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DESIGN DIMENSIONS FOR O-RING INSTALLATION

O-rings are normally used as seals in several ways, and dimensions of the groove or gland will also vary with the cross section of the ring, the type of operation, and the amount of pressure used in the system. These dimensions will also be different if the O-ring is sealing a liquid which has a low volume swell on the ring (0-15% Design Chart 1 & 3) or if it is **sealing** a liquid which has a high volume swell on the ring (15-25% Design Chart 2 & 4). It has not been practical to attempt to seal liquids which will swell the O-ring more than 25%, in most cases, since the rings will lose most of their desirable physical properties with such a high swell.

STATIC SEALS (Design Charts 1, 2, 3 & 4)

In a static seal, where the O-ring does not move and is used simply for containing pressure or maintaining a vacuum, the ring may be compressed AXIALLY or parallel to a line drawn through the center or axis of the ring. In this case, you will use the dimensions under AXIAL opposite the cross section of the ring you desire.

Although the depth and width of the groove will remain the same for all Axial staticseals, the I.D. and O.D. of the groove will vary depending on whether you are sealing against inter nal pressure or external pressure (a vacuum in the vessel being sealed.).

In the case of internal pressure, the O.D. of the groove should be the same as the O.D. of the ring, plus the normal tolerance for that size-ring.

In the case of external pressure (i.e., a vacuum in the vessel being sealed), the I.D. of the groove should be the same as the I.D. of the ring being used, plus the normal tolerance range for that size ring

A static seal ring may also be compressed RADIALLY; that is, being compressed between the internal diameter (I.D.) and overall diameter (O.D.). In this case, you will use the dimensions under RADIAL opposite the appropriate cross section column for the ring you wish to use.

DYNAMIC SEALS (Design Charts 1, 2, 3, 4 & 5)

Dynamic or moving seals basically fall into two classes; reciprocating (as in the case of the piston and a cylinder), or rotating (as in the case of a shaft rotating in a housing). Reciprocating design data will be found in Charts 1, 2, 3 & 4. Rotating design data will be found in Chart 5.

Reciprocating seals may be designed so as to permit or prevent rolling of the ring within the groove. When the ring is allowed to roll within the groove, the breakaway force necessary to move the piston is usually lower; but some sacrifice must be made in the pressure limitations of the seal and also in the life of the seal. This is caused by the constant flex of the O-ring with each stroke of the piston.

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DIAMETRAL CLEARANCE (Design Chart 6)

Under the dynamic section you will also find a section on *diametral* ***clearance.*** This calls out the maximum clearance between a piston and cylinder for pressure to 1500 psi, using a 70 durometer compound (low swell fluid) or a 60 durometer compound (in a high swell fluid). If higher pressures are required, a different durometer O-ring may be used, as shown in Design Chart 6; or Teflon back-up rings, as shown in Design Chart 7 Design Chart 6 gives an elaboration of the diametric clearance for various durometers and various pressures. Adherence to these clearances will largely prevent extrusion of the O-ring between the piston and cylinder or shaft and groove, up to 5,000 psi using 90 durometer compound.

ROTATING SEALS (Design Chart 5)

Rotating seals should be limited to shafts having the following maximum rotational speed:

Shaft Diameter .125 – .280 – 350 ft./min.
Shaft Diameter .281 – .625 – 400 ft./min.
Shaft Diameter .626 – ,687 – 450 ft./min.
Shaft Diameter .688 – 1.250 – 600 ft./min.

In rotating shaft seals, a higher durometer (80-90) compound is usually used. Preferably, it should have excellent abrasion resistance and quite often is internally lubricated with graphite or molybdenum disulfide to give maximum protection if run dry.

To find the groove dimensions on a rotating seal, use Desrgn Chart 5. Find the shaft size in the second column. The groove root diameter and width will be found under their respective columns. The Pressure Seals O-ring size will be found in the first column next to shaft diameter.

