

6. MATERIAL SELECTION

The most important component of the oil seal is the elastomer material. It must consider about the environmental conditions and the function of the seal as follows:

- Good chemical resistance
- Good resistance to heat and low temperature
- Good resistance to ozone and weathering

- High resistance to water
- Low compression set
- Good elasticity
- Raw material cost

In order to satisfy various sealing conditions, MFC has many compounds available for your choice.

TABLE 6. GENERAL ELASTOMER INFORMATION

BASE POLYMER	NITRILE	POLYACRYLATE	SILICONE	FLUROELASTOMER
Material Code	A	P	S	F
Temperature* Range	-40°F ~ 250°F -35°C ~ 120°C	-20°F ~ 300°F -30°C ~ 150°C	-80°F ~ 400°F -60°C ~ 200°C	-30°F ~ 400°F -35°C ~ 200°C
Oil Resistance	●	●	●	●
Acid Resistance	○	○	○	●
Alkali Resistance	○	x	x	○
Water Resistance	●	○	●	●
Heat Resistance	○	●	●	●
Cold Resistance	○	○	●	○
Wear Resistance	●	●	○	●
Ozone Resistance	○	●	●	●

	Advantages:	Disadvantages:
NITRILE	<ul style="list-style-type: none"> ● Commonly referred to as Buna-N or NBR and is copolymer of Butadiene and Acrylonitrile. ● Low cost. ● Good resistance to petroleum oils, water silicone oils, greases, glycol base fluids. ● Good abrasion resistance, cold flow, tear resistance. 	<ul style="list-style-type: none"> ● Poor resistance to ozone and weather aging.
POLYACRYLATE	<ul style="list-style-type: none"> ● Polymerised acrylic acidesters or PA and ACM. ● Good resistance to mineral oils, hypoid gear oils E.P. additives, greases, aging and flex cracking. ● Higher temperature limit than Nitrile. 	<ul style="list-style-type: none"> ● Poor cold temperature limit, dry running ability, water resistance. ● Lower mechanical strength. ● Cost slightly higher than Nitrile.
FLUROELASTMER	<ul style="list-style-type: none"> ● Good temperature resistance. ● Compatible with wide range of fluids. ● Commonly chosen as high temperature replacement for Nitrile or Polyacrylate . 	<ul style="list-style-type: none"> ● Fair resistance to water, day running. ● Low temperature resistance is fair. ● Cost is high.
SILICONE	<ul style="list-style-type: none"> ● Broad temperature range. ● Good ozone resistance. ● Resistant to compression set. 	<ul style="list-style-type: none"> ● Low resistance to hydrocarbon fluids like gasoline or paraffin fluids or steam above to 50 psi. ● Cost is higher than Polyacrylate.

1. ● Very good.
 - Good for most applications.
 - Fair, can be used if no other materials available but otherwise not recommended.
 - x 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 7. FLUID COMPATIBILITY

TYPE OF FLUID TO BE SEALED	LIP MATERIAL			
	NITRILE	POLYACRYLATE	SILICONE	FLUOROELASTOMER
Engine Oil	●	●	⊙	●
Gear Oil	⊙	⊙	x	●
Turbine Oil No. 2	⊙	⊙	⊙	●
Machine Oil No. 2	⊙	⊙	○	●
Automatic Transmission Fluid	●	●	○	●
Petroleum Base Lubricating Oil	●	●	○	●
Gasoline	○	x	x	●
Light Oil/Kerosene	○	x	x	⊙
Cutting Oil	●	⊙	○	●
Grease	●	●	●	●
E.P. Lubricants	⊙	●	x	●
Water-Glycol	●	x	⊙	⊙
Alcohol	●	x	⊙	○
20% Hydrochloric Acid Solution	○	○	○	●
30% Sulfuric Acid Solution	○	○	x	●

*Special Compound Available

- Very Good.
- ⊙ Good for most applications.
- Fair, can be used if no other materials available but otherwise not recommended.
- x Not recommended.

6.2 METAL CASE AND SPRING

The other major components of an oil seal are the metal case and garter spring. Table 8 lists the material specification MFC uses for its components.

TABLE 8. CASE AND SPRING SPECIFICATION

CASE				
SAE NO.	AISI NO.	APPLICATION	COST	SUGGESTION
1008 ~ 1010	1008 ~ 1010	GENERAL	Low	
SAE 30304.	304	Special corrosion. Resistance condition	High	By using a fully rubber covered design with carbon steel case can reduce cost.
SPRING				
SAE NO.	AISI NO.	APPLICATION	COST	
1070 ~ 1080	1070 ~ 1080	GENERAL	Low	
30304	304	Special corrosion Resistance condition	High	
C521OR	C5210	Special corrosion & aging resistance	Higher	

The metal case generally is produced from carbon steel for general applications in oil or grease. For special applications when sealing sea water or corrosive fluids or gases, 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.