O-ring Compounds

Compound Properties							
	Compounds						
Property	**Nitrile**	**EPDM**	**Neoprene**	**Silicone**	**Viton®**	**Polyurethane**	**Fluorosilicone**
Abrasion Resistance	G	GE	G	P	G	E	P
Acid Resistance	F	G	FG	FG	E	P	FG
Chemical Resistance	FG	E	FG	GE	E	FG	E
Cold Resistance	G	GE	FG	E	PF	G	GE
Dynamic Properties	GE	GE	F	P	GE	E	P
Electrical Properties	F	G	F	E	F	FG	E
Flame Resistance	P	P	G	F	E	P	G
Heat Resistance	G	E	G	E	E	F	E
Impermeability	G	G	G	P	G	G	P
Oil Resistance	E	P	FG	FG	E	G	G
Ozone Resistance	P	E	GE	E	E	E	E
Set Resistance	GE	GE	F	GE	GE	F	GE
Tear Resistance	FG	GE	FG	P	F	GE	P
Tensile Strength	GE	GE	G	P	GE	E	F
Water Resistance	FG	E	F	F	FG	P	F
Weather Resistance	F	E	E	E	E	E	E

E = Excellent G = Good F = Fair P = Poor
Materials are listed in order of least to most expensive.

Nitrile (Buna-N, NBR)
Nitrile rubber is the general term for acrylonitrile butadiene terpolymer. The acrylonitrile content of nitrile sealing compounds varies considerably, 18 to 50 percent, and influences the physical properties of the finished material. The higher the acrylonitrile content, the better the resistance to oil and fuel. At the same time, elasticity and resistance to compression set is adversely affected. In view of these opposing realities, a compromise is often drawn, and a medium acrylonitrile content selected. Nitrile has good mechanical properties when compared with other elastomers and high wear resistance. Nitrile is not resistant to weathering and ozone.

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Heat resistance - Up to 212°F (100°C) with shorter life at 250°F (121°C).

Cold flexibility - Depending on individual compound, between –30°F & –70°F (–34°C & –57°C).

Chemical resistance

- Aliphatic hydrocarbons (propane, butane, petroleum oil, mineral oil and grease, diesel fuel, fuel oils) vegetable and mineral oils and greases
- HFA, HFB and HFC fluids
- Dilute acids, alkali and salt solutions at low temperatures
- Water (special compounds up to 212°F (100°C)).

Not compatible with:

- Fuels of high aromatic content (for flex fuels a special compound must be used)
- Aromatic hydrocarbons (benzene)
- Chlorinated hydrocarbons (trichlorethylene)
- Polar solvents (ketone, acetone, acetic acid, ethyleneester)
- Strong acids
- Brake fluid with glycol base
- Ozone, weather and atmospheric aging.

EPDM (Ethylene Propylene, EPM)
EPM is a copolymer of ethylene and propylene. Ethylenepropylene-diene rubber (EPDM) is produced using a third monomer and is particularly useful when sealing phosphate-ester hydraulic fluids and in brake systems that use fluids having a glycol base.

Heat resistance - Up to 300°F (149°C) (max. 400°F (204°C) in water and/or steam).

Cold flexibility - Down to approximately –70°F (–57°C).

Chemical resistance

- Hot water and steam up to 300°F (149°C) with special compounds up to 400°F (204°C)
- Glycol based brake fluids up to 300°F (149°C)
- Many organic and inorganic acids
- Cleaning agents, soda and potassium alkalis
- Phosphate-ester based hydraulic fluids (HFD-R)
- Silicone oil and grease
- Many polar solvents (alcohols, ketones, esters)
- Ozone, aging and weather resistant.

Not compatible with - Mineral oil products (oils, greases, and fuels).

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Neoprene (Chloroprene, CR)
Neoprene was the first synthetic rubber developed commercially and exhibits generally good ozone, aging and chemical resistance. It has good mechanical properties over a wide temperature range.

Heat resistance - Up to approximately 250°F (121°C).

Cold flexibility - Down to approximately –40°F (–40°C).

Chemical resistance

- Paraffin base mineral oil with low DPI, e.g. ASTM oil No. 1
- Silicone oil and grease
- Water and water solvents at low temperatures
- Refrigerants
- Ammonia
- Carbon dioxide
- Improved ozone, weathering and aging resistance compared with nitrile rubber.

Limited compatibility

- Naphthalene based mineral oil (IRM 902 and IRM 903 oils)
- Low molecular aliphatic hydrocarbons (propane, butane, fuel)
- Glycol based brake fluids.

