloy/Inconel 600

Other materials on request

Spring Material

- Alloy/Inconel X-750
- Alloy/Inconel 718
- 302 SS



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Omniseal® Metal O-Rings:
Seal & Groove Dimensions
(imperial)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a significant impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS									GROOVE DIMENSONS		
DG / A		AS / C		MT / T				DC / Z	GD / F	WG / G	R / R
Outer Diameter (Range)	Inner Diameter (Range)	Axial Section	Tolerance on AS (Cross section)	Material Code / Thickness				Diametrical Clearance	Groove Depth (Min/Max)	Groove Width (Min)	Radius (Max)
				A	B	C	D				
0.250 - 2.000	0,188 - 2,000	0,035	+0,003 / -0,001	0,006	NA	NA	NA	0,008	0,025 - 0,027	0,055	0,010
0.500- 12.000	0,375 - 12,000	0,062	+0,003 / -0,001	0,006	0,010	0,012	0,014	0,011	0,050 - 0,054	0,090	0,015
1.000 - 24.000	0,750 - 24,000	0,094	+0,003 / -0,001	0,006	0,010	0,012	0,018	0,014	0,074 - 0,079	0,125	0,020
1.500 - 32.000	1,250 - 32,000	0,125	+0,004 / -0,002	0,008	0,010	0,012	0,020	0,017	0,100 - 0,105	0,160	0,030
3.000 - 36.000	3,000 - 36,000	0,156	+0,004 / -0,002	NA	0,016	0,020	NA	0,021	0,125 - 0,130	0,200	0,050
4.000 - 36.000	4,000 - 36,000	0,188	+0,004 / -0,002	NA	0,020	0,025	NA	0,024	0,151 - 0,157	0,250	0,050
8.000 - 72.000	8,000 - 72,000	0,250	+0,005 / -0,001	NA	0,025	0,032	NA	0,030	0,200 - 0,208	0,350	0,060
12.000 - 120.000	12,000 - 120,000	0,375	+0,005 / -0,001	NA	0,038	0,050	NA	0,040	0,325 - 0,335	0,500	0,060
36.000 - 280.000	36,000 - 280,000	0,295	+0,006 / -0,002	NA	0,050	0,065	NA	0,050	0,435 - 0,450	0,650	0,060

Most common material and codes

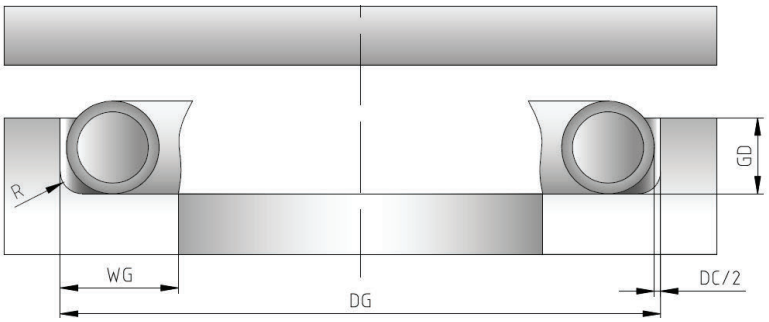
Jacket Material

- Alloy/Inconel X-750
- 321 SS
- Alloy/Inconel 600

Spring Material

- Alloy/Inconel X-750
- Alloy/Inconel 718
- 304 SS

Other materials on request

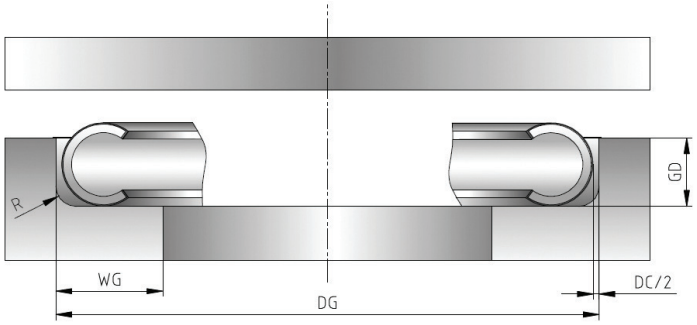


Omniseal® Metal C-Seals:
Seal & Groove Dimensions
(metric)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a significant impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS							GROOVE DIMENSONS			DATA*			
DG	AS		RS	MT		DC	GD	WG	R	Linear Load		Indicative Spring Back	
Diameter Groove (Range)	Axial Section	Tolerance on AS (Cross section)	Radial Section	Material Code / Thickness		Diametrical Clearance	Groove Depth (Min/Max)	Groove Width (Min)	Radius (Max)	N/mm Circumference		Spring Back in mm	
				M	H					M	H	M	H
6-25	0,79	+/-0,05	0,71	0,13	0,18	0,08	0,64-0,69	1,02	0,25	30	60	0,04	0,03
8-50	1,19	+/-0,05	0,96	0,13	0,20	0,13	0,94-1,02	1,40	0,30	20	50	0,05	0,04
8-200	1,57	+/-0,05	1,26	0,15	0,25	0,15	1,27-1,37	1,91	0,38	15	50	0,08	0,06
10-200	2,00	+/-0,05	1,60	0,25	O.R.	0,20	1,60-1,68	2,30	0,45	35	O.R.	0,06	O.R
10-200	2,20	+/-0,05	1,76	0,25	O.R.	0,22	1,76-1,85	2,50	0,47	30	O.R.	0,08	O.R
10-400	2,39	+/-0,05	1,91	0,25	0,38	0,24	1,91-2,01	2,67	0,51	27	70	0,12	0,08
18-400	2,79	+/-0,05	2,25	0,38	O.R.	0,28	2,23-2,34	3,10	0,55	70	O.R.	0,11	O.R
25-600	3,18	+/-0,08	2,54	0,38	0,51	0,32	2,54-2,67	3,43	0,76	50	105	0,15	0,12
32-600	3,60	+/-0,08	2,88	0,41	O.R.	0,36	2,88-3,02	3,90	0,90	55	O.R.	0,18	O.R
35-750	3,96	+/-0,08	3,17	0,41	0,61	0,39	3,18-3,30	4,32	1,27	40	115	0,20	0,17
45-800	4,40	+/-0,08	3,52	0,41	O.R.	0,44	3,52-3,69	4,70	1,27	40	O.R.	0,21	O.R
45-1000	4,78	+/-0,10	3,82	0,51	0,76	0,47	3,84-3,99	5,08	1,27	60	140	0,23	0,18
60-1000	5,00	+/-0,10	4,01	0,51	O.R.	0,50	4,00-4,20	5,30	1,27	55	O.R.	0,27	O.R
75-1000	5,20	+/-0,10	4,16	0,51	O.R.	0,52	4,16-4,37	5,50	1,27	50	O.R.	0,28	O.R
75-1000	5,60	+/-0,10	4.50	0,51	O.R.	0,56	4,48-4,70	5,90	1,27	50	O.R.	0,30	O.R
90-1200	6,35	+/-0,10	5,08	0,64	0,97	0,64	5,08-5,28	6,60	1,52	65	170	0,35	0,30
100-1500	7,90	+/-0,10	6,32	0,97	O.R.	0,79	6,32-6,58	8,22	1,52	120	O.R.	0,35	O.R
100-3000	9,53	+/-0,10	7,62	0,97	1,27	0,96	7,62-8,03	9,65	1,52	100	185	0,50	0,32
750-3000	12,70	+/-0,13	10,16	1.27 mm	1,65	1,27	10,16-10,67	12,70	1,52	125	230	0,55	0,48

*Seal data based on Alloy/Inconel 718 with HT 4, without plating.
O.R. = On request



Most common material and codes

Jacket Material

- Alloy/Inconel X-750
- Alloy/Inconel 718

Other materials on request

Spring Material

- 304 SS
- 316 SS

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Omniseal® Metal C-Seals:
Seal & Groove Dimensions
(imperial)

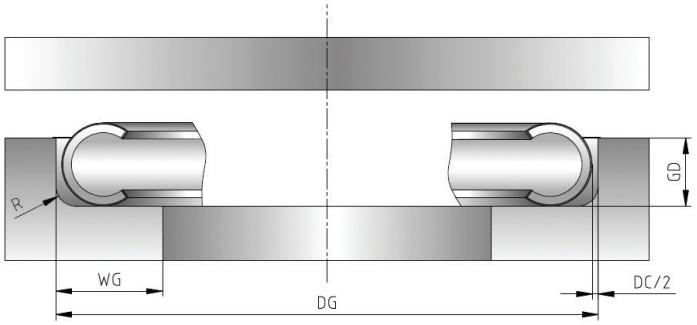
Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a significant impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS							GROOVE DIMENSONS			DATA*			
DG / A	AS / C		RS / M	MT / T		DC	GD	WG	R	Linear Load		Indicative Spring Back	
Diameter Groove (Range)	Axial Section	Tolerance on AS (Cross section)	Radial Section	Material Code / Thickness		Diametrical Clearance	Groove Depth (Min/Max)	Groove Width (Min)	Radius (Max)	lb./inch Circumference		Spring Back in inches	
				A	B					A	B	A	B
0,250 - 2,000	0,031	+/-0,002	0,029	0,006	0,007	0,004	0,64-0,69	0,040	0,010	160	220	0,001	0,001
0,313 - 4,000	0,47	+/-0,002	0,040	0,006	0,008	0,006	0,037 - 0,039	0,055	0,012	120	240	0,002	0,001
0,375 - 12,000	0,62	+/-0,002	0,050	0,006	0,010	0,007	0,049 - 0,051	0,075	0,015	100	270	0,003	0,002
0,500 - 24,000	0,094	+/-0,002	0,078	0,010	0,015	0,011	0,073 - 0,075	0,105	0,020	160	380	0,004	0,003
1,000 - 32,000	0,125	+/-0,003	0,100	0,015	0,020	0,014	0,099 - 0,101	0,135	0,030	280	580	0,005	0,004
1,250 - 36,000	0,156	+/-0,003	0,125	0,015	0,025	0,018	0,123 - 0,127	0,170	0,050	250	600	0,010	0,007
2,000 - 48,000	0,188	+/-0,004	0,150	0,020	0,030	0,020	0,151 - 0,155	0,200	0,050	340	720	0,007	0,006
4,000 - 72,000	0,250	+/-0,004	0,200	0,025	0,032	0,027	0,198 - 0,202	0,260	0,060	400	950	0,010	0,008
18,000 - 120,000	0,375	+/-0,004	0,300	0,038	0,050	0,041	0,297 - 0,303	0,380	0,060	600	1400	0,015	0,012