BACK-UP RINGS (Design Chart 7)

When you have a tendency for O-rings to extrude between the sealing areas under pressure, there are three choices available to minimize this:

1. A harder O-ring material may be used.
2. Clearances may be reduced to a minimum.
3. Back-up rings may be used.

Desrgn Chart 7 shows the groove width necessary to accommodate the thickness of the back-up rings. Teflon back-up rings are usually furnished in single or dual turn rings. Single turn rings conform to MS 28774 and match the standard P.A.I. O-ring sire. Dual turn rings conform to MS 28782 and match the dash numbers of an AN 6227 series of O-rings. MS 28783 back-up rings match the dash numbers of AN 6230 O-rings.

Good practice is to use a back-up ring on either side of the O-ring, even though the pressure on the ring may be from one side only. The only time you will design for a back-up ring on one side is when there is not enough space for two rings. This is not recommended, however, unless absolutely necessary.

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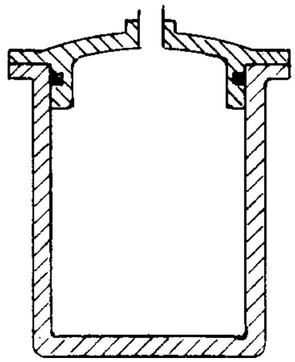
STATIC SEAL: EXAMPLE RADIAL SEAL



It is desired to seal a pressure vessel filled with air at 200 psi. The I.D. of the vessel at the sealing lip is 3.000" and the thickness of the cover at the groove point is .250".

First: Pick a ring series that has a cross section which can be cut into the cover without weakening the cover at this point. (100 series)

Second: Find an O-ring in this series which has an O.D. closest to 3.000" (1-149-O.D. 3.006).

Third: Check the swell characteristics of air, with possible oil traces in it. (Low swell – 0-15%)

Fourth: In the normal swell Design Chart 1, find the cross section column for the 100 series rings (.103 ± .003).

Fifth: In this column, opposite the RADIAL section, find the groovedepth (.083–.003) and the groove width (.125 ± .005).

STATIC SEAL – EXAMPLE: AXIAL SEAL

It is desired to seal a pressure vessel filled with hydraulic oil at 1200 psi. The I.D. of the vessel is 4 inches, and the flange is 1 inch wider and 3/8" thick (see drawing).

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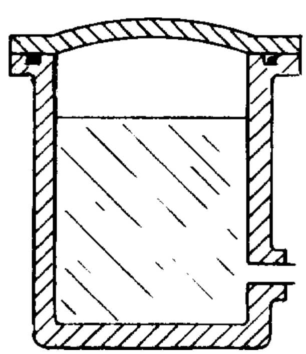


First: Find the O-ring sizes that will fit within the sealing area. (I-244, I-156).

Second: Pick the series O-ring desired, based on the thickness of the flange available to cut the groove depth desired. (I-244)

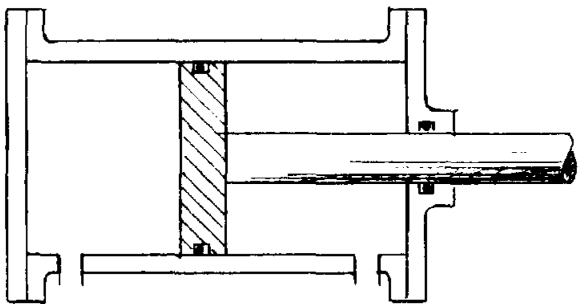
Third: Check the swell characteristics of the fluid on the rubber to determine whether the normal or high swell chart will be used for dimensions of the O-ring groove. (In this case 0-15% or normal swell Chart I).

Fourth: Since this is an internal pressure application, the O.D. of the groove should be the O.D. of the ring (4.512) plus the tolerance (.015) or 4.527 inches.

Fifth: Since this is an axial squeeze, look in the AXIAL section, Design Chart #1, under the cross section of the ring (.139). The groove depth will be .110"-.008" and the width will be .185" ± ,005.

DYNAMIC SEAL: RECIPROCATING, Low Pressure

A piston moves back and forth in a 1.000" cylinder to pump acetone at a pressure of 200 psi, maximum. An O-ring seal is required for this piston.