Not compatible with:

- Aromatic hydrocarbons (benzene)
- Chlorinated hydrocarbons (trichloroethylene)
- Polar solvents (ketones, esters, ethers, acetones).

Silicone (VMQ)
The term silicone covers a large group of materials in which vinyl-methyl-silicone (VMQ) is often the central ingredient. Silicone elastomers as a group have relatively low tensile strength, poor tear and wear resistance. However, they have many useful properties as well. Silicones have good heat resistance up to 400°F (205°C), good cold flexibility down to –75°F (–59°C) and good ozone and weather resistance as well as good insulating and physiologically neutral properties.

Heat resistance - Up to approximately 400°F (205°C) (special compounds up to 450°F (232°C)).

Cold flexibility - Down to approximately –75°F to –65°F (–59°C to –54°C) with special compounds down to –175°F (–115°C).

O-ring Compounds

Chemical resistance

- Engine and transmission oil (e.g.: ASTM oil No.1)
- Animal and vegetable oil and grease
- Brake fluid (non-petroleum base)
- Fire-resistant hydraulic fluid, HFD-R and HFD-S
- High molecular weight chlorinated aromatic hydrocarbons (including flame-resistant insulators, and coolant for transformers)
- Moderate water resistance
- Diluted salt solutions
- Ozone, aging and weather resistant.

Not compatible with:

- Superheated water steam over 250°F (121°C)
- Acids and alkalis
- Low molecular weight chlorinated hydrocarbons (trichloroethylene)
- Aromatic mineral oil
- Hydrocarbon based fuels
- Aromatic hydrocarbons (benzene, toluene).

Viton® (Fluorocarbon, FKM)
Fluorocarbon rubber has excellent resistance to high temperatures, ozone, oxygen, mineral oil, synthetic hydraulic fluids, fuels, aromatics and many organic solvents and chemicals. Low temperature resistance is normally not favorable and for static applications is limited to approximately –15°F (–26°C) although in certain situations it is suitable down to –40°F (–40°C). Under dynamic conditions, the lowest service temperature is between 5°F and 0°F (–15°C and –18°C). Gas permeability is very low and similar to that of butyl rubber. Special fluorocarbon compounds exhibit an improved resistance to acids, fuels, water and steam.

Heat resistance - Up to 400°F (204°C) and higher temperatures with shorter life expectancy.

Cold flexibility - Down to –15°F (–26°C) (some to –40°F (–40°C)).

Chemical resistance

- Mineral oil and grease, low swelling in ASTM oil No. 1, and IRM 902 and IRM 903 oils
- Non-flammable hydraulic fuels in the group HFD
- Silicone oil and grease
- Mineral and vegetable oil and grease
- Aliphatic hydrocarbons (fuel, butane, propane, natural gas)
- Aromatic hydrocarbons (benzene, toluene)
- Chlorinated hydrocarbons (trichlorethylene and carbon tetrachloride)
- Fuels, also fuels with methanol content
- High vacuum
- Very good ozone, weather and aging resistance.

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Not compatible with:

- Glycol based brake fluids.
- Ammonia gas, amines, alkalis
- Superheated steam
- Low molecular organic acids (formic and acetic acids).

Polyurethane (AU, EU)
One must differentiate between polyester urethane (AU) and polyether urethane (EU). AU type urethanes exhibit better resistance to hydraulic fluids. Polyurethane elastomers, as a class, have excellent wear resistance, high tensile strength and high elasticity in comparison with any other elastomers. Permeability is good and comparable with butyl rubber.

Heat resistance - Up to approximately 180°F (82°C).

Cold flexibility - Down to approximately –40°F (–40°C).

Chemical resistance

- Pure aliphatic hydrocarbons (propane, butane, fuel)
- Mineral oil and grease
- Silicone oil and grease
- Water up to 125°F (50°C) (EU type)
- Ozone and aging resistant.

Not compatible with:

- Ketones, esters, ethers, alcohols, glycols
- Hot water, steam, alkalis, amines, acids.

Fluorosilicone (FVMQ)
Fluorosilicone rubber contains trifluoro propyl groups next to the methyl groups. The mechanical and physical properties are very similar to silicone rubber. However, Fluorosilicone offers improved fuel & mineral oil resistance but poor hot air resistance when compared with silicone.

Heat resistance - Up to 350°F (177°C) max.

Cold flexibility - Down to approximately –100°F (–73°C).

Chemical resistance

- Aromatic mineral oils (IRM 903 oil)
- Fuels
- Low molecular weight aromatic hydrocarbons (benzene, toluene).