Most common material

- Alloy/Inconel X-750
- Alloy/Inconel 718

Other materials on request



Omniseal® Metal Spring-Energized C-Seals: Seal & Groove Dimensions (metric)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a huge impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS							GROOVE DIMENSONS			DATA*			
DG	AS		RS	MT		DC	GD	WG	R	Average Load**		Indicative Spring Back	
Diameter Groove (Range)	Axial Section	Tolerance on AS (Cross section)	Radial Section	Material Code Spring Load	Material Thickness Jacket	Diametrical Clearance	Groove Depth (Min/Max)	Groove Width (Min)	Radius (Max)	N/mm Circumference		Spring Back in mm	
										M	H	M	H
8-200	1,57	+/-0,05	1,42	M/H	0,15	0,15	1,27-1,37	2,05	0,35	70	175	0,08	0,07
12-300	2,00	+/-0,05	1,75	M/H	0,25	0,20	1,60-1,68	2,50	0,40	150	240	0,08	0,08
12-300	2,20	+/-0,05	1,95	M/H	0,25	022	1,76-1,85	2,86	0,45	150	230	0,09	0,08
12-400	2,39	+/-0,05	2,14	M/H	0,25	0,24	1,91-2,01	3,10	0,50	135	330	0,11	0,10
18-500	2,79	+/-0,05	2,41	M/H	0,38	0,28	2,23-2,34	3,60	0,50	210	270	0,11	0,10
25-600	3,18	+/-0,08	2,80	M/H	0,38	0,32	2,54-2,67	4,10	0,75	125	270	0,12	0,12
32-750	3,60	+/-0,08	3,19	M/H	0,41	0,36	2,88-3,02	4,68	0,75	145	350	0,12	0,11
35-750	3,96	+/-0,08	3,55	M/H	0,41	0,39	3,18-3,30	5,10	1,2	130	300	0,19	0,15
40-800	4,40	+/-0,08	3,99	M/H	0,41	0,44	3,52-3,69	5,72	1,2	175	255	0,20	0,18
45-900	4,78	+/-0,10	4,37	M/H	0,51	0,47	3,84-3,99	6,20	1,2	195	420	0,20	0,18
60-900	5,00	+/-0,10	4,49	M/H	0,51	0,50	4,00-4,2	6,50	1,2	185	390	0,28	0,25
60-900	5,20	+/-0,10	4,69	M/H	0,51	0,52	4,16-4,37	6,76	1,2	240	365	0,29	0,26
75-1000	5,60	+/-0,10	5,09	M/H	0,51	0,56	4,48-4,70	7,30	1,2	220	330	0,29	0,27
90-1800	6,35	+/-0,10	5,71	M/H	0,64	0,64	5,08-5,28	8,30	1,5	320	700	0,37	0,27
100-3000	7,90	+/-0,10	6,93	M/H	0,97	0,79	6,32-6,58	10,40	1,5	335	675	0,40	O.R
100-3000	9,53	+/-0,10	8,56	M/H	0,97	0,96	7,62-8,03	12,40	1,5	520	730	0,43	0,35
500-3000	12,7	+/-0,13	11,43	M/H	1,27	1,27	10,16-10,67	16,50	1,5	600	320	0,50	0,40

O.R. = On request
For diameter >1200 - non-standard packaging
*Seal data based on Alloy 718 jacket and Inconel 718 spring without heat treatment (HT1) and without plating.
**In case spring is placed after forming or plating, usually for seals with a diameter >200mm, the + tolerance on AS will be slightly higher than standard.

Most common material and codes

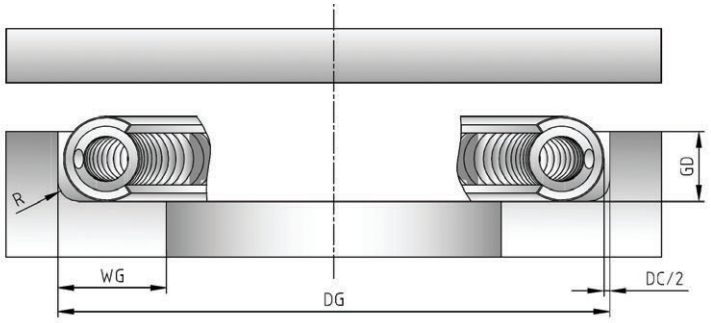
Jacket Material

- Alloy/Inconel X-750
- Alloy/Inconel 718
- 304 SS
- 316 SS

Other materials on request

Spring Material

- Alloy/Inconel X-750
- Alloy/Inconel 718
- 302 SS
- Elgiloy
- 316 SS
- Nimonic 90



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Omniseal® Metal Spring-Energized C-Seals: Seal & Groove Dimensions (imperial)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a significant impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS											GROOVE DIMENSONS			DATA*					
DG / A	AS / C		RS / M	MT /						DC / Z	GD	WG / G	R / R	Linear Load			Total SB		
Diameter Groove (Range)	Axial Section	Tolerance on AS (Cross section)	Radial Section	Material Code Spring Load			Material Thickness Jacket			Diametrical Clearance	Groove Depth (Min/Max)	Groove Width (Min)	Radius (Max)	lb./inch Circumference			Spring Back in inches		
				V	W	Y	V	W	Y					V	W	Y	V	W	Y
0,375 - 2,500	0,047	+/-0,002	0,043	0,006	NA	NA	0,006	NA	NA	0,005	0,037 - 0,040	0,070	0,012	450	NA	NA	0,003	NA	NA
0,500 - 8,000	0,062	+/-0,002	0,058	0,006	0,010	NA	0,006	0,008	NA	0,006	0,050 - 0,054	0,090	0,015	400	700	NA	0,004	0,003	NA
0,750 - 16,000	0,094	+/-0,002	0,088	0,008	0,010	0,010	0,008	0,006	0,010	0,008	0,075- 0,07 9	0,125	0,020	500	500	850	0,008	0,008	0,006
1,000 - 24,000	0,125	+/-0,003	0,116	0,012	0,015	NA	0,010	0,012	NA	0,012	0,100 - 0,105	0,160	0,030	500	950	NA	0,01	0,008	NA
1,250 - 30,000	0,156	+/-0,003	0,147	0,012	0,015	NA	0,012	0,015	NA	0,016	0,125 - 0,130	0,200	0,050	600	1300	NA	0,012	0,009	NA
3,000 - 36,000	0,188	+/-0,004	0,177	0,015	0,020	NA	0,014	0,018	NA	0,018	0,151 - 0,157	0,250	0,050	600	1600	NA	0,014	0,011	NA
4,000 - 72,000	0,250	+/-0,004	0,234	0,020	0,025	NA	0,020	0,025	NA	0,020	0,200 - 0,208	0,350	0,060	600	2100	NA	0,016	0,014	NA
12,000 - 120,000	0,375	+/-0,004	0,354	0,025	0,038	NA	0,025	0,038	NA	0,030	0,300 -0,308	0,500	0,060	1200	2500	NA	0,018	0,015	NA
32,000 - 180,000	0,500	+/-0,004	0,472	0,025	0,025	NA	0,032	0,038	NA	0,062	0,400 - 0,410	0,604	0,060	2800	3200	NA	0,025	0,03	NA

Most common material and codes

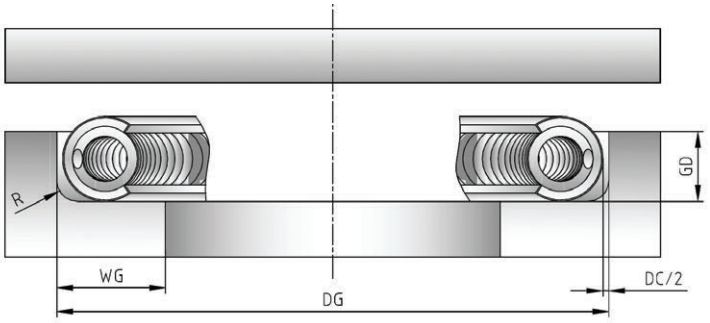
Jacket Material

- Alloy/Inconel X-750
- Alloy/Inconel 718
- 304 SS
- 316 SS

Other materials on request

Spring Material

- Alloy/Inconel X-750
- Alloy/Inconel 718
- 304 SS
- Elgiloy
- 316 SS



Omniseal® Metal E-Seals:
Seal & Groove Dimensions
(imperial)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a huge impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS									GROOVE DIMENSONS				DATA*			
DG / A		AS / C		RS / M		MT / T		DC / Z	GD	WG / G		R / R	Linear Load**		Indicative Spring Back	
Diameter Groove (Range)		Axial Section	Tolerance on AS (Cross section)	Radial Section / Width		Material Code / Thickness		Diametrical Clearance	Groove Depth (Min/Max)	Groove Width (Min)		Radius (Max)	lb./inch Circumference		Spring Back in inches	
W	Y			W	Y	W	Y			W	Y		W	Y	Y	Y
2,250 - 18,000	NA	0,098	+/-0,003	0,083	NA	0,008	NA	0,003	0,075 - 0,080	0,110	NA	0,020	37	NA	0,018	NA
2,250 - 18,000	2,000 - 18,000	0,108	+/-0,005	0,091	NA	0,010	NA	0,003	0,085 - 0,089	0,115	NA	0,020	85	NA	0,014	NA
2,500 - 32,000	NA	0,132	+/-0,003	0,191	NA	0,008	NA	0,005	0,112 - 0,118	0,145	NA	0,030	35	NA	0,024	NA
2,250 - 32,000	2,500 - 32,000	0,140	+/-0,005	0,193	NA	0,012	NA	0,005	0,116 - 0,120	0,160	0,230	0,030	50	NA	0,022	NA
3,500 - 48,000	NA	0,218	+/-0,005	0,180	0,185	0,010	0,015	0,006	0,179 - 0,183	0,230	0,230	0,040	32	55	0,041	0,034
6,000 - 60 ,000	NA	0,295	+/-0,006	0,268	NA	0,020	NA	0,008	0,245 - 0,250	0,315	NA	0,050	75	NA	0,045	NA