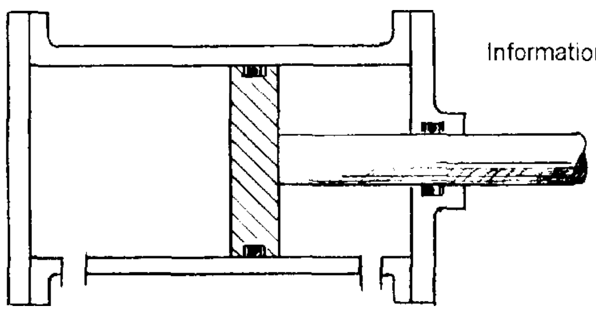
First: Find ring sizes whose O.D. is close to 1.000" (I-I 17, I-210).

Second: Check the swell characteristics of the liquid being pumped. (acetone swells most rubbers but does not attack EPDM rubber, so an EPDM ring could be used with normal swell -- table I).

Third: Opposite the dynamic section under the cross section of the 100 series (.103 ± .003), find the depth of the groove (.090 – ,003) and the width of the groove (.120 ± ,005). If it were desired that the ring roll in the groove, the width would be .145 ± .005.

DYNAMIC SEAL: RECIPROCATING, High Pressure

A piston seal is desired for a high pressure piston at 3,000 psi using hydraulic oil. Piston diameter is .875".



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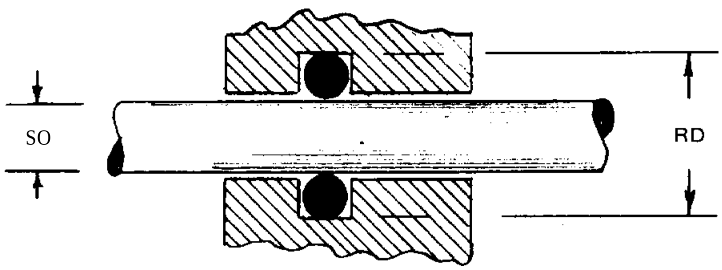
First: Find a ring size with an O.D. approximately .875" (I-I 15 with an O.D. of ,880).

Second: Determine whether the swell characteristics will fall into the normal (0-15%) or high (15-25%) range (normal range Design Chart #1).

Third: Find under the cross section column (.103" ±.003") opposite dynamic section, Design Chart #1, the groove depth (.090" – .003").

Fourth: Since the pressure range is over the 1500 psi maximum, 2 back-up rings will be required – one on either side of the O-ring. Under the column MS 28774 dash 1 IO-149 the width of the groove, with 2 rings, will be .245". The rings to use will have the number MS 28774-I 15.

DYNAMIC SEAL: ROTATING SEAL



It is desired to seal a mixer shaft with a rotor extending into the vessel through a housing seal and bearing combination and driven at 450 linear feet per minute. The shaft diameter is 1.000 inches. The material being mixed is a blend of oil and detergents.

First: In Design Chart 5, find in the second column the shaft size (1 inch)

Second: Under the Groove root diameter, find the root diameter (1.265).

Third: Under the groove width columm, find the groove width (.157).

Fourth: Under the radial clearance column, find the clearance of the shaft in the housing (.0015-.002).

Fifth: Under the bearing I.D. tolerance, find the clearance of the shaft in the bearing (–.0000 + .0012).

Sixth: On the extreme left column, find the P.A.I. O-ring size (I-215).

