O-RINGS

Product	Page
O-Rings	126
Seal Compatibility	127
Elastomer Characteristics	128
Basic Seal Materials	129

O-RINGS

Bar Hydraulics offers O-rings and gaskets which are the most commonly used types of oil seals throughout the industry worldwide. Bar Hydraulics can supply o-rings and gaskets to the following standards: DIN 3771; ISO 3601-1; JIC B2401; SAE J1926 (English); ISO 6149(Metric)

WHAT IS AN O-RING?

An O-ring is a torus, or doughnut-shaped ring, generally molded from an elastomer, although O-rings are also made from PTFE and other thermoplastic materials, as well as metals, both hollow and solid. This section deals with elastomeric O-rings only.

WHAT IS AN O-RING SEAL?

An O-ring seal is used to prevent the loss of fluid or gas. The seal assembly consists of an elastomer O-ring and a gland. An O-ring is a circular cross-section ring molded from rubber (Figure 1). The gland – usually cut into metal or another rigid material – contains and supports the O-ring (Figures 2 and 3). The combination of these two elements; O-ring and gland – constitute the classic O-ring assembly.

Fig. 1

ADVANTAGES OF O-RINGS

- They seal over a wide range of pressure, temperature and tolerance.
- Ease of service, no smearing or retightening.
- No critical torque on tightening, therefore unlikely to cause structural damage.
- O-rings normally require very little room and are light in weight.
- In many cases an O-ring can be reused, an advantage over non-elastic flat seals and crush-type gaskets.
- The duration of life in the correct application corresponds to the normal aging period of the O-ring material.
- O-ring failure is normally gradual and easily identified.
- Where differing amounts of compression effect the seal function (as with flat gaskets), an O-ring is not affected because metal to metal contact is generally allowed for.
- They are cost-effective.

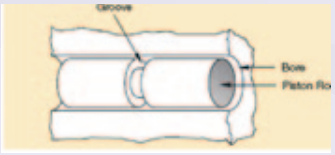


Fig. 2

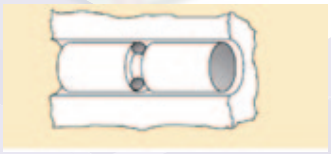


Fig. 3

OPERATION

All robust seals are characterized by the absence of any pathway by which fluid or gas might escape. Detail differences exist in the manner by which zero clearance is obtained – welding, brazing, soldering, ground fits or lapped finishes – or the yielding of a softer material wholly or partially confined between two harder and stiffer members of the assembly. The O-ring seal falls in the latter class.

The rubber seal should be considered as essentially an incompressible, viscous fluid having a very high surface tension. Whether by mechanical pressure from the surrounding structure or by pressure transmitted through hydraulic fluid, this extremely viscous fluid is forced to flow within the gland to produce "zero clearance" or block to the flow of the less viscous fluid being sealed. The rubber absorbs the stack-up of tolerances of the unit and its internal memory maintains the sealed condition. Figure 4 illustrated the O-ring as installed, before the application of pressure. Note that the O-ring is mechanically squeezed out of round between the outer and inner members to close the fluid passage. The seal material under mechanical pressure extrudes into the microfine grooves of the gland. Figure 5 illustrates the application of fluid pressure on the O-ring. Note that the O-ring has been forced to flow up to, but not into, the narrow gap between the mating surfaces and in so doing, has gained greater area and force of sealing contact. Figure 6 shows the O-ring at its pressure limit with a small portion of the seal material entering the narrow gap between inner and outer members of the gland. Figure 7 illustrates the result of further increasing pressure and resulting extrusion failure. The surface tension of the elastomer is no longer sufficient to resist flow and the material extrudes (flows) into the open passage or clearance gap.