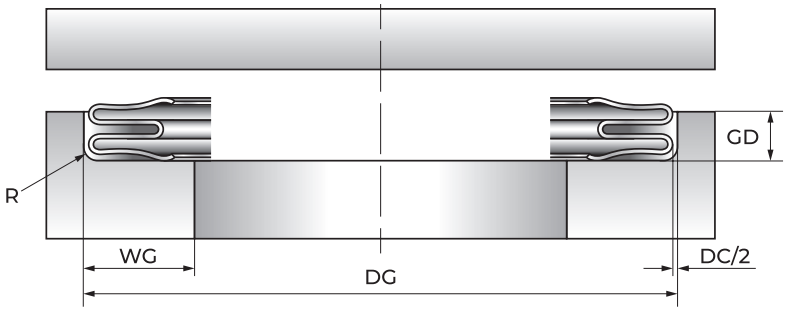
***Seal data based on Alloy 718 jacket and Inconel 718 spring without heat treatment (HT1) and without plating.**

Most common material and codes

Jacket Material

- Alloy/Inconel X-750
- Alloy/Inconel 718

Other materials on request



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Omniseal® Metal Turbo Seals:
Seal & Groove Dimensions
(imperial)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a huge impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

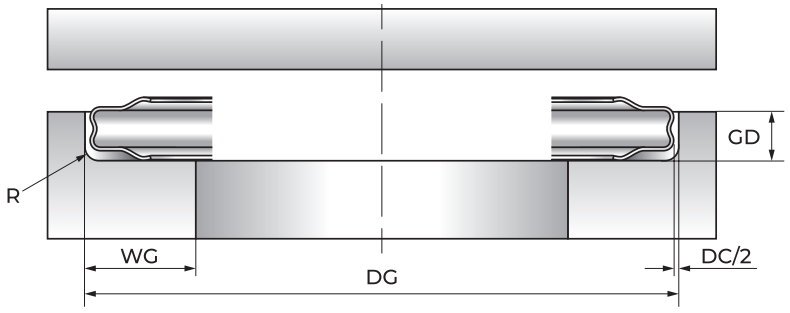
SEAL DIMENSONS						GROOVE DIMENSONS			DATA*	
DG / A	AS / C		RS / M	MT / T	DC / Z	GD / F	WG / G	R / R	Linear Load	Indicative Spring Back
Diameter Groove (Range)	Axial Section	Tolerance on AS (Cross section)	Radial Section	Material Code / Thickness	Diametrical Clearance	Groove Depth (Min/Max)	Groove Width (Min)	Radius (Max)	N/mm Circumference	Spring Back in mm
2,500 - 32,000	0,132	+/-0,003	0,119	0,008	0,008	0,005	0,145	0,030	35	0,024
3,500 - 48,000	0,218	+/-0,005	0,185	0,015	0,015	0,006	0,230	0,040	55	0,034

Most common material and codes

Jacket Material

- Alloy/Inconel X-750
- Alloy/Inconel 718

Other materials on request



Omniseal® Metal Aluminum Jacket Spring-Energized Seals:
Seal & Groove Dimensions
JCE (metric)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a huge impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS								GROOVE DIMENSONS		
DG	AS		RS	MT / AT			DC	GD	WG	R
Diameter Groove (range)	Axial Section	Tolerance on AS (Cross section)	Radial Section	Material Code Spring Load	Material Thickness Jacket	Aluminum Layer Thickness	Diametrical Clearance	Groove Depth (Min/Max)	Groove Width (Min)	Radius (Max)
20-180	2,00	-0,10 / +0,20	1,65	M	0,15	0,20	0,20	1,60 - 1,68	2,50	0,40
20-180	2,60	-0,10 / +0,20	2,20	M	0,25	0,20	0,26	2,08 - 2,18	3,50	0,50
35-300	3,50	-0,10 / +0,20	2,92	M	0,38	0,20	0,35	2,80 - 2,94	4,60	0,75
40-400	4,00	-0,10 / +0,20	3,39	M	0,41	0,20	0,40	3,20 - 3,36	5,10	1,20
50-500	4,50	-0,10 / +0,20	3,79	M	0,41	0,30	0,45	3,60 - 3,78	5,80	1,20
60-600	4,80	-0,10 / +0,20	4,19	M	0,41	0,20	0,48	3,84 - 4,03	6,20	1,20
80-750	5,60	-0,10 / +0,20	4,79	M	0,51	0,30	0,56	4,48 - 4,70	7,30	1,20
100-750	6,20	-0,10 / +0,20	5,39	M	0,51	0,30	0,62	4,96 - 5,20	8,10	1,40

Seating load is case sensitive, as an average 230N/mm can be used for bold calculation. Please contact us if you need more detailed information.

Most common material and codes

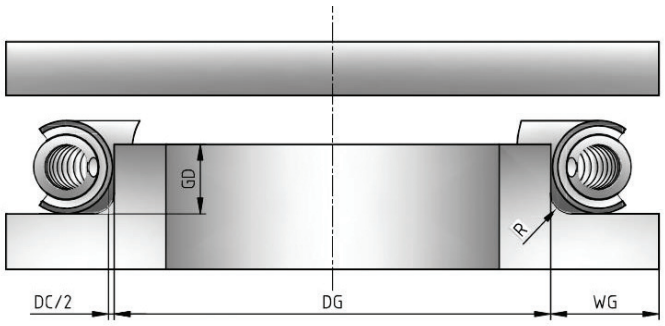
Jacket Material

- Alloy 718 /Inconel

Spring Material

- Nimonic 90

Other materials on request



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Omniseal® Metal Oysterseal® Seals:
Seal & Groove Dimensions
YI – YE (metric)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a huge impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS						GROOVE DIMENSONS			DATA*	
DG	AS		RS	MT	DC	GD	WG	R	Average Load	Indicative Spring Back
Diameter Groove (range)	Axial Section	Tolerance on AS (Cross section)	Radial Section	Material Thickness Jacket	Diametrical Clearance	Groove Depth (Min)	Groove Width (Min)	Radius (Max)	N/mm Circumference	Spring Back in mm
30-400	2,39	+/-0,05	2,63	0,25	0,14	1,91-2,01	3,10	0,50	20	0,28
40-600	3,18	+/-0,08	3,50	0,38	0,19	2,54-2,67	4,10	0,75	25	0,35
65-750	3,96	+/-0,08	4,36	0,41	0,24	3,18-3,30	5,10	1,20	25	0,46
70-900	4,78	+/-0,10	5,26	0,51	0,29	3,84-3,99	6,20	1,20	25	0,70
90-1000	5,60	+/-0,10	6,16	0,51	0,34	4,48-4,70	7,30	1,20	22	0,80
140-1800	6,35	+/-0,10	6,99	0,64	0,38	5,08-5,28	8,30	1,50	30	0,85
450-2000	9,53	+/-0,10	10,49	0,97	0,57	7,62-8,03	12,40	1,50	45	0,90

Non-standard packaging is needed for diameter above 1200mm.

*Seal data, load and spring back values are based on Inconel 718 in hardened condition. Actual load and spring back values can differ hugely up to 100% from the given data due to a specific seal design and application parameters.

Most common material and codes

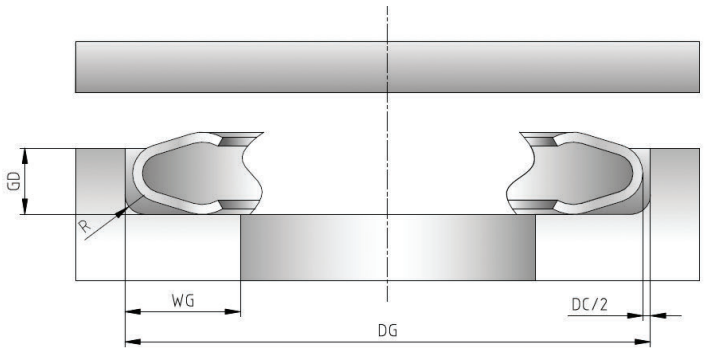
Jacket Material

- Alloy/Inconel 718

Spring Material

- Alloy/Inconel 718

Other materials on request



Omniseal® Metal Axial C-Seals:
Seal & Groove Dimensions
(metric)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a huge impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS									GROOVE DIMENSONS					
DG / D	MC	AS / CS	RS	MT / T	DSO / D		DSI / C		BD / A		SD / B		BD / A	R / R
Diameter Groove (range)	Material Code	Axial Section	Radial Section	Material Thickness	Diameter Seal Outside	Tolerance on DSO	Diameter Seal Inside	Tolerance on DSI	Bore Diameter	Tol. on BD	Shaft/Rod Diameter	Tol. on SD	Groove Depth (Min)	Radius (Max)
14 < 38	1,57M	1,35	1,64	0,20	BD+0,08	+0,06 / -0,03	DSO-3,28	+0,03 / -0,06	SD+3,12	+0,03 / -0	BD-3,12	-0,03/+0	1,50	0,25
38-45	1,57M	1,35	1,64	0,20	BD+0,10	+0,06 / -0,03	DSO-3,28	+0,03 / -0,06	SD+3,07	+0,03 / -0	BD-3,07	-0,03/+0	1,50	0,25
25-38	2,39M	1,99	2,42	0,25	BD+0,08	+0,06 / -0,03	DSO-4,85	+0,03 / -0,06	SD+4,70	+0,03 / -0	BD-4,70	-0,03/+0	2,14	0,28
38-85	2,39M	1,99	2,42	0,25	BD+0,10	+0,06 / -0,03	DSO-4,85	+0,03 / -0,06	SD+4,65	+0,03 / -0	BD-4,65	-0,03/+0	2,14	0,28
40-85	3,18M	2,65	3,22	0,38	BD+0,10	+0,06 / -0,03	DSO-6,45	+0,03 / -0,06	SD+6,25	+0,03 / -0	BD-6,25	-0,03/+0	2,80	0,38
85 < 150	3,18M	2,65	3,22	0,38	BD+0,15	+0,08 / -0,05	DSO-6,45	+0,05 / -0,08	SD+6,15	+0,05 / -0	BD-6,15	-0,05/+0	2,80	0,38
150-300	3,18M	2,65	3,22	0,38	BD+0,20	+0,08 / -0,05	DSO-6,45	+0,05 / -0,08	SD+6,05	+0,05 / -0	BD-6,05	-0,05/+0	2,80	0,38
50-120	3,96M	3,30	4,01	0,38	BD+0,15	+0,08 / -0,05	DSO-8,03	+0,05 / -0,08	SD+7,72	+0,05 / -0	BD-7,72	-0,05/+0	3,45	0,51
120-300	3,96M	3,30	4,01	0,41	BD+0,20	+0,08 / -0,05	DSO-8,03	+0,05 / -0,08	SD+7,62	+0,05 / -0	BD-7,62	-0,05/+0	3,45	0,51
85 < 150	4,78M	3,96	4,81	0,51	BD+0,15	+0,08 / -0,05	DSO-9,63	+0,05 / -0,08	SD+9,32	+0,05 / -0	BD-9,32	-0,05/+0	4,11	0,51
150-450	4,78M	3,96	4,81	0,51	BD+0,20	+0,08 / -0,05	DSO-9,63	+0,05 / -0,08	SD+9,22	+0,05 / -0	BD-9,22	-0,05/+0	4,11	0,51
190-450	6,35M	5,27	6,40	0,64	BD+0,20	+0,08 / -0,05	DSO-12,80	+0,05 / -0,08	SD+12,40	+0,05 / -0	BD-12,40	-0,05/+0	5,42	0,76