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DESIGN CHART #2 INDUSTRIAL O-RINGS-HIGH SWELL (15 to 25%)

O-RING CROSS SECTION	.040 ± .003	.050 ± .003	.060 ± .003	.070 ± .003	.103 ± .003	.139 ± .004	.210 ± .005	.275 ± .006
PSI SIZE NUMBER RANGE	1-001 902-1/2	1-002	1-003	1-004 1-055	1-108 1-178	1-202 1-284	1-312 1-395	1-404 1-476
O-RING ID SIZE RANGE	1/32 1/16	3/64	1/16	5/64 6-1/2	1/4 9-3/4	1/4 18	5/8 26	1-7/8 27
AXIAL SQUEEZE (min.)	.012	.015	.017	.020	.024	.030	.043	.056
GLAND DEPTH (max.)	.025 −.002	.032 −.002	.040 −.002	.047 −.002	.076 −.003	.105 −.004	.162 −.005	.213 −.006
GROOVE WIDTH (min.) (Wall to Wall)	.065	.076	.088	.108	.162	.215	.317	.418
RADIAL SQUEEZE (min.)	.010	.012	.014	.016	.020	.025	.030	.040
GLAND DEPTH (max.)	.027 −.001	.035 −.001	.043 −.001	.051 −.002	.080 −.003	.110 −.004	.175 −.005	.229 −.006
GROOVE WIDTH (min.) (Wall to Wall)	.065	.076	.088	.108	.162	.215	.317	.418
DYNAMIC SQUEEZE (min.)	.008	.010	.012	.014	.017	.020	.025	.035
GLAND DEPTH (max.)	.029 −.001	.037 −.001	.045 −.001	.053 −.002	.083 −.002	.115 −.003	.180 −.003	.234 −.004
GROOVE WIDTH (min.) (Wall to Wall)	.065	.076	.088	.103	.154	.204	.305	.405
DIAMETRAL CLEARANCE (max.)* 250 psi	.004	.005	.006	.007	.009	.011	.012	.014
1000 psi	.002	.0025	.003	.004	.005	.006	.007	.008
RADIUS (max.)	.005	.008	.012	.015	.020	.030	.040	.050
ECCENTRICITY (max.)	.001	.001	.001	.002	.003	.004	.005	.006

*These maximum diametral clearances based on 60 Durometer compound. If harder compound is used, see Chart 6 for proper maximum clearance.

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DESIGN CHART #3 900 SERIES O-RINGS-NORMAL SWELL (0 to 15%)

O-RING CROSS SECTION	.056 ± .003	.064 ± .003	.072 ± .003	.078 ± .003	.082 ± .003	.087 ± .003	.097 ± .003	.116 ± .004	.118 ± .010
PSI SIZE NUMBER RANGE	1-901	1-902 1-903	1-904 1-905	1-906	1-907	1-908	1-909 1-910	1-911 1-916	1-920 1-932
O-RING ID SIZE RANGE	.185	.239 .301	.351 .415	.468	.530	.644	.706 .755	.863 1.171	1.475 2.337
AXIAL SQUEEZE (min.)	.012	.014	.016	.017	.018	.019	.020	.022	.022
GLAND DEPTH (max.)	.040 − .002	.046 − .002	.051 − .004	.058 − .004	.065 − .005	.072 − .005	.080 − .006	.090 − .006	.090 − .006
GROOVE WIDTH (min.) (Wall to Wall)	.079 ± .003	.088 ± .003	.095 ± .003	.107 ± .003	.120 ± .003	.130 ± .004	.145 ± .005	.158 ± .005	.158 ± .005
RADIAL SQUEEZE (min.)	.011	.013	.014	.014	.015	.016	.017	.018	.018
GLAND DEPTH (max.)	.042 − .001	.047 − .001	.053 − .001	.063 − .001	.070 − .001	.078 − .002	.083 − .003	.094 − .003	.094 − .003
GROOVE WIDTH (min.) (Wall to Wall)	.070 ± .003	.078 ± .003	.090 ± .003	.098 ± .003	.107 ± .004	.183 ± .004	.125 ± .005	.140 ± .005	.142 ± .005
DYNAMIC SQUEEZE (min.)	.007	.008	.009	.009	.009	.010	.010	.011	.011
GLAND DEPTH (max.)	.046 − .001	.052 − .001	.058 − .001	.065 − .001	.068 − .001	.072 − .002	.084 − .003	.101 − .003	.103 − .003
GROOVE WIDTH (Wall to wall) With Roll No Roll (Tolerance for both)	.079 .068 ± .003	.088 .078 ± .003	.095 .090 ± .003	.105 .098 ± .003	.111 .139 ± .004	.117 .109 ± .004	.145 .120 ± .005	.158 .145 ± .005	.160 .146 ± .005
DIAMETRAL CLEAR- ANCE (max.)* 500 psi 1500 psi	.006 .003	.007 .004	.008 .004	.008 .004	.009 .004	.009 .004	.010 .005	.011 .005	.011 .006
R RADIUS (max.)	.008	.013	.015	.015	.015	.018	.020	.022	.022
ECCENTRICITY (max.)	.001	.001	.001	.001	.001	.001	.002	.002	.002