Fig. 4

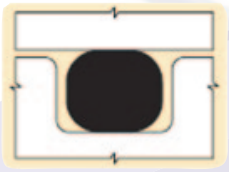


Fig. 5

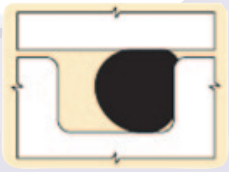


Fig. 6

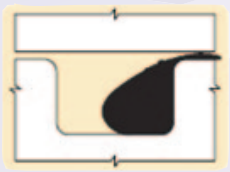
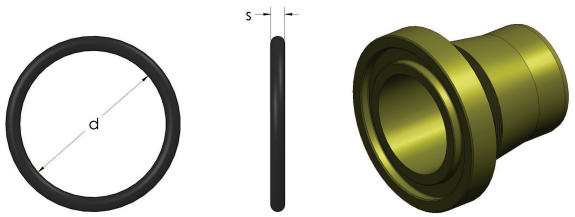
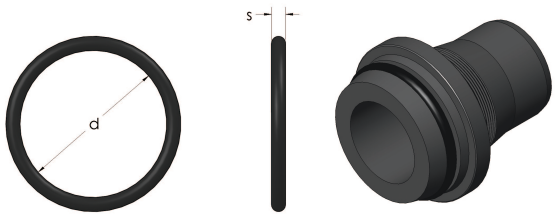


Fig. 7

O-RINGS



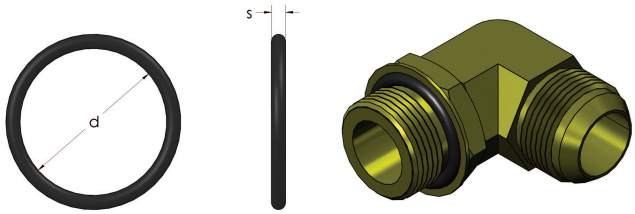


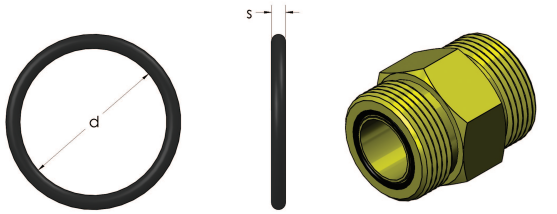
BARCONN® SAE Code 61/62			
Part #	Nom. Size	d (in.)	s (in.)
BHOR-CON-210-V	½"	0.734 ± 0.010	0.139 ± 0.004
BHOR-CON-214-V	¾"	0.984 ± 0.010	0.139 ± 0.004
BHOR-CON-219-V	1"	1.296 ± 0.012	0.139 ± 0.004
BHOR-CON-222-V	1¼"	1.484 ± 0.015	0.139 ± 0.004
BHOR-CON-225-V	1½"	1.859 ± 0.018	0.139 ± 0.004
BHOR-CON-228-V	2"	2.234 ± 0.020	0.139 ± 0.004
BHOR-CON-232-V	2½"	2.734 ± 0.024	0.139 ± 0.004
BHOR-CON-237-V	3"	3.359 ± 0.024	0.139 ± 0.004
BHOR-CON-241-V	3½"	3.859 ± 0.028	0.139 ± 0.004
BHOR-CON-245-V	4"	4.359 ± 0.030	0.139 ± 0.004
BHOR-CON-251-V	5"	5.359 ± 0.035	0.139 ± 0.004
BHOR-CON-263-V	6"	7.234 ± 0.045	0.139 ± 0.004
BHOR-CON-271-V	8"	9.234 ± 0.045	0.139 ± 0.004

** Material = 90 Durometer Fluorocarbon (Viton)*

BARDKO®			
Part #	Nom. Size	d (mm)	s (mm)
BHOR-DKO-08S-V	8 S	6,0 ± 0,13	1,5 ± 0,08
BHOR-DKO-10S-V	10 S	7,5 ± 0,13	1,5 ± 0,08
BHOR-DKO-12S-V	12 S	9,0 ± 0,13	1,5 ± 0,08
BHOR-DKO-16S-V	16 S	12,0 ± 0,15	2,0 ± 0,08
BHOR-DKO-20S-V	20 S	16,3 ± 0,18	2,4 ± 0,08
BHOR-DKO-25S-V	25 S	20,3 ± 0,20	2,4 ± 0,08
BHOR-DKO-30S-V	30 S	25,3 ± 0,25	2,4 ± 0,08
BHOR-DKO-38S-V	38 S	33,3 ± 0,30	2,4 ± 0,08

