Design Characteristics

Shaft & Bore Configurations

Shaft Material
Seals perform best on medium carbon steel or stainless steel shaft. Heat treatment or nitriding is especially recommended. To seal water at low surface velocities, stainless steel is more suitable.

The minimum hardness on the area where the sealing lip contacts the shaft should be 45 HRC. Where lubrication is doubtful, abrasive matter is present, or shaft speed is greater than 4 m/sec, 55 HRC is preferred.

The shaft must be machined to the surface roughness of Rt=l to 4 micrometers (Ra= 0.2 to 0.8 micrometers). In the areas of the contact surface, any rifling marks are not permitted.

Shaft Tolerance

Nominal Shaft Diameter	Tolerance
up to 4.000	+/- 0.003
over 4.000 to 6.000	+/- 0.004
over 6.000 to 10.000	+/- 0.005
over 10.000	+/- 0.006

Shaft Material and Hardness

Condition	Material	Hardness
General	Carbon steel (Heat treatment or nitriding is especially recommended)	45 HRC min.
For sealing Water with low surface velocity	Stainless steel	55 HRC min.

Configuration of the Bore

The leading corner of the bore should be chamfered and free of burrs. The inside corner of the bore should have a maximum radius of 0.047". The tolerance for the bore are shown below.

Bore Tolerance in inches

Bore diameter	Bore Tolerance
up to 3.000	+/- 0.001
3.001 to 6.000	+/- 0.0015
6.001 to 10.000	+/- 0.002
10.001 to 20.000	+/- 0.002/-0.004
20.001 to 40.000	+/- 0.002/-0.006
40.001 to 60.000	+/- 0.002/-0.010

Bore Material
Steel and cast iron provide a good surface for both rubber O.D. and metal O.D. seals. For soft alloy (aluminum) bore, seals with rubber O.D. provide better sealing capacity than metal O.D.

The table below shows the recommended maximum bore roughness

Bore I.D. Roughness	Maximum Roughness
Metal O.D.	10 microinches Ra
	2.50 microinches Ra
Rubber cover O.D.	150 microinches Ra
	3.75 microinches Ra

Shaft Eccentricity

Two types of shaft eccentricity effect seal performance. They are dynamic runout (double dynamic eccentricity) and offset (shaft to bore misalignment or static eccentricity).

The accompanying graphs show tolerance levels for each type.