*These maximum diametral clearances based on 70 Durometer compound. If harder compound is used, see Chart 6 for relative maximum clearance.

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DESIGN CHART #4 900 SERIES O-RINGS-HIGH SWELL (15 to 25%)

O-RING CROSS SECTION	.056 ± .003	.064 ± .003	.072 ± .003	.078 ± .003	.082 ± .003	.087 ± .003	.097 ± .003	.116 ± .004	.118 ± .010
PSI SIZE NUMBER RANGE	1-901	1-902 1-903	1-904 1-905	1-906	1-907	1-908	1-909 1-910	1-911 1-916	1-920 1-932
O-RING ID SIZE RANGE	.185	.239 .301	.351 .415	.468	.530	.644	.706 .755	.863 1.171	1.475 2.337
AXIAL SQUEEZE (min.)	.016	.018	.020	.021	.021	.022	.023	.025	.027
GLAND DEPTH (max.)	.039 − .002	.042 − .002	.048 − .002	.053 − .002	.056 − .002	.061 − .002	.072 − .003	.088 − .003	.090 − .003
GROOVE WIDTH (min.) (Wall to Wall)	.084	.092	.110	.121	.129	.138	.157	.186	.188
RADIAL SQUEEZE (min.)	.014	.015	.017	.018	.018	.018	.019	.021	.022
GLAND DEPTH (max.)	.040 − .001	.046 − .001	.052 − .002	.056 − .002	.059 − .002	.062 − .002	.074 − .003	.108 − .004	.100 − .004
GROOVE WIDTH (min.) (Wall to Wall)	.084	.092	.110	.119	.125	.133	.156	.179	.189
DYNAMIC SQUEEZE (min.)	.011	.012	.015	.016	.016	.016	.016	.017	.018
GLAND DEPTH (max.)	.042 − .001	.048 − .001	.054 − .002	.059 − .002	.062 − .002	.066 − .002	.078 − .002	.098 − .003	.100 − .003
GROOVE WIDTH (min.) (Wall to Wall)	.082	.094	.105	.114	.121	.128	.150	.178	.179
DIAMETRAL CLEARANCE (max.)* 250 psi	.005	.006	.007	.007	.007	.007	.008	.010	.010
1000 psi	.002	.003	.004	.004	.004	.004	.004	.005	.005
RADIUS (max.)	.010	.013	.015	.015	.015	.020	.020	.020	.020
ECCENTRICITY (max.)	.001	.001	.002	.002	.002	.002	.002	.002	.003

*These maximum diametral clearances based on 60 Durometer compound. If harder compound is used, see Chart 6 for relative maximum clearance.

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DESIGN CHART #5 ROTATING SHAFT SEAL