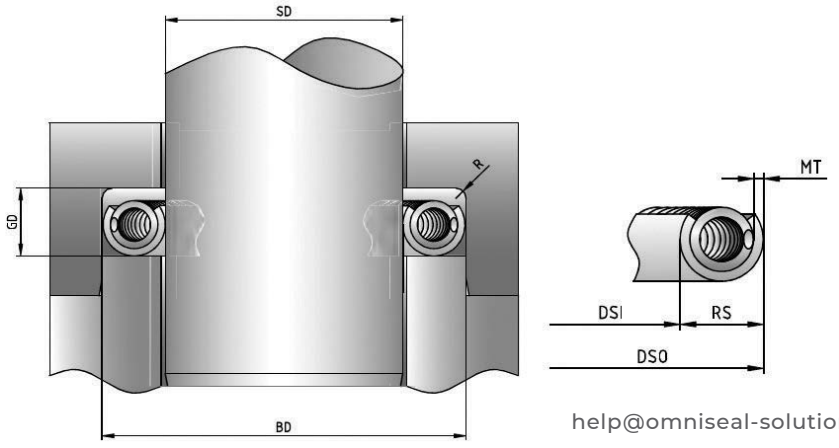
Important note: in case of CSA groove depth will be 15% more compared to the values mentioned above.

Most common material and codes

Jacket Material

- Alloy/Inconel X-750
- Alloy/Inconel 718
- 304 SS
- 316 SS

Other materials on request



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Omniseal® Metal Axial C-Seals:
Seal & Groove Dimensions
(imperial)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a significant impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

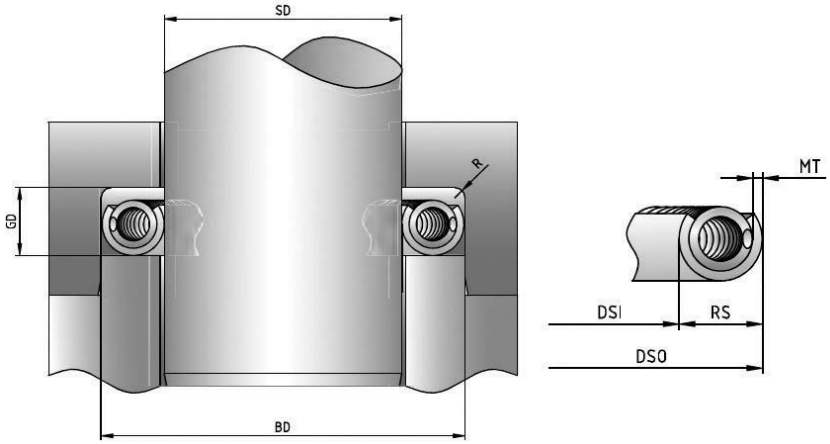
SEAL DIMENSONS														GROOVE DIMENSONS													
AS / CS	MT / T	DSO / D						DSI / C						BD / A						SD / B						GD / G	R / R
Axial Sec-tion	Mat. Thick-ness	Diameter Seal Outside			Tolerance on DSO			Diameter Seal Inside			Tolerance on DSI			Bore Diameter			Tolerance on BD			Shaft/Rod Diameter			Tolerance on SD			Grv. Dpth (Min/ Max)	Rad. (Max)
		V	W	Y	V	W	Y	V	W	Y	V	W	Y	V	W	Y	V	W	Y	V	W	Y	V	W	Y			
0,047	0,20	AMIN +0,003	NA	NA	+/- 0,001	NA	NA	D- 0,097	NA	NA	+/- 0,001	NA	NA	0,300- 1,000	NA	NA	+0,001 /-0	NA	NA	AMIN- 0,091	NA	NA	+0/- 0,001	NA	NA	0,042	0,13
0,062	0,20	AMIN +0,003	AMIN +0,004	NA	+/- 0,001	+/- 0,001	NA	D- 0,129	D- 0,129	NA	+/- 0,001	+/- 0,001	NA	0,375- 1,500	1,501- 2,000	NA	+0,001 /-0	+0,001 /-0	NA	AMIN- 0,123	AMIN- 0,121	NA	+0/- 0,001	+0/- 0,001	NA	0,055	0,02
0,094	0,25	AMIN +0,004	AMIN +0,006	NA	+/- 0,001	+/- 0,001	NA	D- 0,191	D- 0,191	NA	+/- 0,001	+/- 0,001	NA	0,750- 1,500	1,501- 3,250	NA	+0,001 /-0	+0,001 /-0	NA	AMIN- 0,185	AMIN- 0,183	NA	+0/- 0,001	+0/- 0,001	NA	0,078	0,02
0,125	0,25	AMIN +0,004	AMIN +0,006	AMIN +0,008	+/- 0,001	+/- 0,002	+/- 0,002	D- 0,254	D- 0,254	D- 0,254	+/- 0,001	+/- 0,002	+/- 0,002	1,750- 3,250	3,251- 6,000	6,001- 10,000	+0,001 /-0	+0,002 /-0	+0,002 /-0	AMIN- 0,246	AMIN- 0,242	AMIN- 0,238	+0/- 0,001	+0/- 0,002	+0/- 0,002	0,109	0,03
0,156	0,38	AMIN +0,006	AMIN +0,008	NA	+/- 0,002	+/- 0,002	NA	D- 0,316	+/- 0,002	NA	+/- 0,002	+/- 0,002	NA	3.250- 6.000	6.001- 10.000	NA	+0,002 /-0	+0,002 /-0	NA	AMIN- 0,304	AMIN- 0,300	NA	+0/- 0,002	+0/- 0,002	NA	0,130	0,05
0,188	0,38	AMIN +0,006	AMIN +0,008	NA	+/- 0,002	+/- 0,002	NA	D- 0,379	D- 0,379	NA	+/- 0,002	+/- 0,002	NA	3,500- 6,000	6,001- 12,000	NA	+0,002 /-0	+0,002 /-0	NA	AMIN- 0,367	AMIN- 0,363	NA	+0/- 0,002	+0/- 0,002	NA	0,156	0,05
0,250	0,025	AMIN +0,008	NA	NA	+/- 0,002	NA	NA	D- 0,504	NA	NA	+/- 0,002	NA	NA	6,00- 12,000	NA	NA	+0,002 /-0	NA	NA	AMIN- 0,488	NA	NA	+0/- 0,002	NA	NA	0,218	0,06

Most common material and codes

Jacket Material

- Alloy/Inconel X-750
- Alloy/Inconel 718
- 304 SS
- 316 SS

Other materials on request



Omniseal® Metal Lip Seals:
Seal & Groove Dimensions
(imperial)

SEAL DIMENSONS								GROOVE DIMENSONS				
Cross Section	S	A	J	K	L	MT / MT		DSI / C	W1	W2	W3	R
	Radial Span	Inside Diameter	Nom. I.D. Interference	Nom. O.D. Interference	Overall Length	Material Thickness		Diameter Difference	Inner Gland Width (Min)	Outer Gland Width (Min)	Gland Chamfers Width (Min)	Corner Radius (Max)
						W	Y					
1/16	0,067	-0,10 / +0,20	0,004	0,008	0,093	0,007	0,010	0,121	0,120	0,070	0,100	0,015
3/32	0,100	-0,10 / +0,20	0,004	0,008	0,139	0,010	0,015	0,183	0,166	0,090	0,110	0,020
1/8	0,134	2,500-3,500	0,004	0,008	0,185	0,012	0,020	0,242	0,212	0,115	0,120	0,030
5/32	0,162	3,500-4,500	0,005	0,010	0,242	0,012	0,025	0,304	0,270	0,130	0,130	0,050
3/16	0,195	4,500-8,000	0,006	0,012	0,290	0,015	0,030	0,367	0,320	0,155	0,140	0,050
1/4	0,259	8,000-12,000	0,007	0,014	0,387	0,020	0,038	0,488	0,415	0,210	0,150	0,060

***Seal data based on Alloy 718 jacket and Inconel 718 spring without heat treatment (HT1) and without plating.**

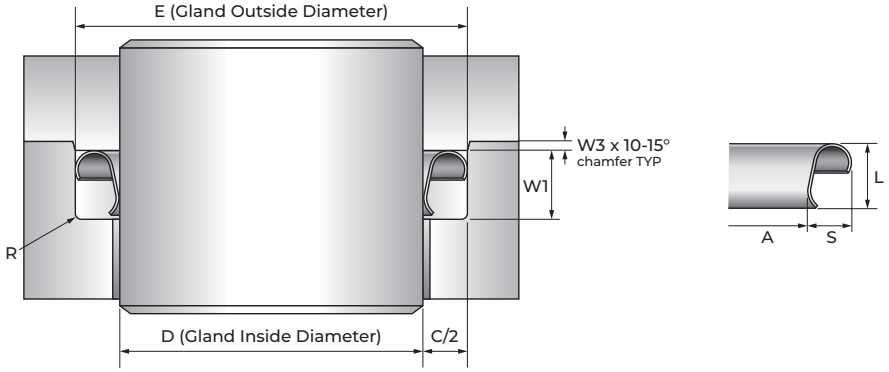
Many Lip Seals fall outside of the typical cross-section sizing. This makes them a bit more customizable as they depend on thermal expansion as groove ID/OD. Please consult our engineering team for more information about material thickness.

