## LIP MATERIAL

One of the most important components of the seal is the elastomer material. Freudenberg-NOK has specially developed elastomer blends to meet a wide variety of sealing requirements. Available are many classes of materials with over 100 individual formulas to satisfy various sealing conditions. Table 10 and Table 11 provide general information and fluid compatibility ratings.

### TABLE 10 GENERAL ELASTOMER INFORMATION

| BASE POLYMER | NITRILE | POLYACRYLATE | SILICONE | FLUOROELASTOMER |
|---|---|---|---|---|
| TEMPERATURE* RANGE | -50°F ~ 250°F<br>-45°C ~ 125°C | -20°F ~ 300°F<br>-30°C ~ 150°C | -80°F ~ 400°F<br>-60°C ~ 200°C | -30°F ~ 400°F<br>-35°C ~ 200°C |
| Oil Resistance | ● | ● | ■ | ● |
| Acid Resistance | ■ | ▲ | ▲ | ▲ |
| Alkali Resistance | ■ | ❖ | ❖ | ▲ |
| Water Resistance | ■ | ▲ | ■ | ■ |
| Heat Resistance | ■ | ● | ● | ● |
| Cold Resistance | ■ | ▲ | ■ | ▲ |
| Wear Resistance | ● | ● | ■ | ● |
| Ozone Resistance | ■ | ● | ● | ● |

| | ADVANTAGES | DISADVANTAGES |
|---|---|---|
| NITRILE | • Commonly referred to as Buna-N and is Copolymer of Butadiene and Acryonitrile<br>• Low cost<br>• Good resistance to petroleum oils, water, silicone oils, greases, glycol base fluids<br>• Good abrasion resistance, cold flow, tear resistance | • Poor resistance to ozone and weather aging |
| POLYACRYLATE | • Polymerised acrylic acidesters<br>• Good resistance to mineral oils, hypoid gear oils, E.P. additives, greases, aging and flex cracking<br>• Higher temperature limit than Nitrile | • Fair cold temperature limit<br>• Lower mechanical strength<br>• Costs slightly higher than Nitrile<br>• Poor dry running ability, water resistant |
| SILICONE | • Broad temperature range<br>• Good ozone resistance<br>• Resistant to compression set | • Low resistance to hydrocarbon fluids like gasoline or paraffin fluids or steam above 50 psi<br>• Cost is higher than Polyacrylate |
| FLUOROELASTOMER | • Good temperature resistance<br>• Compatible with wide range of fluids<br>• Commonly chosen as high temperature replacement for Nitrile or Polyacrylate | • Fair resistance to water, dry running<br>• Low temperature resistance is fair<br>• Cost is high |

* Maximum temperature limits dependent on other operating conditions.

1. ● Very good.
   ■ Good for most applications.
   ▲ Fair, can be used if no other materials available but otherwise not recommended.
   ❖ Not recommended
2. Phosphate Ester and Water Glycol hydraulic fluids are not included in the Table.
3. Water resistance includes steam. No material is ideally compatible as lubricity of water is very poor.
4. PTFE, Ethylene Acrylate, and other elastomers are available.

## TABLE 11 **FLUID COMPATIBILITY**

| TYPE OF FLUID TO BE SEALED | | LIP MATERIAL | | | |
|---|---|---|---|---|---|
| | | NITRILE | POLYACRYLATE | SILICONE | FLUOROELASTOMER |
| Engine Oil | SAE 30 Wt. | ● | ● | ● | ● |
| | SAE 10 Wt. | ● | ● | ■ | ● |
| Gear Oil | Super Gear | ● | ● | ▲ | ● |
| | Hypoid Gear | ■ | ■ | ❖ | ● |
| Turbine Oil No. 2 | | ■ | ■ | ■ | ● |
| Machine Oil No. 2 | | ■ | ■ | ▲ | ● |
| Automatic Transmission Fluid | | ● | ● | ▲ | ● |
| Petroleum Base Lubricating Oil | | ● | ● | ▲ | ● |
| Gasoline | | ▲* | ❖ | ❖ | ● |
| Light Oil/Kerosene | | ▲ | ❖ | ❖ | ■ |
| Cutting Oil | | ● | ■ | ▲ | ● |
| Grease | | ● | ● | ● | ● |
| E.P. Lubricants | | ■ | ● | ❖ | ● |
| Water-Glycol | | ● | ❖ | ■ | ▲ |
| Alcohol | | ● | ❖ | ■ | ▲ |
| 20% Hydrochloric Acid Solution | | ▲ | ▲ | ▲ | ● |
| 30% Sulfuric Acid Solution | | ▲ | ▲ | ❖ | ● |

* Special compound available.