PSI Size Number	Shaft Size	O-Ring ID	O-Ring Cross Section	Actual Shaft Dia. SD	Groove Root Dia. RD	Groove Width W	Bearing Length L	Radial Clear. Max.	Bearing ID Tolerance
				+.000	—.000 +.002	±.003			
1-007	1/8	.145 ± .005	.070 ± .003	.125 - .001	.256	.080	5/8	.0008 - .001	—.0000 - +.0008
1-008	5/32	.176 ± .005	.070 ± .003	.156 - .001	.287	.080	5/8	.0008 - .001	—.0000 - +.0008
1-009	3/16	.208 ± .005	.070 ± .003	.1875 - .0014	.318	.080	5/8	.0008 - .001	—.0000 - +.0008
1-010	7/32	.239 ± .005	.070 ± .003	.2187 - .0014	.349	.080	5/8	.0008 - .001	—.0000 - +.0008
70-270	1/4	.270 ± .005	.070 ± .003	.2500 - .0014	.381	.080	5/8	.0008 - .001	—.0000 - +.0008
1-011	9/32	.301 ± .005	.070 ± .003	.2812 - .0014	.413	.080	5/8	.0008 - .001	—.0000 - +.0008
1-110	5/16	.362 ± .005	.103 ± .003	.3125 - .0015	.509	.117	7/8	.001 - .0015	—.0000 - +.0010
1-111	3/8	.424 ± .005	.103 ± .003	.375 - .0015	.572	.117	7/8	.001 - .0015	—.0000 - +.0010
1-112	7/16	.487 ± .005	.103 ± .003	.4375 - .0015	.634	.117	7/8	.001 - .0015	—.0000 - +.0010
1-113	1/2	.549 ± .005	.103 ± .003	.500 - .002	.696	.117	7/8	.001 - .0015	—.0000 - +.0010
1-114	9/16	.612 ± .005	.103 ± .003	.562 - .002	.758	.117	7/8	.001 - .0015	—.0000 - +.0010
1-115	5/8	.674 ± .005	.103 ± .003	.625 - .002	.821	.117	7/8	.001 - .0015	—.0000 - +.0010
1-116	11/16	.737 ± .005	.103 ± .003	.687 - .002	.883	.117	7/8	.001 - .0015	—.0000 - +.0010
1-211	3/4	.796 ± .006	.139 ± .004	.750 - .002	1.016	.157	7/8	.0015 - .002	—.0000 - +.0012
1-212	13/16	.859 ± .006	.139 ± .004	.812 - .002	1.078	.157	7/8	.0015 - .002	—.0000 - +.0012
1-213	7/8	.921 ± .006	.139 ± .004	.875 - .002	1.141	.157	7/8	.0015 - .002	—.0000 - +.0012
1-214	15/16	.984 ± .006	.139 ± .004	.937 - .002	1.203	.157	7/8	.0015 - .002	—.0000 - +.0012
1-215	1	1.046 ± .006	.139 ± .004	1.000 - .002	1.265	.157	7/8	.0015 - .002	—.0000 - +.0012
1-216	1 1/16	1.109 ± .006	.139 ± .004	1.063 - .002	1.329	.157	7/8	.0015 - .002	—.0000 - +.0012
1-217	1 1/8	1.171 ± .006	.139 ± .004	1.125 - .002	1.391	.157	7/8	.0015 - .002	—.0000 - +.0012
1-218	1 3/16	1.234 ± .006	.139 ± .004	1.188 - .002	1.454	.157	7/8	.0015 - .002	—.0000 - +.0012
1-219	1 1/4	1.296 ± .006	.139 ± .004	1.250 - .002	1.516	.157	7/8	.0015 - .002	—.0000 - +.0012

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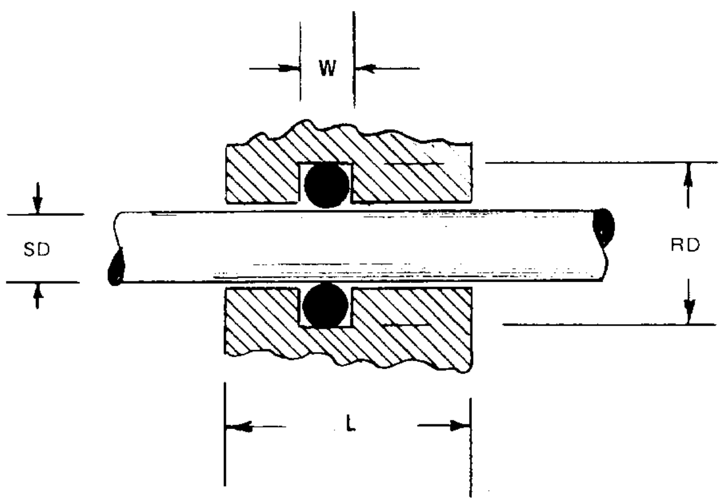