** Material = 90 Durometer Fluorocarbon (Viton)*





SAE O-Ring BOSS			
Part #	Nom. Size	d (in.)	s (in.)
BHOR-ORB-904-N	¼"	0.351 ± 0.005	0.072 ± 0.003
BHOR-ORB-906-N	⅜"	0.468 ± 0.005	0.078 ± 0.003
BHOR-ORB-908-N	½"	0.644 ± 0.009	0.087 ± 0.003
BHOR-ORB-910-N	⅝"	0.755 ± 0.009	0.097 ± 0.003
BHOR-ORB-912-N	¾"	0.924 ± 0.009	0.116 ± 0.004
BHOR-ORB-916-N	1"	1.171 ± 0.010	0.116 ± 0.004
BHOR-ORB-920-N	1¼"	1.475 ± 0.014	0.118 ± 0.004
BHOR-ORB-924-N	1½"	1.720 ± 0.014	0.118 ± 0.004
BHOR-ORB-932-N	2"	2.338 ± 0.019	0.118 ± 0.004

** Material = 90 Durometer Nitrile-Butadiene (Buna)*

O-Ring Face Seal (ORFS)			
Part #	Nom. Size	d (in.)	s (in.)
BHOR-OFS-011-N	¼"	0.301 ± 0.005	0.070 ± 0.003
BHOR-OFS-012-N	⅜"	0.364 ± 0.005	0.070 ± 0.003
BHOR-OFS-014-N	½"	0.489 ± 0.005	0.070 ± 0.003
BHOR-OFS-016-N	⅝"	0.614 ± 0.009	0.070 ± 0.003
BHOR-OFS-018-N	¾"	0.739 ± 0.009	0.070 ± 0.003
BHOR-OFS-020-N	⅞"	0.864 ± 0.009	0.070 ± 0.003
BHOR-OFS-021-N	1"	0.926 ± 0.009	0.070 ± 0.003
BHOR-OFS-025-N	1¼"	1.176 ± 0.011	0.070 ± 0.003
BHOR-OFS-029-N	1½"	1.489 ± 0.013	0.070 ± 0.003
BHOR-OFS-135-N	2"	1.925 ± 0.017	0.103 ± 0.003

** Material = 90 Durometer Nitrile-Butadiene (Buna)*

Seal Compatibility with Common Fluids

R = Recommended **S** = Satisfactory **M** = Marginal **U** = Unsatisfactory = Insufficient Data

Fluid Name	Mfg. Code	Military Spec.	Trade Name / Number	Colour	Type of Seal Compound - Common Name								
					Buna-N	Butyl	Corfam	EP	Viton	Silicone	Neoprene	Nat. Rubber	Polyure'ane
Water - Glycol	1		Houghto-Safe 600 Series	Red	R	R	R	R	R	S	S	R	U
	1		Houghto-Safe 500 Series	Red	R	R	R	R	R	S	S	R	U
	1	MIL-H22072	Houghto-Safe 271	Red	R	R	R	R	R	S	S	-	U
	4		Ucon Hydrolube	Yel. or Red	R	R	R	R	R	R/S	S	R	U
	4		Ucon M1	Yellow	R	R	R	R	R	S	S	S	U
	5		Celluguard	Red	R	R	R	R	R	S	S	-	U
	10		Safety Fluid 200	Bright Pink	R	R	R	R	R	S	S	-	U
Water/Oil Emulsion	1		Houghto-Safe 5000 Series	White	R	U	R	U	R	-	S	U	U
	3		FR	Creamy	R	U	R	U	R	-	S	U	U
	7		Irus 900	Yellow	R	U	R	U	R	U	S	U	M
	8		Pyrogard C & D	Pale Yel.	R	U	BARDKO	U	R	-	S	U	U
Water-Soluble Oil	-			Milky	R	M	R	-	R	-	S	S	M/U
Water-Fresh	-			-	R	R	R	R	R	R/S	M	R	M/U
Water-Salt	-			-	R	R	R	R	R	R/S	M	R	M/U
Phosphate Ester	1		Haughto-Safe 1000 Series	Green	U	R	M/U	R	R	M	U	U	M
	1	MIL-H-19547B	Houghto-Safe 1120	Green	U	R	M/U	R	R	M	U	U	M
	2		Pydraul F-9, 150, 625	Cloudy Bl.	U	R/S	M/U	S	R	R/S	U	U	S
	5		Fyrquel	Lt. Green	U	R	M/U	R	R	M	U	U	M
	7		Shell SFR B.C.D.	Aqua Gr.	U	R	M/U	R	R	M	U	U	M
	8		Pyrogard 42,43,53,55,190	Pale Yel.	U	R	M/U	R	R/S	M	U	U	M
	2		Skydrol 500B	Purple	U	S	U	R	U	M	U	U	U
	2		Skydrol 7000	Green	U	S	U	R	U	M	U	U	U
	2		Pydraul 312, 135 (2)	Blue Gr.	U	M	M	M	R	R	U	U	-
	2		Pydraul AC	Cloudy Bl.	U	S	M/U	S	R	R	U	U	M/U
	2		Pydraul 60	Cloudy Bl.	U	R	M/U	R	U	S	U	U	M/U
	8		Pyrogard 210 (3)	Yellow	U	M	-	M	R	R	U	U	M/U
Diester	-	MIL-H-7808	Lube Oil-Aircraft	Amber	S	U	R	U	R	U	U	U	U
Clorinat. Hydrocarb	2		Aroclor 1200 Series (1)	Clear	M	S	-	S	R	S	U	U	U
	2		Pydraul A-200	Cloudy Bl.	U	M	M	M	R	R	U	U	M/U
Silicate Ester	2		OS-45 Type 4	Clear	S	U	-	S	R	U	R	U	R
	6	MILO-8200	Oronite 8200	Clear	S	U	-	U	R	U	R	U	R
	6	MIL-8515	Oronite 8515	Clear	S	U	-	U	R	U	R	U	R
	9	MIL-H-8446B	Brayco 846	Red Brown	S	U	-	U	R	U	R	U	R
Kerosene	-			Clear	R	U	R	U	R	U	M/U	U	R
Jet Fuel	-	MIL-J-5624	JP-3, 4, 5 (RP-1)	Lt. Straw	R	U	R	U	R	U	U	U	S
Diesel Fuel	-			Clear	R	U	R	U	R	U	M/U	U	R
Gasoline	-		Gasoline	Various	R	U	R/S	U	R	U	U	U	R
Petroleum Base	-	MIL-H-6083	Preservative Oil	Red	R	U	R	U	R	U	R	S	R
Petroleum Base	-	MIL-H-5606	Aircraft Hyd. Fluid	Red	R	U	R	U	R	U	S	U	R