Most common material and codes

Jacket Material

- Alloy /Inconel X-750
- Alloy /Inconel 718

Other materials on request



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Omniseal® Metal Commaseal® Seals:
Seal & Groove Dimensions (metric)

Be aware that the tolerance on GD, the DC, different materials, plating, and diameter can have a huge impact on the actual load and spring back of a seal. Please contact Omniseal Solutions to evaluate your specific case.

SEAL DIMENSONS							GROOVE DIMENSONS						
DG	AS		RS	MT		DC	GD	WG	SD	BD		R	Gap
Diameter Groove (range)	Axial Section	Tolerance on AS	Radial Section	Material Code Spring Load	Material Thickness	Diametrical Clearance	Groove Depth (Min/Max)	Groove Width (mm)	Tolerance on Shaft Diameter	Bore Diameter	Tolerance on BD	Radius (Max)	Min / Max
20-150	1,57	+/-0,05	1,79	M	0,15	0,15	1,27-1,32	1,86	+0 / -0.03	SD+3,73	-0 / +0,08	0,30	0,20 / 0,30
35-200	2,39	+/-0,05	2,73	M	0,25	0,20	1,91-2,01	2,93	+0 / -0,03	SD+5,66	-0 / +0,10	0,50	0,40 / 0,50
45-200	3,18	+/-0,08	3,63	M	0,38	0,30	2,54-2,67	3,78	+0 / -0,03	SD+7,56	-0 / +0,12	0,75	0,60 / 0,75
60-200	3,96	+/-0,08	4,52	M	0,41	0,41	3,18-3,30	4,72	+0 / -0,05	SD+9,45	-0 / +0,15	1,20	0,70 / 0,80
100-200	4,78	+/-0,10	5,46	M	0,51	0,46	3,84-3,99	5,69	+0 / -0,05	SD+11,38	-0 / +0,15	1,20	0,80 / 1,00

Load values comparable to CS-seals.

Most common material and codes

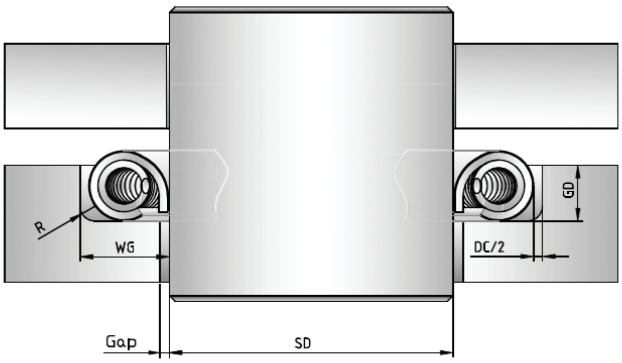
Jacket Material

- Alloy/Inconel 718

Spring Material

- Alloy/Inconel 718

Other materials on request



Omniseal® Metal Seals for Market Standards:

Metal Boss Seals for AS5202 fittings

Design

Jacket materials: Inconel® X-750, Incone® 718, Stainless Steel 302, 316, 321

Washer/Ring materials: 300 series Stainless Steel, Inconel® 718, and others

Platings and coatings maximum operational temperature:

PTFE +290°C
Silver +427°C
Silver with gold flash +649°C
Gold +930°C
Copper +930°C
Nickel +1204°C

Performance

Leakage rate: up to 10^{-8} to 10^{-9} mbar.l/s

Temperature range: Cryogenic to +815°C

Pressure range: up to 12,000 PSI – consult our technical team support.

Media: LOX, Helium, Nitrogen, Hydrogen, Methane, Hydraulic fluids

Dash Number	Liner ID (Inner diameter)	Free heights	Metal thickness
	mm	mm	mm
-1	—	1,168	—
-2	7,061	1,168	0,152
-3	8,661	1,168	0,152
-4	10,084	1,168	0,152
-5	11,659	1,168	0,152
-6	13,132	1,168	0,152
-7	14,707	1,168	0,152
-8	17,755	1,168	0,152
-9	19,329	1,168	0,152
-10	20,752	1,168	0,152
-11	23,673	1,168	0,152
-12	25,273	1,575	0,254
-14	28,449	1,575	0,254
-15	30,048	1,575	0,254
-16	31,643	1,575	0,254
-18	36,373	1,575	0,254
-20	39,548	1,575	0,254
-24	45,898	1,575	0,254
-28	55,423	1,575	0,254
-32	61,773	1,575	0,254

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Omniseal® Metal Seals for Market Standards:

Metal E-Seals for AS1895 flanges

The AS1895/7 and /23 E-seals offer several advantages, making them highly suitable and reliable for demanding applications in aircraft pneumatic systems:

- These seals are engineered to achieve an ideal balance between strength and weight, which is essential for aerospace applications.
- They can function effectively across a broad temperature range, from -53°C to 648°C (-65°F to over 1200°F), making them suitable for high-pressure and high-temperature conditions.
- The snap-fit design eases the installation process, saving time and effort.
- These seals are made in Inconel 718 and provide excellent longevity and reliability.

AS 1895/7

AS 1895 Dash Number	Part Number	Outside Diameter	Inside Diameter
		mm	mm
-100	040227-100	31,725	24,333
-125	040227-125	38,075	30,683
-150	040227-150	44,425	37,033
-175	040227-175	50,775	43,383
-200	040227-200	57,125	49,733
-225	040227-225	63,475	56,083
-250	040227-250	69,825	62,433
-275	040227-275	76,175	68,783
-300	040227-300	82,525	75,133
-325	040227-325	88,875	81,483
-350	040227-350	95,225	87,833
-400	040227-400	107,925	100,533
-450	040227-450	120,625	113,233
-500	040227-500	133,325	125,933
-550	040227-550	146,025	138,633
-600	040227-600	158,725	151,333
-650	040227-650	171,425	164,033
-700	040227-700	184,125	176,733
-750	040227-750	196,825	189,433

AS 1895/23

AS 1895 Dash Number	Part Number	Outside Diameter	Inside Diameter
		mm	mm
-100	040367-100	31,725	24,079
-125	040367-125	38,075	30,429
-150	040367-150	44,425	36,779
-175	040367-175	50,775	43,129
-200	040367-200	57,125	49,479
-225	040367-225	63,475	55,829
-250	040367-250	69,825	62,179
-275	040367-275	76,175	68,529
-300	040367-300	82,525	74,879
-325	040367-325	88,875	81,229
-350	040367-350	95,225	87,579
-400	040367-400	107,925	100,279
-450	040367-450	120,625	112,979
-500	040367-500	133,325	125,679
-550	040367-550	146,025	138,379
-600	040367-600	158,725	151,079
-650	040367-650	171,425	163,779
-700	040367-700	184,125	176,479
-750	040367-750	196,825	189,179

Engineering Technical Appendix

Detailed Metal Seals Guide & Specifications

This section provides detailed technical documentation intended to support engineering design, development, and application activities.

It includes comprehensive technical guidelines, product specifications, and engineering recommendations that reflect our commitment to quality, performance, and reliability.

More About Our Proprietary Coatings & Heat Treatment

Additionally, this appendix presents our coating and heat treatment capabilities, outlining the advanced processes and technologies employed to enhance material properties and ensure consistent results that meet the highest industry standards.

Discover Our Engineering Expertise

Use this section as a technical reference to better understand our engineering expertise and the value our many years of experience brings to your projects.

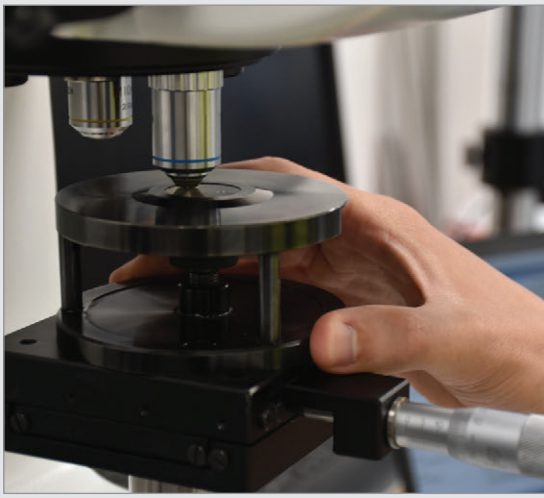
Engineering Services & Capabilities

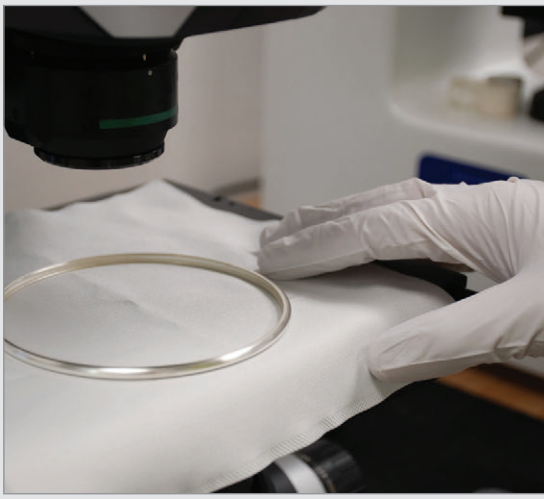
Research and Testing

The expertise that we build up in the field and in our own lab makes Omniseal Solutions the partner to set up the qualification program for the seal that you need for your application. Each item is on request of the following is available on request:

- Check on feasibility
- Fully integrated helium leak test facility. High pressure leak tests are available on special request.
- Load and spring back test equipment
- Hardness test available on each component of the seal (jacket, spring, plating)
- Leak tests can be performed at temperatures ranging from -196°C to +80°C (-321°C to +176°C) on special request.
- Dynamic leak and load test to determine the useful spring back
- Hydrostatic pressure tests
- Liquid penetrant and fluoropenetrant inspection test on O-Ring seal welds
- X-ray of weld area on request
- PMI test and plating layer thickness measurement available by X-ray fluorescence (XRF)
- CNC optical measurement for in-line and end control
- Microsection inspection (etching, optical measurement, metallographic)
- Extensive R&D lab

Note: Tests are available both on a batch-to-batch basis or as acceptance testing. Specific tests requirements are managed case by case.





