1. The primary purpose is to retain lubricant in the assembly (prevent lubrication egress)
   The sealing lip should be positioned towards the lubricant.

2. The primary purpose is to exclude contamination (prevent contamination egress)
   The sealing lip should be facing the contamination.
Theory of Operation

- Radial lip seals are contact seals
- Performance depends on formation of hydrodynamic meniscus
- Meniscus is not always present
- Meniscus formation dependant on several factors:
  - Shaft Finish
  - Shaft Hardness
  - Lubricant Properties
  - Lip Geometry
  - Lip Load
- Seal only acts on one side
**Seal Orientation**

**LUBRICANT RETENTION**
- Oil or grease lubricant
- Clean environment

**CONTAMINATION EXCLUSION**
- Seal lubrication still required
- Grease packed bearing

**RETENTION & EXCLUSION**
- Grease purge for heavily contaminated environments
- Common in steel mills
There are three primary classes of oil seals used in industries

1. **Bonded**
   Bonded seals contain a chemical bond (adhesive) between the elastomer sealing element and the metal OD shell. Bonded seals are supplied with or without a garter spring that sits in a groove on the sealing lip.

2. **Assembled**
   Assembled seal designs produced by Garlock KLOZURE® mechanically integrate the elastomer sealing element in a metallic case with a molded-in or mechanically retained spring.

3. **Molded**
   Molded seal designs produced by Garlock KLOZURE® introduce a composite or metallic OD reinforcement to the seal OD and supply a molded-in spring to eliminate concerns of “spring dumping”
**Assembled vs. Bonded Seal Lip seal**

**Assembled & Molded**
- Heavy Duty - Robust Construction
- Installation Friendly
- Tolerant of Equipment Variation
- Engineered Mill-Right® Material Technology

**Bonded**
- Potential for garter spring “dumping”
- Often found in OEM applications and replaced with assembled seal designs
Assembled Seal Construction: Model 64°
Garlock Klozure oil seal material

Garlock Oil Seal Available in below lip materials

- NBR
- HNBR
- FKM
- MILL-RIGHT® N
- MILL-RIGHT® ES
- MILL-RIGHT® V
- GYLON®

MILL-RIGHT materials has been specifically engineered to have the highest abrasion resistance and lowest wear of any seal in the industry. This translates directly to higher equipment efficiencies, longer bearing life, increased production and....well...less maintenance.
Seal life performance Parameters

Seal selection and Effective sealing life depends on below parameters

• Shaft Finish/Roughness ... (0.25 – 0.50 μm Ra)
• Shaft Hardness ... (min. 30 HRC )
• Shaft to Bore misalignment
• Shaft run-out
• Shaft and Bore Tolerances
• Pressure ... (0.48 bar max.)
• Temperatures
• Media
• Application
• Speed
• pxv ratio

Housing Bore Tolerances for Oil Seals

<table>
<thead>
<tr>
<th>Housing Bore Diameter (Nominal)</th>
<th>Recommended Bore Diameter Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>mm</td>
</tr>
<tr>
<td>Thru 1.000</td>
<td>25.41</td>
</tr>
<tr>
<td>1.001 - 3.000</td>
<td>25.41 - 76.20</td>
</tr>
<tr>
<td>3.001 - 4.000</td>
<td>76.21 - 101.60</td>
</tr>
<tr>
<td>4.001 - 4.375</td>
<td>101.61 - 111.13</td>
</tr>
<tr>
<td>4.376 - 6.000</td>
<td>111.14 - 152.40</td>
</tr>
<tr>
<td>6.001 - 7.000</td>
<td>152.41 - 177.80</td>
</tr>
<tr>
<td>7.001 - 8.000</td>
<td>177.81 - 203.20</td>
</tr>
<tr>
<td>8.001 - 9.000</td>
<td>203.21 - 228.60</td>
</tr>
<tr>
<td>9.001 - 10.000</td>
<td>228.61 - 254.00</td>
</tr>
<tr>
<td>10.001 - 11.000</td>
<td>254.01 - 508.00</td>
</tr>
<tr>
<td>20.001 - 30.000</td>
<td>508.01 - 762.00</td>
</tr>
<tr>
<td>30.001 - 40.000</td>
<td>762.01 - 1016.00</td>
</tr>
<tr>
<td>40.001 - 60.000</td>
<td>1016.01 - 1524.00</td>
</tr>
</tbody>
</table>

Shaft Diameter Tolerances for Oil Seals

<table>
<thead>
<tr>
<th>Shaft Diameter</th>
<th>Recommended Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>mm</td>
</tr>
<tr>
<td>Up thru 4.000</td>
<td>Up thru 101.60</td>
</tr>
<tr>
<td>4.001 - 6.000</td>
<td>101.61 - 152.40</td>
</tr>
<tr>
<td>6.001 - 10.000</td>
<td>152.41 - 254.00</td>
</tr>
<tr>
<td>10.001 &amp; Up</td>
<td>254.01 &amp; Up</td>
</tr>
</tbody>
</table>
Key points

• Heavy duty Robust construction
• Engineered MILL-RIGHT® Material Technology
• High abrasion resistance
• Spring molded in lip
• Finger Spring design
• Aggressive shaft-to-bore misalignment capability
• High speed capability
• Better Coefficient of friction
• Available in different lip configurations
• Available in split type...easy to install
• Better life