Notes:
(1) Halogenated
(2) Petroleum and halogenated hydrocarbon and phosphate ester mixture
(3) Chlorinated phosphate ester

Manufacturer's Code Number

No.	Manufacturer				
1.	E.F. Houghton	4.	Union Carbide & Chemical	8.	Mobil Oil
2.	Monsanto	5.	Stauffer Chemical	9.	Bray Oil - Royal Lubricant
3.	Gulf	6.	Standard Oil (Ortho Chemical)	10.	Texaco
		7.	Shell Chemical		

Elastomer Characteristics

Elastomer	Styrene Butadiene	Butyl	Chlorosulphonated Polyethylene	Ethylene Propylene	Flurocarbon	Flurosilicone	Natural	Polychloroprene	Nitrile	Polyacrilic	Polysulphide	Polyurethane	Silicone
Symbol	**SBR**	**IIR**	**TFE**	**CSM**	**EPM**	**FPM**	**FSI**	**NR**	**CR**	**NBR**	**ACM**	**TR**	**AU-EU**
Upper Temp. Limit (°F)	194	500	212	248	284	347	392	176	230	266	320	221	212
Lower Temp. Limit (°F)	-58	-148	-22	-4	-49	5	-76	-76	-40	-49	-4	-67	-58
Abrasion Resistance	S	U	M	R	•	S	•	R	R	S	•	•	R
Compression Set Resisit.	•	•	U	M	M	S	U	R	S	R	U	U	S
Resilience	M	U	U	U	U	M	U	R	S	M	M	U	S
Radiation	U	U	•	•	•	•	M	•	•	•	•	•	S
Weather Resistance	M	R	R	R	R	R	R	U	U	U	R	R	R
Ozone Resistance	M	R	R	R	R	R	R	M	•	M	R	S	R
Adhesion to Metal	R	S	S	R	S	R	R	R	•	R	S	R	R

R = Recommended S = Satisfactory M = Marginal U = Unsatisfactory • = Consult MFGR.

Basic Seal Materials (Elastomers)

The following is a brief list of the various elastomers used in seals.

Buna N (Nitrile) (NBR)
Coplymer of butadiene & acrylonitrile. Excellent with petroleum products. -65 to +250°F. For low temperatures it is necessary to sacrifice some high temperature resistance. Superior in compression set, cold flow, tear and abrasion resistance. Inferior in resistance to ozone, sunlight or weather.

