An o-ring is a torus or a doughnut shaped object, generally made from an elastomer. They are designed to be seated in a groove and compressed during assembly between two or more parts, creating a seal at the interface. An O-Ring is a means of closing off a passageway and preventing an unwanted loss or transfer of fluid. The O-Ring seal consists of two elements, the O-Ring itself and a properly designed gland to contain the elastomeric material.

O-rings are one of the most common seals used in machine design because they are inexpensive and easy to make, reliable, and have simple mounting requirements. They can seal tens of MPA (thousands of psi) pressure.

**Static and Dynamic O-Ring Sealing Applications**

Static Sealing – in which there is little or no relative motion between the mating surfaces: and Dynamic Sealing – which must function between surfaces with definite relative motion, such as seal on the piston or hydraulic cylinder. Of the two types, dynamic sealing is the more difficult and requires more critical design work and materials selection.

O-ring selection is based on chemical compatibility, application temperature, sealing pressure, lubrication requirements, quality, quantity and cost.

Standard O-rings are made from a variety of rubber compounds and compression molded into the shape of an O-Ring. Base polymers include polyacrylate (ACM), ethylene acrylate (AEM), butyl rubber (Isoprene, IIR), polychloroprene rubber (Neoprene), ethylene propylene rubber (EPM, EPDM), fluorosilicone, acrylonitriles-butadiene (Nitrile, NBR), hydrogenated nitrile (HNBR), polyurethane (AU), silicone, fluoro carbon (Viton, FKM), tetrafluoroethylene propylene (Aflas), high performance fluoroelastomers (Hifluor), and perfluorinated elastomer (Parofluor and Parofluor ULTRA).

Industry standard O-Ring sizes in accordance with AS 568 dimensions are available or custom O-Rings of practically any dimension can be made to fit an application. Miniature o-rings, large special o-rings, continuously molded and spliced cord are just a few examples of the custom o-ring possibilities.

Please contact Industrial Seal Inc. for more information
Nitrile (Buna-N, NBR)

Nitrile rubber is the general term for acrylonitrile butadiene terpolymer. The acrylonitrile content of nitrile sealing compounds varies considerably (18% to 50%) and influences the physical properties of the finished material. The higher the acrylonitrile content, the better the resistance to oil and fuel. At the same time, elasticity and resistance to compression set is adversely affected. In view of these opposing realities, a compromise is often drawn, and a medium acrylonitrile content selected. Nitrile has good mechanical properties when compared with other elastomers and high wear resistance. Nitrile is not resistant to weathering and ozone.

Heat resistance

- Up to 212°F (100°C) with shorter life at 250°F (121°C).

Cold flexibility

- Depending on individual compound, between –30°F and –70°F (–34°C and –57°C).

Chemical resistance

- Aliphatic hydrocarbons (propane, butane, petroleum oil, mineral oil and grease, diesel fuel, fuel oils) vegetable and mineral oils and greases
- HFA, HFB and HFC fluids
- Dilute acids, alkali and salt solutions at low temperatures
- Water (special compounds up to 212°F (100°C)).

Not compatible with:

- Fuels of high aromatic content (for flex fuels a special compound must be used)
- Aromatic hydrocarbons (benzene)
- Chlorinated hydrocarbons (trichlorethylene)
- Polar solvents (ketone, acetone, acetic acid, ethyleneester)
- Strong acids
- Brake fluid with glycol base
- Ozone, weather and atmospheric aging.

Please Contact Industrial Seal Inc. for more information
Neoprene (Chloroprene, CR)

Neoprene was the first synthetic rubber developed commercially and exhibits generally good ozone, aging and chemical resistance. It has good mechanical properties over a wide temperature range.

Heat resistance

- Up to approximately 250°F (121°C).

Cold flexibility

- Down to approximately –40°F (–40°C).