Metal Seals Leak Rate & Recommendations

What leak rate is acceptable for my application?

This information is often not available and is most likely the most difficult question at the start of a seal selection. A certain leakage level can be accepted for one customer/ application, but it could be far away from the acceptance level for another.

To quantify leak rates, several methods can be employed. For larger leaks, pressure tests or bubble tests are commonly used. In contrast, very small leaks are typically measured using a mass spectrometer. Helium is usually chosen as the tracer gas due to its favorable properties: low atomic mass, wide availability, ease of detection, and safety.

Leak rate (mbar*l/s)	Tightness/leak path
10^{0}	Water leaking Leak path 100 µm
10^{-1}	
10^{-2}	Water tight Leak path 30 µm
10^{-3}	
10^{-4}	Bacteria tight Leak path 10 µm
10^{-5}	
10^{-6}	Virus tight Leak path 3 µm
10^{-7}	
10^{-8}	Gas tight Leak path 0,8 µm
10^{-9}	
10^{-10}	Technically tight Leak path 0,1 µm
10^{-11}	
10^{-12}	

Leak Conversion Table

Leakage is scaled logarithmic over time. The SI-unit is Pa*m3/s, but the most common unit is mbar*l/s (1 Pa*m3/s = 10 mbar*l/s). An overview of the most common units with conversion factors can be found in the following table:

Imagine a helium leak rate of 7*E-7 mbar*l/s, how to interpret this unit and result?

	atm*cm3/s	cc/min	pa*m3/s	mbar*l/s	torr*l/s
1 atm*cm3/s	1	59,8	0,1013	1,013	0,76
1 cc/min	0,0167	1	1,69E-03	1,69E-02	1,27E-02
1 pa*m3/s	9,87	592	1	10	7,5
1 mbar*l/s	0,987	59,22	0,1	1	0,75
1 torr*l/s	1,32	79,2	0,133	1,33	1

Every second, a pressure loss of 7*E-7 mbar on a volume of 1 liter helium

Or

Every second, a volume loss of 7*E-7 liters helium at atmospheric pressure

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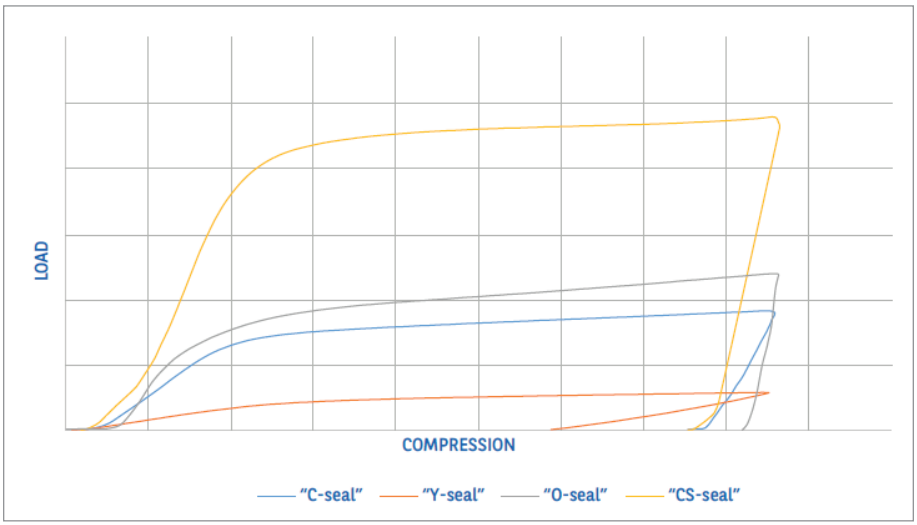
Metal Seals Load & Guidelines

As a reaction to the applied displacement during compression, the seal will generate a force which of course is needed to create a sealing effect. This force (seating load or seating stress) is an important design parameter to the hardware of the application.

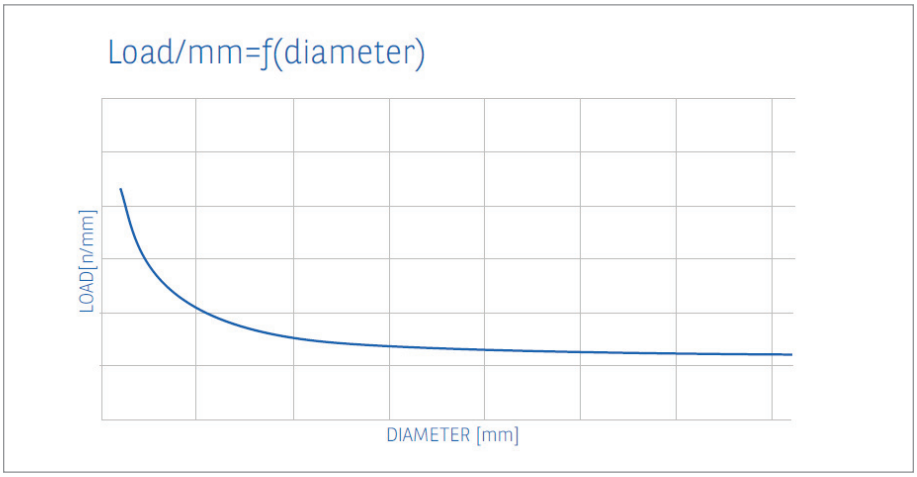
LOAD AND COMPRESSION



The compression/decompression graph of an elastic metal seal is established by compressing the seal and plotting the measured load (force) as a function of the displacement. After reaching the maximum compression for a given seal, the seal is unloaded until flange lift-off occurs.

There is a strong relation between the seal diameter and the seating stress/seating load. Due to hoop stresses, seating load can increase >50% for small diameter seals. The load presented at the seal pages in this catalogue are values for seals where the diameter is no longer significant.

LOAD DIAMETER AND SEATING STRESS



Omniseal® Metal Seals Materials

METAL SEALS MATERIALS

Metric Code	Imperial Code	Material	Similar to W.Nr.	Similar to UNS-Nr.
1	**750**	Alloy X-750/Inconel® X-750	2.4669	N07750
2	**718**	Alloy 718/Inconel® 718	2.4668	N07718
3	**321**	SS 321	1..4541	S32100
4	**600**	Alloy 600 / Inconel® 600	2.4816	N06600
	174	SS 17-4	—	—
	200	SS 200	—	—
	201	SS 201	—	—
	301	SS 301	—	—
	304	SS 304	—	—
5		SS 304 L	1.4306 / 1.4307	S30403
9		SS 302	1.4310	S30200
P	**316**	SS 316 L	1.4401	S31600
A	**ELG**	Elgiloy® / Phynox	2.4711	R30003
B		Haynes 214	2.4646	N07214
C		Aluminum 1050 (for JCE seals)	EN AW-1050A / 3.0255	—
D	**625**	Alloy 625 / Inconel® 625	2.4856	N06625
E		Nimonic 90	2.4632	N07090
F	**276**	Hastelloy C-276	2.4819	N10276
G	**188**	Haynes 188	2.4683	R30188
	282	Haynes 282	—	—
H		Aluminum 6060 (for JCE seals)	EN AW-6060 / 3.3206	—
I		Tantalum	—	—
K	**286**	Alloy A-286	1.4980	S66286
	347	SS 347	—	—
	400	Monel 400	—	—
	725	Alloy 725 / Inconel® 725	—	—
	H25	Haynes 25	—	—
	ARM	Armco Pure Iron	—	—
	WAS	Waspaloy	—	—
	HAST	Hastelloy	—	—
	201	Nickel 201	—	—
	157	SS 15-7 Mo	—	—
	1100	Aluminum 1100	—	—

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Aerospace Material Specifications (AMS)

AEROSPACE MATERIAL SPECIFICATION (AMS)

Material (Common Designation)	Strip & Sheet	Tubing	Wire		Bar
	C-Rings, E-Rings, U-Rings	O-Rings	Rings	Springs	
301 Stainless Steel	AMS 5901 (Cond A) AMS 5517 (1/4 Hard) AMS 5518 (1/2 Hard) AMS 5519 (Full Hard)	—	—	—	—
302 Stainless Steel	AMS 5515	—	—	AMS 5688	—
304L Stainless Steel	AMS 5511				
316 Stainless Steel	AMS 5507	AMS 5584	AMS 5690	AMS A313 ASTM A580	—
316L Stainless Steel	AMS 5507	—	—	—	—
17-4 PH Stainless Steel	AMS 5604	AMS 5895	—	AMS 5678	—
15-7 Mo	AMS 5520	—	—	—	—
Monel 400	AMS 4544	AMS 4574	AMS 4730	—	—
321 Stainless Steel	AMS 5512	AMS 5570 AMS 5576	AMS 5689	—	—
347 Stainless Steel	AMS 5512	AMS 5575	AMS 5674	—	—
Alloy 400	—	—	—	—	—
Alloy 600 /Inconel	AMS 5540	AMS 5580	—	AMS 5687	—
Alloy 625 /Inconel	AMS 5599	AMS 5581	—	—	—
Aluminum Al 1100-0	AMS 4001	—	—	—	—
Hastelloy C-276	ASTM B575 UNS N1026	—	—	—	—
Alloy/Inconel X-750	AMS 5598	AMS 5582	—	AMS 5699	AMS 5582 AMS 5542 AMS 5667
Alloy/Inconel 718	AMS 5596	AMS 5590	—	AMS 5962	AMS 5662
Alloy 725	—	—	—	—	ASTM B805 ASME Code Case 2217
Elgiloy	AMS 5876	—	—	AMS 5833 AMS 5834	—
Stainless Steel Alloy A-286	AMS 5525	AMS 5895	AMS 5731	AMS 5732	—
Waspaloy	AMS 5544	—	—	—	—
Haynes 188	AMS 5608	—	—	—	AMS 5772
Haynes 282	AMS 5951	—	—	—	—
Nickel	AMS 5553	—	—	—	—

Metal Seals Heat Treatment

HEAT TREATMENT COMPATIBILITY MATRIX (METRIC)