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DESIGN CHART #6
DIAMETRAL CLEARANCE VS. DUROMETER HARDNESS

SHORE A HARDNESS—60 DUROMETER

CROSS SECTION	.056 .064	.070 .078	.082 .087	.097 .103	.116 .118	.139	.210	.275
250 psi max.	.006	.007	.008	.009	.010	.011	.012	.014
500 psi max.	.004	.005	.006	.007	.008	.009	.010	.012
1000 psi max.	.003	.004	.004	.005	.005	.006	.007	.008
1500 psi max.	.002	.002	.002	.003	.003	.004	.005	.006

SHORE A HARDNESS—70 DUROMETER

CROSS SECTION	.056 .064	.070 .078	.082 .087	.097 .103	.116 .118	.139	.210	.275
500 psi max.	.007	.008	.009	.010	.011	.012	.014	.016
1000 psi max.	.005	.006	.006	.007	.008	.009	.010	.012
1500 psi max.	.003	.004	.004	.005	.005	.006	.007	.008
2000 psi max.	.002	.002	.002	.003	.003	.004	.004	.0045
2500 psi max.	.001	.001	.001	.0015	.002	.002	.0025	.0025

SHORE A HARDNESS—80 DUROMETER

CROSS SECTION	.056 .064	.070 .078	.082 .087	.097 .103	.116 .118	.139	.210	.275
500 psi max.	.009	.010	.011	.012	.014	.016	.018	.020
1000 psi max.	.007	.008	.009	.010	.011	.012	.014	.016
1500 psi max.	.004	.005	.006	.007	.007	.008	.010	.012
2000 psi max.	.003	.004	.004	.005	.005	.006	.007	.008
2500 psi max.	.002	.003	.003	.004	.004	.005	.006	.007
3000 psi max.	.001	.002	.002	.003	.003	.004	.0045	.005

SHORE A HARDNESS—90 DUROMETER

CROSS SECTION	.056 .064	.070 .078	.082 .087	.097 .103	.116 .118	.139	.210	.275
500 psi max.	.012	.014	.015	.016	.017	.018	.020	.020
1000 psi max.	.010	.012	.013	.014	.015	.016	.018	.018
1500 psi max.	.008	010	.011	.012	.013	.014	.015	.016
2000 psi max.	.006	.008	.008	.009	.009	.010	.012	.012
2500 psi max.	.005	.006	.006	.007	.007	.008	.010	.010
3000 psi max.	.004	.005	.005	.006	.006	.007	.008	.008
5000 psi max.	.002	.003	.003	.004	.004	.005	.006	.006