1. ● Very good.
   ■ Good for most applications.
   ▲ Fair, can be used if no other materials available but otherwise not recommended.
   ❖ Not recommended

## METAL CASE AND SPRING

The other major components of a seal are the metal case and garter spring. Table 12 lists the material specification Freudenberg-NOK uses for its components.

## TABLE 12 **CASE AND SPRING SPECIFICATION**

| CASE | |
|---|---|
| SAE NO. | APPLICATION |
| 1008 ~ 1010 | General |
| 30302 ~ 30304 | Special Corrosion Resistance Condition |

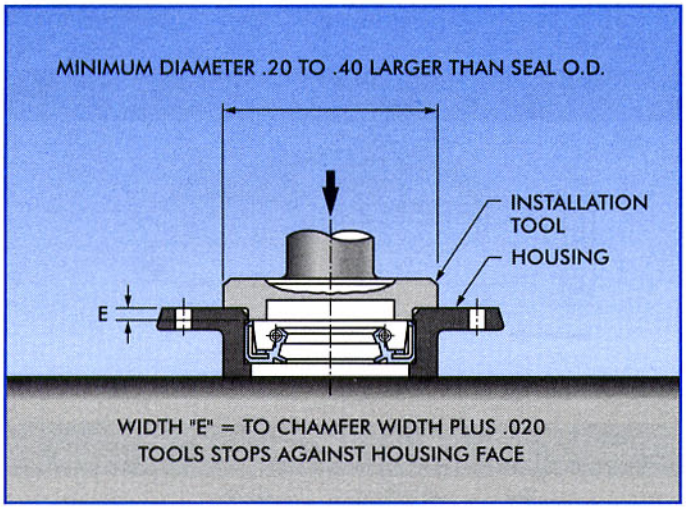
| SPRING | |
|---|---|
| ASTM OR SAE NO. | APPLICATION |
| A228 ~ A227 | General |
| 30302 ~ 30304 | Special Corrosion Resistance Condition |

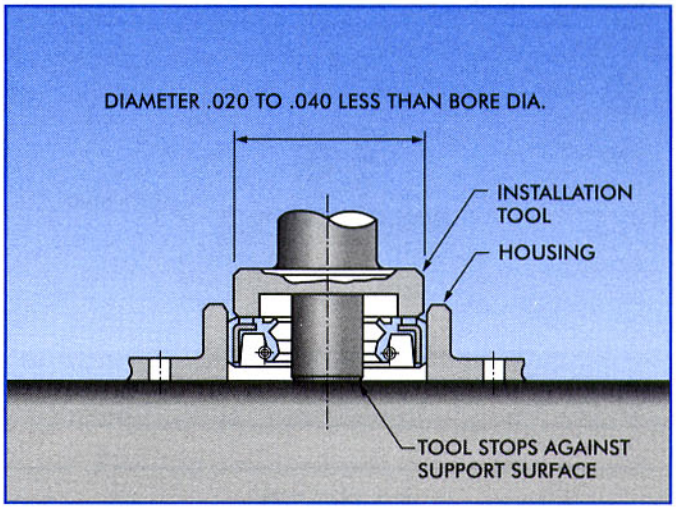
The metal case is produced from carbon steel for general applications in oil or grease. For special applications when sealing sea water or corrosive fluids or gasses, stainless steel can be applied at an increase in price. With water applications, cost may be reduced by using a rubber covered design with carbon steel case. For the garter spring, piano wire is used for general applications. Where corrosion resistance or extreme heat resistance is required, stainless steel is available.

