



EnerRings™

***Metal Sealing Solutions
for Extreme Environments***



Engineered Metal Sealing Solutions for Extreme Environments

Metal Seals

Parker is an industry leader in the design and manufacturer of metal seals and metal sealing systems for extreme applications.

Our metal seals are ideal for high-pressure, high-temperature, harsh chemicals and vacuum applications.

- Temperature > 980 °C (1800 °F)
- Pressure > 6,900 bar (100,000 psi)
- Vacuum < 1×10^{-7} bar
- Harsh chemicals

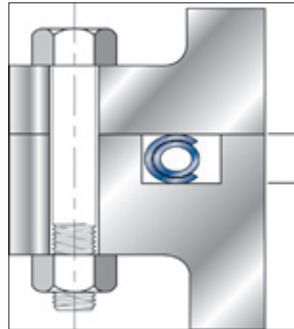
The Advanced Products Business Unit is part of the Parker Seal Group's Composite Sealing Systems Division. The business unit was formed when Parker purchased Advanced Products in 2004. Advanced began producing metal seals in 1954, and has developed hundreds of different seal designs for the most demanding applications. Our standard metal seal products include:

- C-Rings
- E-Rings
- O-Rings
- U-Rings
- Spring Energized C-Rings
- and other

Metal Sealing Systems



One of our strengths is our expertise in a diverse range of products and applications. Not only do we design and manufacture typical one-piece metal-seals, we also develop multi-piece, multi-function sealing systems.



How Metal Seals Work

The metal seal is compressed in a cavity about 20 % on average of its original free height. The force generated through compression of the

ring produces a high contact stress at the seal/cavity interface. This force is supplemented by the pressure-energization force which rises in proportion to the increase in differential pressure.

Markets Served

We offer a wide range of high performance alloys, special platings, and unique geometries to perform in the most rigorous sealing applications. Our sealing technology is currently being used on the ocean floor and in outer space exploration. Our metal seal solutions are used extensively in critical applications in the following markets:

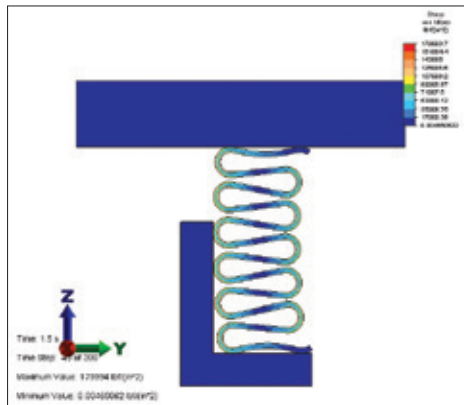
- Aerospace
- Power generation
- Energy, oil and gas
- Space exploration
- Heavy duty diesel engine
- Military
- Automotive
- General industrial.



Engineering Expertise

Parker's team of engineers and scientists offer expert application assistance. Trained sealing experts with decades of combined experience in real world applications are ready to help you find the most reliable, cost-effective solution. We provide value-added engineering and analysis to simulate and evaluate metal seal performance, utilizing the latest technology:

- Perform 2D and 3D Finite Element Analysis (FEA): Non-linear / Vibration / Thermal



- Assessment of seal stress levels, stress relaxation, fatigue, load, wear, friction, torque, plastic deformation, elastic recovery, resonant frequencies, and leakage
- Pressure test from 10^{-7} bar to 2,400 bar (35,000 psi)
- Temperature test from cryogenic to 1,150 °C (2,100 °F)
- Helium mass spectrometer leak detection down to 10^{-11} mbar x liter/sec

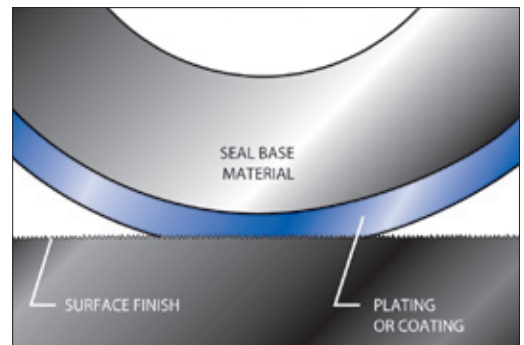
Advantages of Parker Metal Seals

Resilient metal seals meet the challenges of high-temperatures or cryogenics, high-pressures, deep vacuum, corrosive chemicals and even intense levels of radiation.