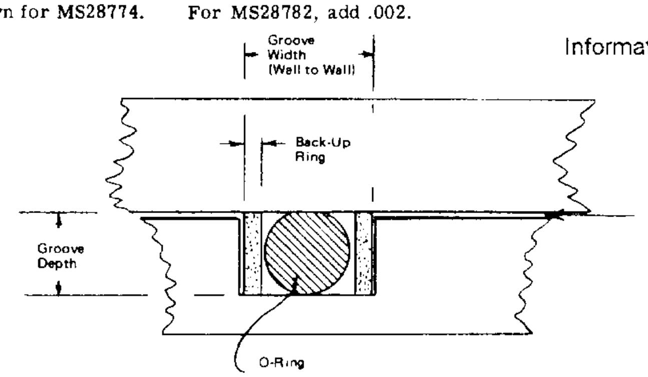
DESIGN CHART #7

TEFLON BACK-UP RINGS

MS28774 DASH NO. (Single Turn)	NOMINAL ID	THICKNESS	MS28782 DASH NO. (Dual Turn)	NOMINAL ID	THICKNESS (Single Turn)	CROSS SECTION ±.001	GROOVE WIDTH	
							One Ring	Two Rings
004 - 028	1/8 to 1-1/2	.045 - .052	-1 to - 7	1/8 to 3/8	.025 - .029	.053	.149	.207
110 - 149	3/8 to 2-13/16	.045 - .052	-8 to -14	3/8 to 3/4	.025 - .029	.086	.183	.245
210 - 247	3/4 to 4-5/8	.045 - .052	-15 to -27	3/4 to 1-1/2	.025 - .029	.119	.225	.304
325 - 349	1-1/2 to 4-1/2	.065 - .075	-28 to -52	1-1/2 to 4-1/2	.031 - .036	.183	.334	.424
425 - 460	4-1/2 to 15-1/2	.100 - .110	-53 to -88	4-1/2 to 15	.046 - .052	.236	.440	.579
MS28784 -1 to -25	1-5/8 to 4-5/8	.045 -.052	MS28783 -1 to -25	1-5/8 to 4-5/8	.025 - .029	.120	.225	

Note - Cross Section shown for MS28774. For MS28782, add .002.

Information provided by PAI, Inc.



PRESSURE SEALS, Inc. **310 Nutmeg Road South • South Windsor, CT 06074**

LUBRICATION OF O-RINGS AND PARTS FOR EASE IN ASSEMBLY

In assembling o-rings and components into a unit part, it is quite often necessary to lubricate the o-ring or seal in order to facilitate easy assembly. This is usually a temporary lubricant, since the liquid being sealed will generally provide lubrication when in operation. If the operating fluid does not provide sufficient lubricity, or if the seal is operating in a gas or a vacuum, it may be necessary to pre-lubricate the assembly for lower friction during operation. We have listed below, beside the dry type lubricants that we are able to furnish for most seals, a number of compatible lubricants used by government and industry which may help solve your assembly and operational lubrication problems.

COMMON COMPATIBLE LUBRICANTS FOR SEALS

BRAND NAME	TYPE	RECOMMENDED USE	SUITABLE BASE POLYMERS	TEMPERATURE RANGE Fahrenheit (Celsius)
Celvacene	Cellulose ester & castor oil	High vacuum to 1 x 10^{-7} Torr	Silicone, Nitrile Neoprene, Viton® Butyl, Hydrin	-40 to +266 (-40 to +130)
DC-33	Silicone Grease	Vacuum, Extreme Temperature, Heavy duty	Nitrile, Butyl Viton, Hydrin Neoprene. Do not use on Silicones or Fluoro-Silicone	-100 to +400 (-73 to +204)
DC-44	Silicone Grease	Same as above but lighter duty		-40 to +400 (-40 to +204)
DC-55 (MIL-G-4343)	Silicone	High vacuum, Extreme Temp. Lubricant		-65 to +400 (-54 to +204)
DC-200	Silicone Oil (200,000 cps)	Pneumatic use for High Pressure-High Speed	High durometer Nitrile, Neoprene Viton, Hydrin. Not for Silicones	-65 to +440 (-54 to +227)
MCS 352	Skydrol® Base Grease	Phosphate Ester Brake and Hydraulic Systems	Butyl SBR EPDM	-65 to +200 (-54 to +93)
Oxweld No. 64 Anti-Friction Compound	Fluorocarbon Base Compound	U-L Approved Assembly Oxygen Systems to 500 psi.	Nitrile EPDM Viton Butyl	0 to +250 (-19 to +121)
Petrolatum	Petroleum Base Grease	Petroleum Base Hydraulic Fluids Oil Systems	Nitrile, Acrylic Viton, Hydrin Fluoro-Silicones	-20 to +180 (-29 to +82)
Pre-Sil - Lube	Silicone Lubricant	Pneumatic, High Pressure & High Speed	Nitrile, Butyl EPDM, Viton, SBR Neoprene, Hydrin Urethane, Acrylic. Not for Silicones	-65 to +400 (-73 to +204)
Versilube	Silicone Grease	Pneumatic, 3,000 psi. – High Speed	Nitrile, Neoprene Viton, Acrylic. Do not use on Silicones	-100 to +400 (-73 to +204)

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