Chemical resistance

- Paraffin base mineral oil with low DPI, e.g. ASTM oil No. 1
- Silicone oil and grease
- Water and water solvents at low temperatures
- Refrigerants
- Ammonia
- Carbon dioxide
- Improved ozone, weathering and aging resistance compared with nitrile rubber.

Limited compatibility

- Naphthalene based mineral oil (IRM 902 and IRM 903 oils)
- Low molecular aliphatic hydrocarbons (propane, butane, fuel)
- Glycol based brake fluids.

Not compatible with:

- Aromatic hydrocarbons (benzene)
- Chlorinated hydrocarbons (trichloroethylene)
- Polar solvents (ketones, esters, ethers, acetones).

Please contact Industrial Seal Inc. for more information
Silicone (VMQ)
The term silicone covers a large group of materials in which vinyl-methyl-silicone (VMQ) is often the central ingredient. Silicone elastomers as a group have relatively low tensile strength, poor tear and wear resistance. However, they have many useful properties as well. Silicones have good heat resistance up to 450°F (232°C), good cold flexibility down to –75°F (–59°C) and good ozone and weather resistance as well as good insulating and physiologically neutral properties.

Heat resistance
- Up to approximately 400°F (204°C) (special compounds up to 450°F (232°C)).

Cold flexibility
- Down to approximately –75°F to –65°F (–59°C to –54°C) with special compounds down to –175°F (–115°C).

Chemical resistance
- Engine and transmission oil (e.g.: ASTM oil No.1)
- Animal and vegetable oil and grease
- Brake fluid (non-petroleum base)
- Fire-resistant hydraulic fluid, HFD-R and HFD-S
- High molecular weight chlorinated aromatic hydrocarbons (including flame-resistant insulators, and coolant for transformers)
- Moderate water resistance
- Diluted salt solutions
- Ozone, aging and weather resistant.

Not compatible with:
- Superheated water steam over 250°F (121°C)
- Acids and alkalis
- Low molecular weight chlorinated hydrocarbons (trichloroethylene)
- Aromatic mineral oil
- Hydrocarbon based fuels
- Aromatic hydrocarbons (benzene, toluene).

Please contact Industrial Seal Inc. for more information
Fluorosilicone (FVMQ)

Fluorosilicone rubber contains trifluoropropyl groups next to the methyl groups. The mechanical and physical properties are very similar to silicone rubber. However, fluorosilicone offers improved fuel and mineral oil resistance but poor hot air resistance when compared with silicone.

Heat resistance

- Up to 350°F (177°C) max.

Cold flexibility

- Down to approximately −100°F (−73°C).

Chemical resistance

- Aromatic mineral oils (IRM 903 oil)
- Fuels
- Low molecular weight aromatic hydrocarbons (benzene, toluene).

Please contact Industrial Seal Inc. for more information
Aflas (Tetrafluoroethylene Propylene, FEPM)

This elastomer is a copolymer of tetrafluoroethylene (TFE) and propylene. Its chemical resistance is excellent across a wide range of aggressive media.

Heat resistance

- Up to approximately 450°F (232°C).

Cold flexibility

- Down to approximately 25°F (–4°C).

Compatible with:

- Bases
- Phosphate esters
- Amines
- Engine oils
- Steam
- Pulp and paper liquors.

Not compatible with:

- Aromatic fuels
- Ketones
- Carbon tetrachloride.

Please contact Industrial Seal Inc. for more information
Viton (Flurocarbon, FKM)
Fluorocarbon rubber has excellent resistance to high temperatures, ozone, oxygen, mineral oil, synthetic hydraulic fluids, fuels, aromatics and many organic solvents and chemicals. Low temperature resistance is normally not favorable and for static applications is limited to approximately –15°F (–26°C) although in certain situations it is suitable down to –40°F (–40°C). Under dynamic conditions, the lowest service temperature is between 5°F and 0°F (–15°C and –18°C). Gas permeability is very low and similar to that of butyl rubber. Special fluorocarbon compounds exhibit an improved resistance to acids, fuels, water and steam.