Generally recommended for:	Not recommended for:
General Purpose	Halogenated Hydrocarbons
Petroleum	Phosphate Ester
Water	Ketones
Diester	Acids
Water-Glycol	Brake Fluid

Fluorocarbon (FPM) (VITON)
A linear copolymer of vinylidene fluoride and hexafluoropropylene (approximately 65% fluorine). Excellent for high vacuum. Compatible and recommended with most fluids and gasses. -20 to +350°F (to +600°F for short periods).

Generally recommended for:	Not recommended for:
Petroleum	Ketones
Silicate Ester	Skydrol 500, 700
Diester	
Halogenated Hydrocarbons	
Most Phosphate Esters	

Isoprene Rubber-Synthetic (IR) (Polyisoprene)
The same chemical composition as natural rubber. (For properties, refer to natural rubber)

Buna S (SBR) (GRS)
Originally a substitute for natural rubber. Composition, styrene and butadiene rubber. Little used for hydraulic seals (except brake systems). -65 to +200°F.

Generally recommended for:	Not recommended for:
Automotive Brake Fluid	Ozone
Some Alcohols	Petroleum
Water	
Ketones	

Butyl Rubber (IIR)
Copolymer of isobutylene and isoprene. -65 to +225°F. Used for inner tubes. Excellent resistance to gas permeation. Particularly useful for high vacuum.

Generally recommended for:	Not recommended for:
Phosphate Ester	Petroleum
Ketones	Diester

Silicone Rubber (SI)
Made from silicone, oxygen, hydrogen, and carbon. Resistance to temp. extremes. -135 to +500°F for short periods. Recommended temperature, 400°F. Retention of properties at high temperatures is superior to other elastic materials. Fluorosilicone combines the good temperature properties of silicone with basic fuel and oil resistance. Not recommended for dynamic sealing because of poor tear and tensile strength. Higher than normal mold shrinkage.

Generally recommended for:	Not recommended for:
High Aniline Point Oils	Most Petroleum
Chlorinated Di-Phenyls	Ketones
Some Water Glycols	Some Phosphate Esters

Tetrafluoroethylene (TFE) (not an elastomer)
Rigid tetrafluoroethylene resin. Extemely low friction. Compatible and recommended with most fluids and gases. Will cold flow under high loads. -320 to +500°F.

Chloroprene Rubber (CR) (NEOPRENE)
Homopolymers of chloroprene (chlorobutadiene). -65 to +250°F. Should be spring loaded for low temperatures.

Generally recommended for:	Not recommended for:
Refrigerants (Freons)	Phophate Ester Fluids
High Aniline Point Petroleum	Ketones
Silicate Esters	

Ethylene Propylene Rubber (EPM) (EP) (EPR)
An elastomer of ethylene and propylene monomers (Ethylene Propylene Copolymers). Excellent with Skydrol 500 and phosphate esters. -65 to +300°F.

Generally recommended for:	Not recommended for:
Phosphate Ester	Petroleum
Steam (to +400°F)	Diester
Water	
Ketones	

Corfam
Totally new material made of corfam poromeric substrate impregnated with adiprene polyurethane rubber. High abrasion, oil, and fuel resistance. Also available with silicone or Teflon coating. Finished seals are waterproof. -65 to +212°F.

Generally recommended for:	Not recommended for:
General Purpose	High Test Gasoline
Petroleum	Hot Detergent Water
Hot Water	Phosphate
Water-Glycols	
Water-Oil Emulsion	
Water-Soluble Oil	

Natural Rubber - Natural Polysoprene (NR)
Principle source: the tree Hevea Brasiliensis. Petroleum oils are the greatest enemy of natural rubber compounds.

Generally recommended for:	Not recommended for:
Brake Fluid	Petroleum
Water	Water / Oil
	Phosphate Ester
	Silicate Esters

Polyurethane
Diisocyanate with polyesters or polyethers. Superior mechanical and physical properties. Good resistance to petroleum products. Difficult to mold or cast. Some have poor compression and permanent set properties. Tend to soften excessively at temperatures above +250°F and in hot water.

Generally recommended for:	Not recommended for:
Petroleum	Hot Water
Water / Oil (Moderate Temp.)	Acids
Phosphate Ester	Ketones
	Chlorinated Hydrocarbons

NOTES