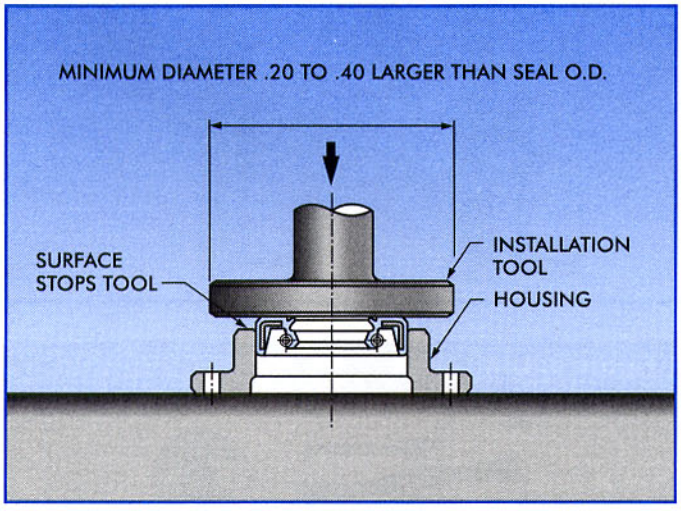
# OIL SEAL INSTALLATION PROCEDURES

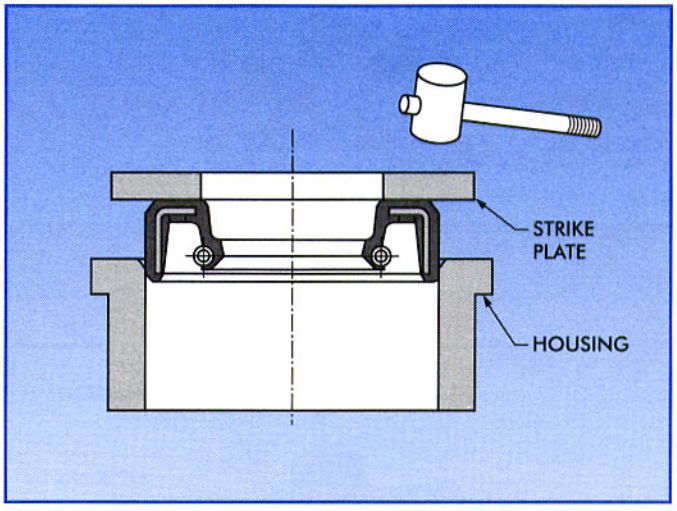
The subject of installation represents an area commonly overlooked when selecting an oil seal for an application. Studies have shown this area to be one of the major causes of premature seal failure. To assist the installation, the seal should be prelubricated with grease or oil to reduce sliding friction of contact surfaces. This will also help protect the seal lips during initial run-in. An installation tool should always be used when installing an oil seal. The use of a tool improves ease of installation and reduces the possibility of seal cocking (non-perpendicular to shaft). A hydraulic or pneumatic press is advised to supply necessary force to install the seal. Following are examples of both recommended and improper installation methods.