Heat resistance

- Up to 400°F (204°C) and higher temperatures with shorter life expectancy.

Cold flexibility

- Down to –15°F (–26°C) (some to –40°F (–40°C)).

Chemical resistance

- Mineral oil and grease, low swelling in ASTM oil No. 1, and IRM 902 and IRM 903 oils
- Non-flammable hydraulic fuels in the group HFD
- Silicone oil and grease
- Mineral and vegetable oil and grease
- Aliphatic hydrocarbons (fuel, butane, propane, natural gas)
- Aromatic hydrocarbons (benzene, toluene)
- Chlorinated hydrocarbons (trichlorethylene and carbon tetrachloride)
- Fuels, also fuels with methanol content
- High vacuum
- Very good ozone, weather and aging resistance.

Not compatible with:

- Glycol based brake fluids
- Ammonia gas, amines, alkalis
- Superheated steam
- Low molecular organic acids (formic and acetic acids).

Please contact Industrial Seal Inc. for more information
Kalrez (Perfluoroelastomer, FFKM)

The name "perfluoroelastomer" is somewhat misleading. An actual perfluorinated material with a high molecular weight is polytetrafluoroethylene or PTFE which has the chemical formula 
$\text{(CF}_2\text{)}_n\text{.}$ The molecular carbon chain is shielded by the chemical inertness of the large bonded fluorine atoms. Perfluoroelastomer is produced by the copolymerization of tetrafluoroethylene (TFE) and a perfluorinated ether, e.g. perfluoromethylvinylether (PMVE). The differing resistance to volume swell of the different perfluoroelastomers is due to the perfluorinated ether element, where the side-chain can consist of up to four perfluorinated carbon atoms. The extraordinary chemical resistance is partly due to the fluorine atoms shielding the carbon chain, and partially due to the vulcanization system.

Heat resistance

- 450°F to 600°F (232°C to 316°C) depending on compound.

Cold flexibility

- 0°F to –15°F (–18°C to –26°C).

Chemical resistance

- Aliphatic and aromatic hydrocarbons
- Chlorinated hydrocarbons
- Polar solvents (acetone, methyl ethyl ketone, ethyl acetate, diethylether and dioxane)
- Inorganic and organic acids
- Water and steam
- High vacuum with minimal loss in weight.

Not compatible with:

- Fluorinated refrigerants (R11, 12, 13, 113, 114, etc.).

Please contact Industrial Seal Inc. for more information
Disogrin® 6865 (TODI/Polyurethane)

This material was developed to solve difficult hydraulic applications, and was produced specifically for use as O-rings. It possesses extremely high mechanical properties, excellent abrasion, tear and extrusion resistance with low compression set. It has outstanding cold temperature properties and is usable in petroleum based, bio-degradable (synthetic and natural Ester) based fluids.

**Typical Physical Properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Natural</td>
</tr>
<tr>
<td>Hardness, Shore A</td>
<td>70</td>
</tr>
<tr>
<td>Tensile Strength, psi</td>
<td>5,000</td>
</tr>
<tr>
<td>Elongation</td>
<td>550</td>
</tr>
<tr>
<td>Compression Set:</td>
<td>70 hrs. at 70°C 9</td>
</tr>
<tr>
<td>Service Temperature Range, °C (°F)</td>
<td>-81 to 121(-115 to 250)</td>
</tr>
</tbody>
</table>

**Operating Limits**

The operating limits are highly dependent on the application. Combinations of pressure, temperature, fluid medium and other factors all greatly affect the performance and longevity of the seal.