Metric	Material Code	HT-1	HT-2	HT-3	HT-4	HT-5	HT-6	HT-7	HT-8
1	Alloy X-750 / Inconel® X-750	X	X		X				
2	Alloy 718 / Inconel® 718	X	X		X		X		X
3	Stainless Steel 321	X							
4	Alloy 600 / Inconel® 600	X		X					
5	Stainless Steel 304 L	X							
6	Stainless Steel 304 high tensile	X							
7	Stainless Steel 316 Ti	X							
9	Stainless Steel 302	X							
A	Elgiloy® / Phynox	X	X						
B	Haynes 214	X					X		
C	Aluminum 1050	X		X					
D	Alloy 625 / Inconel® 625	X		X			X	X	
E	Nimonic 90	X	X						
F	Hastelloy C-276	X					X		
G	Haynes 188	X					X		
H	Aluminum 6060	X		X					
I	Tantalum	X							
K	Alloy A-286	X							
P	Stainless Steel 316 L	X							

HT-1: Work hardened

HT-2: Age hardened

HT-3: Soft annealing

HT-4: Solution annealing + precipitation hardened

HT-5: Solution annealing + precipitation hardened (NACE MR 0175)

HT-6: Solution annealing

HT-7: Stress annealing

HT-8: Solution annealing + short cycle precipitation hardened

Metal Seals Heat Treatment

HEAT TREATMENT COMPATIBILITY MATRIX (METRIC)

Material Code	Material	00 WH	OP 20	OP 30	OP 50	OP 60	OP 70	P1 00	P1 10	SP 01	SP 10	SP 30	SP 40 (A)	SP 80	SP 90	SP 100	SP 101	00 S1	00 S2	00 S3	00 S4	00 S5	00 S6	00 S7	00 S8	00 S9	00 T1
174	17-4 Stainless Steel	X																									
188	Haynes 188	X																						X			
200	200 Stainless Steel	X																									
201	201 Stainless Steel	X																									
282	Haynes 282	X													X								X				
286	Alloy A-286	X																								X	
301	301 Stainless Steel	X																			X						
304	304 Stainless Steel	X																			X						
316	316 Stainless Steel	X																			X						
321	321 Stainless Steel	X																									
600	Alloy 600 / Inconel® 600	X																									
625	Alloy 625 / Inconel® 625	X																X									
718	Alloy 718 / Inconel® 718	X		X	X						X		X			X				X							
725	Alloy 725 / Inconel® 725	X												X								X					
750	Alloy X750 / Inconel® X750	X	X			X	X		X	X							X	X									
A10	AISI A-10	X																									X
ARM	Armco Pure Iron	X																							X		
ELG	Elgiloy	X						X																			
HAS	Hastelloy C-276	X																									
WAS	Waspaloy	X										X							X								

Metal Seals Platings & Coatings

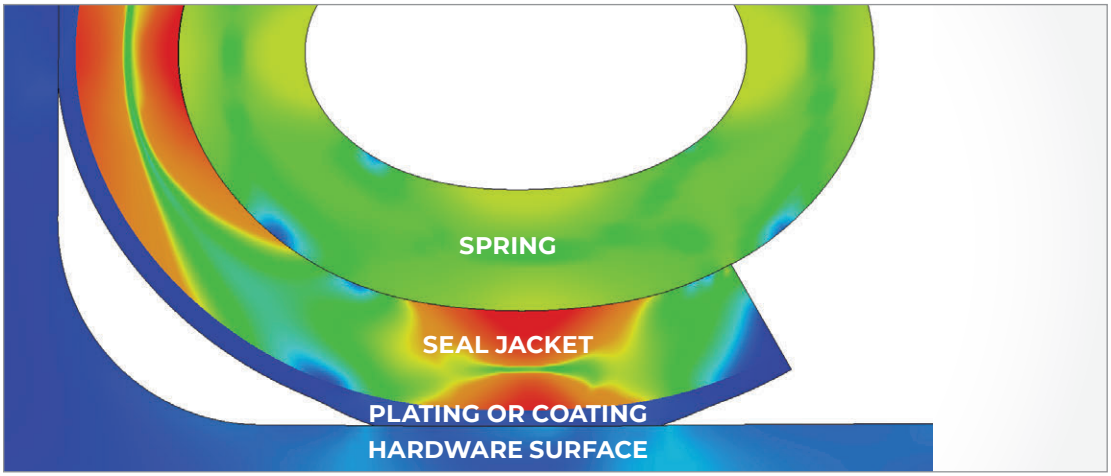
Some applications require high leak tightness. Plating and coating can help to achieve such requirements by enhancing sealing performance. The right choice of plating / coating must be made based on multiple factors. The medium, flange material, temperature and required leak rate all together determine which plating / coating is most suitable for the system.

Omniseal Solutions electroplates copper, silver, tin, nickel, and gold in-house and is also able to to coat seals with PTFE and NCCM, our proprietary coating.

Each plating or coating material has its specific pros and cons.

The use of plating or coating on a seal will enhance its sealing performance, and thus leak tightness, by matching all the unevenness of the hardware surface.

Some coatings can also help to improve wear resistance and expand lifetime of the seal, such as NCCM, Driconite or AlTiN.



Metal Seals Platings & Coatings

Omniseal Solutions
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METAL SEAL MATERIAL ADVANTAGES & CONSIDERATIONS

Material	PROS	CONS
Tin	· Excellent for vacuum and cryogenic applications, as it is a very soft material	· Limited temperature range · Low pressure applications · Limited seating load
PTFE	· Good for cryogenic applications · Chemically inert	· Limited temperature range · Not possible in combination with high load seals · Permeable for gases
Silver	· Relatively soft plating · Good corrosion resistance and anti-galling properties · Wide application range · Inexpensive	· Not for extremely high temperature applications
Silver with Gold Flash	· Ensure a better adhesion of silver plating · Resist to higher temperature than standard silver plating	
Gold	· Relatively soft plating · Superb chemical resistance · High temperature range	· Expensive
Copper	· Relatively soft · Good for high temperature applications · Inexpensive	· Oxidizes in contact with air
NCCM	· Avoid damage to the seal or other delicate components · Net shape coating · Good adhesion to core material · No delamination when seal is in flexing mode -Light contact loads (face seals)	
Nickel	· Good for extremely high temperature applications and oxidizing environments	· Extremely hard plating material requiring high load availability

Metal Seals Designs & Tolerances

The seal diameter shall be as close to the groove diameter as possible.

By compressing the seal in the groove, the seal's outer diameter for internal pressure seals will try to grow and the seal's inner diameter for external pressure seals will try to shrink.

This phenomenon is covered by the DC or diametrical clearance. The DC will give allowance for this increase or decrease of the seal's diameter.

Both the seal tolerance and the groove tolerance shall be kept as small as possible. It is better for the seal performance to keep the diametrical clearance as small as possible in compressed condition.

O-RING TOLERANCES

Cross Section	Tolerances on Diameter
0.89 – 4.78	+0.13
4.79 – 9.52	+0.20
9.53 – 12.70	+0.25

MODIFIED TOLERANCE ON AXIAL SECTION FOR CS-TYPES SEAL (DIAMETER > 200 MM)

Axial Section (AS)	Additional tolerance (to be added to standard tolerance on AS)
≤ 3.96	+0.20
3.96 < AS ≤ 6.35	+0.30
> 6.35	+0.40

GROOVE TOLERANCES

Nominal Diameter (mm)	Cavity ID h10	Cavity OD H10
0 – 3	0 / -0.040	0 / +0.040
3 – 6	0 / -0.048	0 / +0.048
6 – 10	0 / -0.058	0 / +0.058
10 – 18	0 / -0.070	0 / +0.070
18 – 30	0 / -0.084	0 / +0.084
30 – 50	0 / -0.100	0 / +0.100
50 – 80	0 / -0.120	0 / +0.120
80 – 120	0 / -0.140	0 / +0.140
120 –180	0 / -0.160	0 / +0.160
180 – 250	0 / -0.185	0 / +0.185
250 – 315	0 / -0.210	0 / +0.210
315 – 400	0 / -0.230	0 / +0.230
400 –500	0 / -0.250	0 / +0.250
500 – 760	0 / -0.300	0 / +0.300
760 – 1050	0 / -0.400	0 / +0.400
1050 – 1425	0 / -0.500	0 / +0.500
1425 – 1940	0 / -0.630	0 / +0.630

C-SEALS TOLERANCES

Nominal Diameter (mm)	Cavity ID h11	Cavity OD H11
0 – 3	0 / -0.060	0 / +0.060
3 – 6	0 / -0.075	0 / +0.075
6 – 10	0 / -0.090	0 / -+0.090
10 – 18	0 / -0.110	0 / +0.110
18 – 30	0 / -0.130	0 / +0.130
30 – 50	0 / -0.160	0 / +0.160
50 – 80	0 / -0.190	0 / +0.190
80 – 120	0 / -0.220	0 / +0.220
120 –180	0 / -0.250	0 / +0.250
180 – 250	0 / -0.290	0 / +0.290
250 – 315	0 / -0.320	0 / +0.320
315 – 400	0 / -0.360	0 / +0.360
400 –500	0 / -0.400	0 / +0.400
500 – 760	0 / -0.500	0 / +0.500
760 – 1050	0 / -0.630	0 / +0.630
1050 – 1425	0 / -0.760	0 / +0.760
1425 – 1940	0 / -1.000	0 / +1.000

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General Surface Finish Requirements

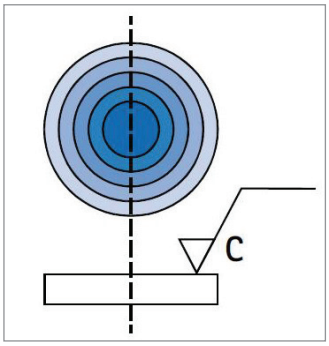
The surface finish of the mating faces is of utmost importance for a leak tight set up. Radial scratches should be always avoided because they form the shortest possible leak path. A longer leak path makes it harder for molecules to cross the sealing surface. Hence it is important that the roughness of the groove follows the sealing surface as best as possible. The ideal finish for a standard seal would be concentric circles.

These circles will be imprinted into the plating forming barriers between the inside and the outside of the seal and thus not creating any leak paths between both sides of the seal at all. To create these barriers, it is important that the grooves don't have a mirror-like roughness. The ideal roughness depends on the application medium, the plating, and the load of the seal.

