Product Information Report
O-Rings

Overview

O-rings are loops of elastomer used as mechanical seals. They are designed to be seated in a groove and compressed during assembly of two or more parts, creating a seal at the connection.

Characteristics

An important characteristic of an O-ring is its durometer. The durometer is the international standard for measuring the hardness of rubber, plastic and other non-metallic materials. A durometer tool measures a compound's susceptibility to indentation, which should not be confused with durability or tensile strength. Lawson's O-rings are measured using the **Shore A** durometer scale.

Material Comparison

- Buna N (Nitrile) – good oil and gasoline resistance, tensile strength, elongation properties and heat resistance
- Neoprene – typically used in general-purpose applications – resists heat, oil, chemicals, ozone, weathering, flexing and flame
- Viton® – excellent resistance to heat, ozone, oils, many chemicals and some solvents

	Buna-N	Neoprene	Viton®
Tensile Strength Max. (PSI)	4,000	4,000	2,500
Elongation Max. %	600	600	300
Hardness, Shore A	30-90	40-90	50-95
Resilience at 73°F	B	B	B
Gas Permeability	B	B	A
Operating Temperature Range	–65°F to +276°F (–54°C to +135°C)	–65°F to +276°F (–54°C to +135°C)	–31°F to +400°F (–35°C to +204°C)
Resistance to:	**Buna-N**	**Neoprene**	**Viton®**
Tearing	C	B	C
Abrasion	A	A	B
Flame	B	D	A
Ozone	A	D	A
Weather	A	D	A
Oxidation	A	B	A
Water	B	A	A
Steam	C	C	B
Acids (dilute/conc.)	A	B	A
Alkalies (dilute/conc.)	A	B	A
Sythetic Lubricants	D	B	A
Lubricating Oils	B	B	A
Animal, Vegetable Oils	B	B	A

A = Excellent C = Fair B = Good D = Use with caution

O-ring Failures

O-ring failures are events that are met with dismay and frustration. These failures can be costly and time-consuming. There are many causes for O-ring failure including temperature, fluid compatibilities, pressure and human factors. Knowing what O-ring works best in a given application can help avoid failures.

O-ring Material Compatibility

Using an O-ring with an incompatible fluid can result in seal failure. The chart below lists three common O-ring materials and their resistance to common fluids.

Fluid	Buna-N	Neoprene	Viton®
Acetic Acid	–	+	x
Ammonia	+	+	x
Auto, Transmission Fluid	+	–	+
Bleach	+	+	+
Boric Acid	+	+	+
Brake Fluid (non-petroleum)	x	+	x
Butane	+	+	+
Butyl Acetate	x	x	x
Carbon Disulfide	x	x	+
Carbonic Acid	+	+	+
Chasis Grease	+	–	+
Chloracetic Acid	x	x	x
Chloroform	x	x	+
Chromic Acid	x	x	+
Citric Acid	+	+	+
Crude Oil	+	x	+
Diesel Oil	+	–	+
Ethane	+	+	+
Ethanol	+	+	+

Fluid	Buna-N	Neoprene	Viton®
Freon 12	+	+	+
Fuel Oil	+	+	+
Gallic Acid	+	+	+
Glycerine	+	+	+
Hydrocyanic Acid	+	+	+
Hydrogen Sulfide	x	+	x
Isopropanol	+	+	+
Kerosine	+	+	+
Lactic Acid	+	+	+
Maleic Acid	x	x	+
Mercury	+	+	+
Methane	+	+	+
Methanol	+	+	x
Methylene Chloride	x	x	+
Nitric Acid	x	x	–
Nitropropane	x	x	x
Octane	+	x	+
Propane	+	+	+
Propanol	+	+	+
Trichloro Ethylene	–	x	+
Triethanol Amine	–	+	x

+ = Recommended – = Marginal x = Unsatisfactory

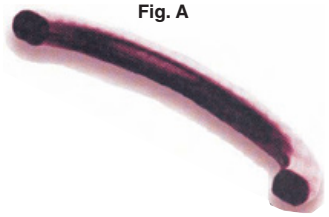
Fig. A

Compression Set

The most common type of O-ring failure is loss of resiliency, commonly called compression set. Over time, the O-ring will exhibit a flattened surface (Fig. A). This happens for a number of reasons, including exposure to excessive temperature or incompatible fluids.
The seal begins to leak because the O-ring can no longer fill the gap it was once sealing.

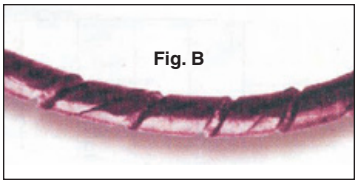
Fig. B

Spiral Failure

In spiral failure (Fig. B) the O-ring rolls to make cuts or marks that spiral around the O-ring. The most common cause of this is use of an O-ring in a slow, reciprocating fashion. This causes the O-ring to roll itself up inside the groove. Another reason for spiral failure is an irregular surface finish over the mating parts. The O-ring grips at a certain point which creates a starting point for the rolling. Due to the cuts in the O-ring, there is now room for leakage. Lubricating the O-ring or choosing an O-ring with a higher durometer can help avoid this problem.

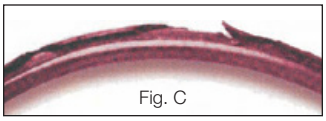
Fig. C

Nibbling and Extrusion

This is when the O-ring appears to be torn away in little pieces (Fig. C). Leakage occurs because the O-ring is missing pieces and is commonly caused by applying too much pressure on the O-ring or using an O-ring with too low of a durometer/hardness. Increasing the durometer is a common way to help avoid this problem.

O-ring Maintenance and Storage

Dielectric Silicone Compound

Seal-Tite Dielectric Silicone Grease

To keep an O-ring working properly, it is important to keep it properly lubricated using an inert or neutral grease. The use of Lawson's Dielectric Silicone or Seal-Tite Silicone is recommended for adding life to the O-ring.

It is also important to keep O-rings properly stored before use. Properly storing O-rings is as easy as putting them in a plastic bag along with a few drops of an inert grease. Keeping them at room temperature and out of direct sunlight is also important.