## ACCEPTABLE METHOD



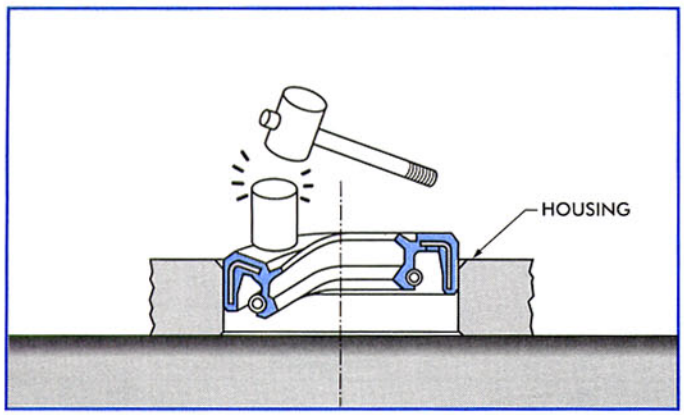



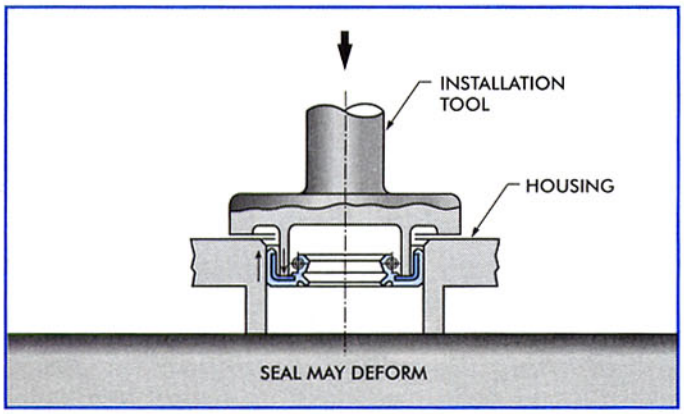



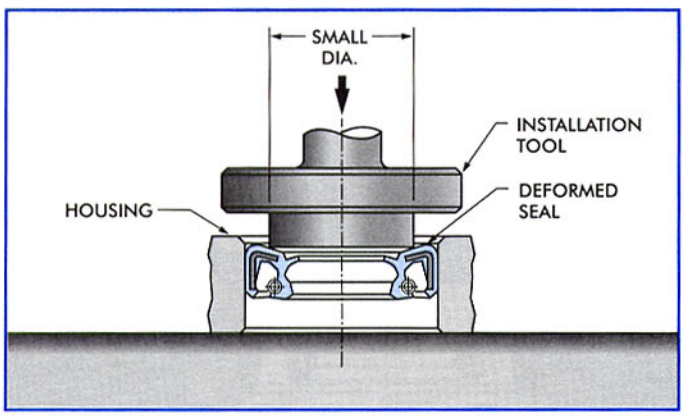



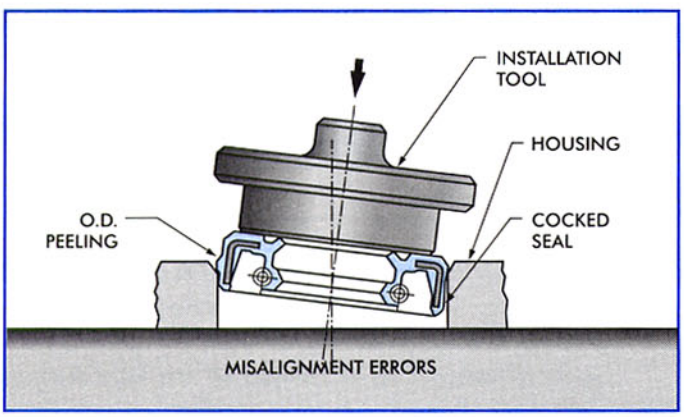

In each preferred method, installation load is absorbed by either housing or bottom plate to prevent seal damage and to assist in locating the seal properly within the bore.

## IMPROPER METHOD




## SHAFT INSTALLATION

The advisable sequence of installation is to install the seal over the shaft and then into the housing bore. Care should be exercised not to damage or deform the seal lip. The proper chamfer angle will minimize this problem. When installing over a keyway or spine, a sleeve or bullet should be employed to protect the seal lip from cuts (reference figure 6).

Where the shaft must be installed through the seal, centering guides for the shaft will prevent lip deformation and dislodging of the spring. When possible, the shaft should be rotated as it passes through the seal to reduce sliding friction.

**Figure 6. Seal Installation Over Shaft Splines**

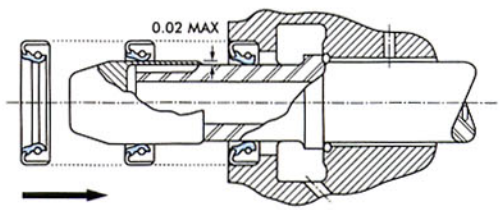



**Figure 7. Heavy Weight Housing**

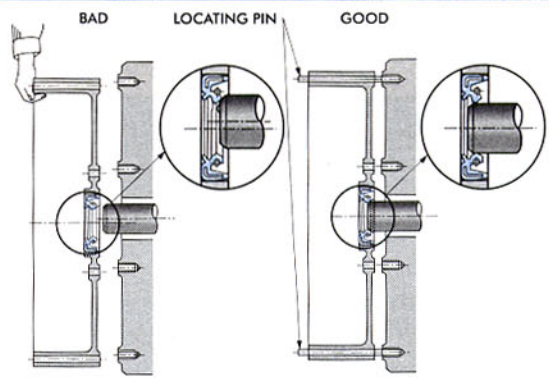



**Figure 8. Long Shaft**