A soft plating like e.g. tin will easily be imprinted by a higher roughness, while a harder plating could have an impaired sealing capacity if the roughness is too high. Low load seals are prone to leakage if the surface roughness is high. For every single set up it is important that Ra values are taken to heart to ensure a good sealing capacity. For circular seals the desired roughness will be given in Ra-c, 'Ra' standing for the arithmetical mean roughness value and 'c' to make clear the surface grooves should be concentric. On drawings it will be depicted as can be seen beside.

A milled surface finish needs to be polished to minimize the leak paths directly crossing the sealing surface. It is the customer's responsibility to rework the groove in the sealing direction using some fine grade sandpaper. Please, contact our technical team for more information.

Application Type / Medium	Surface Finish µm
Water Hydraulic Oil Sealants	0.4 – 1.6
Light Gases	0.2 – 0.4
Heavy Gases	0.4 – 0.8



Installation Guidelines

These installation instructions will contribute to a proper functioning of the seal. The installation of the seal as well as seal finish, the finish of mating surfaces, the design of the application etc. will affect the leak tightness.i

1. Seal

To avoid damage seals should remain in the original packaging until they are needed for installation. Upon opening of the packaging take care that seals are not damaged due to the use of sharp objects. Even little scratches on the sealing surface can prevent the required tightness from being achieved. Before installing the seal, the sealing surface of the seal should be inspected for scratches, damages, or other imperfections. Manipulate the seals only by hand and do not use any tool that touches the sealing surface to inspect or install the seal. In applications where high leak tightness is required it is recommended to manipulate the seals with gloves.

2. Groove and Flange

The finish of the groove, flange or cover must always be in circular direction (except for CA-seal and Commaseal®). Milled grooves can result in leaks. The lower the seal load the better the groove surface finish should be. The leak rate of an application always depends on the condition of the seal and the groove surface. The recommended roughness of the groove, flange or cover depends on the chosen seal Make sure that the sealing area is free of dirt, dust, or burrs.

Every scratch on the sealing area can lead to leakage; only scratches in circular direction are allowed. Before installing the seal, it is recommended that the groove, flange, or cover is cleaned with a dust free cloth with IPA (isopropyl alcohol) or acetone to prevent dirt and dust being trapped between seal and flange. The groove should be inspected for scratches, damage, or other imperfections.

3. Installing the Seal

The seal must be installed very carefully into the groove to avoid scratches. The cover or flange must be put very carefully into place so that no damage or scratches can occur. Try to avoid the use of oil, grease, or other products to install the seal. If the flange is tightened with bolts, the bolts should be tightened cross wise so that the seal is compressed evenly.

4. Technical Data

For technical information, e.g., pressure, temperature range and finish of construction, please contact our experts from Omniseal Solutions.

Disclaimer

Technology never stops, especially at Omniseal Solutions. Consequently, there may always be changes or additions to this catalogue pending. We therefore stress that this catalogue is strictly for your information, and only offers made on your request can be considered binding. Should you wish precise and binding information, as well as price information, please do not hesitate to contact us.

Warranty

Omniseal Solutions is experienced in designing and manufacturing resilient metal seals for extreme environmental service conditions. Omniseal Solutions' metal seals, O-Rings, C-Seals, spring-energized C-Seals and spring-energized O-Rings are produced from high quality alloy materials with full lot control, full traceability, and inspection procedures at all production steps.

All production procedures starting from purchase to shipment are controlled according to our Q.A. manual. Omniseal Solutions is an ISO 9001 , 9100, 14001, 45001 and IATF 16949 certified manufacturer of resilient metal seals. Regular internal audits verify that work procedures are maintained and compliant with our Q.A. manual.

Omniseal Solutions works closely with its customers to analyze sealing problems as correctly as possible and, based on application data, to design and manufacture the best seal for the given application. We strive to manufacture only correct products and are confident that our seals will be free of all material or manufacturing defects. Should a mistake be made, we will replace any defective products with the highest priority free of charge.

Our warranty is limited to the replacement value of the defective seals only and does not include any additional or consequential Liabilities.

Resilient metal seals are sensitive seals by design. Nevertheless, depending on the performance requirements, other parameters, such as handling, effective groove sizes and surface roughness, re equally important to achieve the desired results.

The seal being only one part of the sealing solution, Omniseal Solutions cannot guarantee any leak rate, nor can we accept any liability for costs following poor sealing results. However, should the problem be related to faulty parts, Omniseal Solutions will replace the parts free of charge.

Except for the general recommendations found in this design manual, we cannot give specific warranties for life expectancy, leak rate or other operational parameters. Customers are always advised to qualify seals, preferably by real life testing, or by similarity, in the exact configuration of their intended use.

Application Data Form

Name _____ Address _____
Title _____ City, State _____ Zip _____
Company _____ Phone number _____
Project Name _____ Fax _____
Date _____ Email address _____

Application Information and Conditions

Device sealed (Please attach drawing if available) _____

Number of units/year _____ Number of seals/unit _____

Type of motion: [ ] Rotary [ ] Oscillating [ ] Reciprocating [ ] Static [ ] Dither

Media/fluid _____

Amount in seal area: [ ] Full head [ ] Half shaft [ ] Splash

Operating pressure (units) _____ Proof pressure (units) _____ Burst pressure (units) _____

Temperature (units): [ ] High [ ] Low [ ] Operating RPM _____

Direction or shaft rotation (as viewed from air side or low pressure of side seal): [ ] CW [ ] CCW

Allowable leakage (define units) _____

Friction torque (units) _____ Breakaway _____ Running _____

Life requirement _____ Duty cycle _____

Type of seal evaluation: [ ] Bench [ ] Field [ ] Both [ ] Explain _____

Hardware Data

Can gland hardware be changed? _____

Bore DIA (include TOL) _____ Shaft DIA (include TOL) _____

Bore depth _____ X-section _____

Bore/shaft misalignment (T.I.R.) _____ Shaft runout (T.I.R) _____

Material: Bore _____ Shaft _____

Finish: Bore _____ Shaft _____

Hardness: Bore _____ Shaft _____

Direction which rod/shaft enters element: [ ] Air side or low pressure side [ ] Media side

Will sealing element be required to make contact with keyway, spline, etc.? [ ] Yes [ ] No
If yes, explain _____

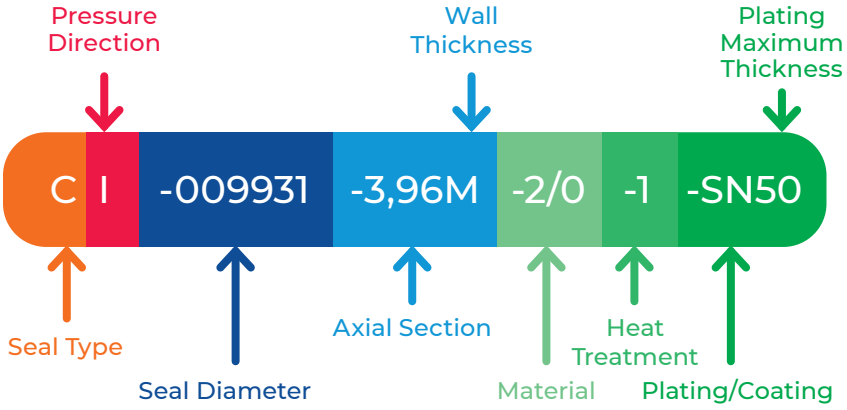
Is installation tooling required? [ ] Yes [ ] No [ ] Omniseal Solutions to design [ ] Supply

Email copy of the completed Application Data Form to:

Omniseal Solutions
Email: help@omniseal-solutions.com

Notes

Memo for part numbers in metric units



Plating / Coating code	Plating / Coating
S	Silver – max. 430°C
G	Gold – max. 930°C
C	Copper – max. 930°C
N	Nickel – max. 1200°C
T	PTFE – max. 290°C
Sn	Tin – max. 200°C

Thickness code	Plating thickness in µm
30	10 - 30
50	30 - 50
70	50 - 70

Heat treatment code	Heat treatment description
1	Work hardened
2	Age hardened
3	Soft annealing
4	Solution annealing + precipitation hardened
5	Solution annealing + precipitation hardened (NACE MR 0175)
6	Solution annealing
7	Stress annealing
8	Solution annealing + short cycle precipitation hardened

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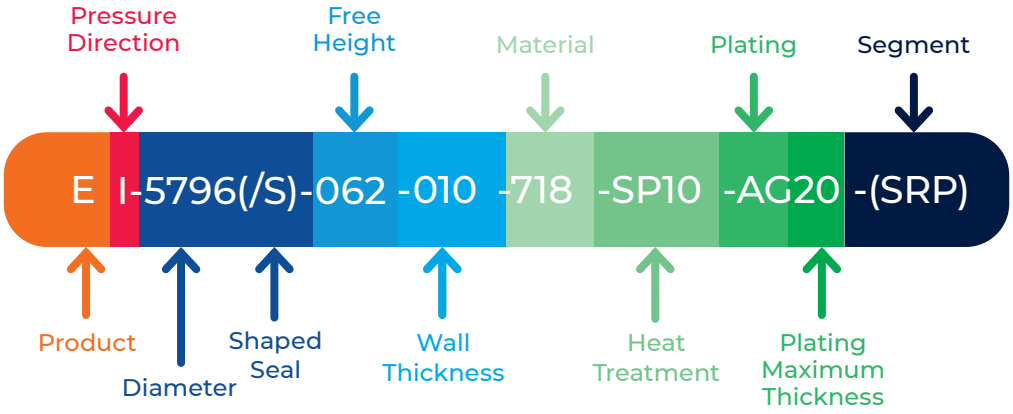
Memo for part numbers in imperial system



Plating / Coating code	Plating / Coating
SN	Tin
TC	PTFE
AG	Silver
AA	Silver with Gold Flash
AU	Gold
CU	Copper
NI	Nickel
DI	Dicronite
NC	NCCM

Heat treatment code	Heat treatment description
"See Heat Treatment capacities page 59."	

Thickness code	Plating thickness in µinch
00	0.00009” or less
06	0.0006”
10	0.0010”
20	0.0020”

A Global Network of Expertise and Service

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Omniseal Solutions
SAINT-GOBAIN

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SAINT-GOBAIN

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