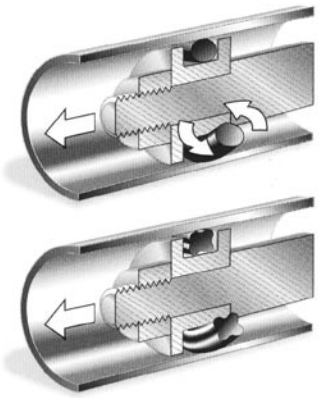
Avoiding Spiral Twist

To minimize breakaway friction, an O-Ring groove must be wide enough to allow rolling or twisting of the seal. In the long stroke of a reciprocating seal application, this twisting action can strain and eventually tear the rubber, causing a failure mode known as spiral twist.

To prevent spiral twist, the Quad-Ring® seal's four-lobed configuration is designed to withstand the distortion and extrusion often caused by high or pulsating pressure. To accommodate these forces, a Quad-Ring® seal uses a narrower groove than a comparable O-Ring seal.

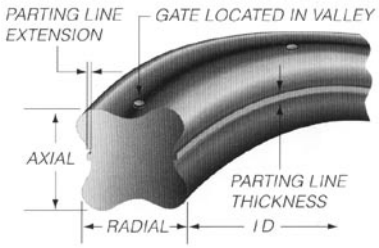


Longer Seal Life

Because less squeeze means less friction with the four-lobe design, seals last longer. This means equipment in which the Quad-Ring® seal is installed will operate longer and require less maintenance.

No Parting Line on Sealing Surface

Unlike O-Rings, where partitioning lines are on the sealing surface, Quad-Rings® seal's parting lines lie between the lobes, away from the sealing surface. This design eliminates the problems of leakage resulting from a parting line's irregular surface.



Groove Design: Quad-Ring Seals for Static and Non-Rotary Dynamic Applications

1. Cross-section

Select a Quad-Ring cross section size from the available standard sizes.

2. Clearance

Determine the maximum clearance present in your application. For a radial seal, subtract the minimum rod (shaft) diameter. For a face seal, subtract the distance between the sealing surface and the mating surface.

RING SIZE	CROSS-SECTION		DYNAMIC RECOMMENDED GLAND DEPTH "C"		STATIC RECOMMENDED GLAND DEPTH "C"		AXIAL GROOVE WIDTH "D"		GROOVE ECCENTRICITY (TIR)	
	(inches)	(mm)	(inches)	(mm)	(inches)	(mm)	+.005/-.000 (inches)	+.005/-.000 (mm)	(inches)	(mm)
Q4004-Q4050	.070 +/-.003	1.78 +/- 0.08	.061	1.55	.056	1.42	.080	2.03	.002	0.05
Q4102-Q4178	.103 +/-.003	2.62 +/ 0.08	.094	2.39	.089	2.26	.115	2.92	.002	0.05
Q4201-Q4284	.139 +/-.004	3.53 +/ 0.10	.128	3.25	.122	3.10	.155	3.94	.003	0.08
Q4309-Q4395	.210 +/-.005	5.33 +/ 0.13	.196	4.98	.188	4.78	.240	6.10	.004	0.10
Q4425-Q4475	.275 +/-.006	6.99 +/ 0.15	.256	6.50	.244	6.20	.310	7.87	.005	0.13

3. Check the Clearance

Determine if the clearance is acceptable for the application pressures and the material hardness being used. Standard-line products are made from materials having a hardness of 70 Shore A. If the clearance is unacceptable, component tolerance will have to be tightened, a harder material will have to be special ordered, or a back-up ring will have to be used.

4. Calculate Quad-Ring Groove Dimensions

Using the table above, determine the maximum recommended gland depth for your application. Then, calculate the Quad-Ring groove diameter as follows:

a. For a rod (shaft) seal:
Quad-Ring Groove Diameter = Min Shaft Diameter + (2 X Recommended Gland Depth)

b. For a bore (piston) seal:
Quad-Ring Groove Diameter = Max Bore Diameter – (2 X Recommended Gland Depth)

c. For a face seal:
Quad-Ring Groove Depth = Recommended Gland Depth – Application Clearance

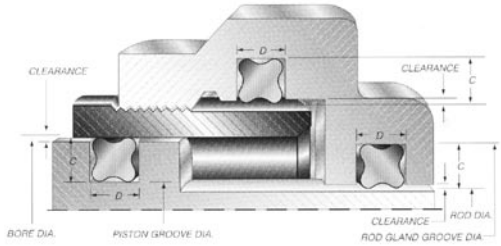
With a face seal, if the two surfaces to be sealed are in direct contact (such as with a cover), the seal groove depth is simply the Recommended Gland Depth.

5. Groove Width

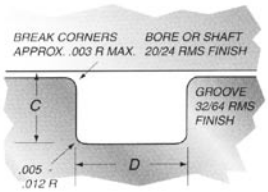
Refer to the table above to determine the groove width for the Quad-Ring cross-section size you have selected. If you are using a back-up ring in your application, increase the groove width by the maximum thickness of the back-up ring.

6. Percent Gland Fill

If the gland fill exceeds 100%, the groove will have to be redesigned. A good "rule of-thumb" is to not exceed about 90% gland fill.



7. Calculate the Seal Squeeze



The recommended gland values in the table above have been developed to create a proper range of squeeze for many applications involving oil, hydraulic fluid, or normal lubricants, providing component tolerances are sufficiently controlled. In applications involving high pressure, large component tolerances, the need for very low frictional forces, or other types of fluids, the seal and groove design should be verified through an acceptable method, such as testing or engineering analysis.

8. Select the Seal

If the bore or shaft size you are using is not listed, select the Quad-Ring with and inside diameter just smaller than the shaft you are using. If you are designing a face seal, select the Quad-Ring with and inside diameter which will position the Quad-Ring on the side of the groove opposite the pressure. Note: If the seal stretch is greater than 3% you may have to use the next size up.

9. Detail the Groove

Complete the groove design by specifying the proper radii and finish as indicated in the figure above.