- Pressure: 3,000 psi / 21 Mpa
- Temperature: -82°C to 121°C

Please contact Industrial Seal Inc. for more information
Disogrin® 7205 (TODI/urethane)

This material was developed to solve difficult hydraulic applications, and was produced specifically for use as O-rings. It is excellent in applications requiring compatibility with water up to +250°F. It is suitable for use in acids and bases with a pH range from 2-13 at temperatures up to +220°F. It is suitable for petroleum base and most bio-degradable fluids. The material has many of the same excellent mechanical properties as our other Disogrin TODI polyurethane materials including abrasion and extrusion resistance and high tensile strength.

Typical Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Natural</td>
</tr>
<tr>
<td>Hardness, Shore A</td>
<td>70</td>
</tr>
<tr>
<td>Tensile Strength, psi</td>
<td>4,655</td>
</tr>
<tr>
<td>Elongation</td>
<td>445</td>
</tr>
<tr>
<td>Compression Set:</td>
<td>70 hrs. at 70°C 12</td>
</tr>
<tr>
<td>Service Temperature Range, °C (°F)</td>
<td>-54 to 127 (-65 to 260)</td>
</tr>
</tbody>
</table>

Operating Limits

The operating limits are highly dependent on the application. Combinations of pressure, temperature, fluid medium and other factors all greatly affect the performance and longevity of the seal.

- Pressure: 3,000 psi / 21 Mpa
- Temperature: -48°C to 110°C (-50°F to 220°F)

Please contact Industrial Seal Inc. for more information
Disogrin® 7695 (TODI/Polyurethane)

This material was developed to solve difficult hydraulic applications, and was produced specifically for use as O-rings. It is excellent in applications requiring compatibility with water up to +250°F. It is suitable for use in acids and bases with a pH range from 2-13 at temperatures up to +220°F. It is suitable for petroleum base, and most bio-degradable fluids. The material has many of the same excellent mechanical properties as our other Disogrin TODI polyurethane materials including abrasion and extrusion resistance and high tensile strength.

Typical Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Natural</td>
</tr>
<tr>
<td>Hardness, Shore A</td>
<td>95</td>
</tr>
<tr>
<td>Tensile Strength, psi</td>
<td>6,750</td>
</tr>
<tr>
<td>Elongation</td>
<td>445</td>
</tr>
<tr>
<td>Compression Set:</td>
<td>70 hrs. at 70°C 23</td>
</tr>
<tr>
<td>Service Temperature Range, °C (°F)</td>
<td>-53 to 135 (-65 to 275)</td>
</tr>
</tbody>
</table>

Operating Limits

The operating limits are highly dependent on the application. Combinations of pressure, temperature, fluid medium and other factors all greatly affect the performance and longevity of the seal.

- Pressure: 10,000 psi / 70 Mpa
- Temperature: -48°C to 110°C (-50°F to 220°F)

Please contact Industrial Seal Inc. for more information
Disogrin® 9250 (TODI/Polyurethane)

This material was developed to solve difficult hydraulic applications, and was produced specifically for use as O-rings. It possesses extremely high mechanical properties, outstanding resistance to abrasion, tear and extrusion over a large range of temperatures. It is suitable for petroleum based, bio-degradable (synthetic and natural Ester) based fluids.

Typical Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Natural</td>
</tr>
<tr>
<td>Hardness, Shore A</td>
<td>90</td>
</tr>
<tr>
<td>Tensile Strength, psi</td>
<td>6,500</td>
</tr>
<tr>
<td>Elongation</td>
<td>420</td>
</tr>
<tr>
<td>Compression Set: 70 hrs. at 70°C</td>
<td>22</td>
</tr>
<tr>
<td>Service Temperature Range, °C</td>
<td>(-59 to 149 °F) 75 to 300</td>
</tr>
</tbody>
</table>

Operating Limits

The operating limits are highly dependent on the application. Combinations of pressure, temperature, fluid medium and other factors all greatly affect the performance and longevity of the seal.

- Pressure: 10,000 psi / 70 Mpa
- Temperature: -48°C to 110°C (-50°F to 220°F)

Please contact Industrial Seal Inc. for more information