- Independent optimization of functional components allows each discrete function

including load, springback and outer sealing layered ductility/hardness to be optimized to ensure the highest sealing performance

- Directly bonded electroplating onto the load bearing substrate eliminates unnecessary parts and failure modes
- Pressure energization uses internal/external hydrostatic pressures to supplement the self-energization forces from the tubing, jacket, or spring
- Total Metal Seal Service includes custom and standard sizes from 6.35 mm (0.250") and larger including circular and non-circular shapes. Parker also offers the complete range of metal O-ring sizes, all AS1895 E-Rings sizes, and the fastest delivery of C-Rings from our preferred size list



Jacket Materials and Platings

The special alloys and metals used as seal base materials maintain optimum performance at extreme temperatures and pressures for long periods of time. Some of the materials include:

- High strength alloys including
 - Inconel 625, 718, X-750
 - Hastelloy C-276
 - Waspaloy
 - Rene 41
- 304, 316, 321, and 347 Stainless Steels

For ultra-tight sealing, Parker offers a multitude of unique platings such as silver, copper, gold, indium and Teflon. These specialized platings and coatings allow the modification of the surface properties of the metal seal to create a ductile, low hardness outer surface layer. This acts as an integral “gasket” and ensures optimum sealing despite mating surface imperfections.

**Parker's team of engineers
and scientists offer expert
application assistance.**

Standard Metal Seals

Design	Features	Applications
Metal C-Rings 	<ul style="list-style-type: none"> • Available in diameters greater than 6.35 mm (.250") • Cross sections from .79 mm to 12.70 mm (.031" to .500") • Good springback properties • Very low leakage rates • High-pressure capabilities • Many plating options • Circular or shaped configurations 	<ul style="list-style-type: none"> • High-temperature applications with moderate movement • Moderate load for lighter flanges • Internally or externally pressurized applications
Metal E-Rings 	<ul style="list-style-type: none"> • Available in diameters greater than 19.50 mm (.750") • Excellent springback properties • Multiple cross sections • Can be TriCom coated for wear resistance • Available in multi-convolutions for high deflection applications • Split, segmented, shaped and liner configurations 	<ul style="list-style-type: none"> • Jet engine and land based turbines • High-temperature and joints with considerable movement • Internally or externally pressurized applications • Available for all AS 1895 flange applications
Metal O-Rings 	<ul style="list-style-type: none"> • Available in diameters greater than 6.35 mm (.250") • Cross Sections from .79 mm to 15.88 mm (.031" to .625") • Available in 304 and 321 stainless steel or 718 and X-750 Inconel • Many plating options • 25 tubing options • Robust high-integrity seal • Internally, externally venting available • Gas pressure filled available 	<ul style="list-style-type: none"> • Many industrial applications and MS9141, 9142, 9292-5, 9371-6 • Heavy joint applications with minimal movement
Metal U-Rings 	<ul style="list-style-type: none"> • Available in diameters greater than 44.45 mm (1.75") • Cross Sections from 1.59 mm to 6.35 mm (.063" to .250") • Good springback properties • High-pressure capabilities • Available in 718 and X-750 Inconel • Economically priced 	<ul style="list-style-type: none"> • Turbochargers • High-temperature pumps • Low load joints with significant movement • High-temperature applications • Internally or externally pressurized applications
Spring Energized C-Rings 	<ul style="list-style-type: none"> • Available in diameters greater than 19.05 mm (.750") • Cross Sections from 1.57 mm to 12.70 mm (.063" to .500") • Good springback properties • Uses jacket and spring forces, and system pressure to increase sealing forces • Lowest leakage standard seal 	<ul style="list-style-type: none"> • Diesel engines, gas turbines and high-pressure valves • Heavy load joints with some movement • Best choice for non-flat mating surfaces • Internally or externally pressurized applications



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