ELASTOMER GUIDE

HIGH PERFORMANCE MATERIALS FOR OIL FIELD SEALS

Double E manufactures a variety of custom molded rubber seals for the oil and gas industry. We have the resources in-house to design, engineer, and mold custom rubber products to your exact specifications. This guide will assist you in choosing the appropriate elastomer for your sealing application. Figure 1 identifies Double E's most popular compounds.

Popular Elastomers

The following four elastomers are the most common in oil field applications. Variations in mechanical properties and seal performance exist among the compounds of a given elastomer, so price and suitability can vary.

Nitrile

Nitrile is the standard to which all the other elastomers are compared. Nitrile compounds are copolymers of acrylonitrile and butadiene.

Acrylonitrile provides resistance to petroleum based fluids such as oils and fuels, while butadiene contributes low-temperature flexibility. Standard nitrile is also known as Buna N rubber. Because they are versatile and inexpensive, nitriles are the most popular industrial seal material.

Nitrile compounds provide excellent service with gasoline, crude oil, power steering fluid, hexane, toluene, water, water-based hydraulic fluids, and dilute bases such as sodium hydroxide. Because nitriles contain unsaturated carbon-carbon bonds in the base polymer, they are not suitable for exposure to ozone, sunlight, and weathering. More than 50% of sealing needs can be met using nitrile.

Individual nitrile compounds have service temperatures within the range from -65 to + 250° F, including certain compounds formulated for lower temperatures.

Fluorocarbon

Fluorocarbon elastomers command a substantial share of the seal market. Fluorocarbons withstand a very broad spectrum of chemicals over a temperature range second only to that of silicone compounds.

Fluorocarbons are commonly rated for continuous service temperatures from -20 to + 400°F, with intermittent exposures as high as 500°F.

In spite of their higher cost, fluorocarbons have replaced nitriles in many applications because of their superior resistance to compression set, high temperature, and a wide range of chemicals.

Fluorocarbon compounds have service temperatures from -20 to + 450°F.

FIGURE 1

POPULAR COMPOUNDS

Material Type	Recommended Temperature Range	Double E Compounds
Nitrile (NBR)	-30 to 200ºF	R1A, R1B, R1C, R1D, R1E, R1F
Hydrogenated Nitrile (HNBR)	-30 to 300ºF	R5AA, R5AG, R5W
Fluorocarbon (FKM)	-15 to 450ºF	R5T, R5U
Aflas (TFE/P)	40 to 400ºF	R5AJ

Hydrogenated Nitrile

Hydrogenated Nitrile (HNBR), like conventional nitrile, is made from acrylonitrile and butadiene monomers. After polymerization, a carbon-carbon double bond from the butadiene molecule is still present in the backbone of the nitrile polymer. These regions of unsaturation make the base polymer susceptible to uncontrolled cross-linking by heat, ozone, hydrogen sulfide, sour crude and other oxidizing agents. Degradation of ordinary nitriles includes increased hardness, loss in elongation and tensile strength, and surface cracking. This weakness in the nitrile polymer can be eliminated by saturating (reacting with hydrogen) the remaining carbon-carbon double bond. Hydrogenated nitriles significantly outperform conventional nitriles in resisting heat and sour crude oil.

HNBR compounds have a service range of -40 to + 325° F. They are recommended when upgrading from nitriles or as an economical alternative to more expensive fluorocarbon elastomers.

Aflas®

Aflas® is a trade name for tetrafluoroethylene propylene copolymer. Aflas® compounds have almost universal resistance to both acids and bases, steam, acid gases, crude oil and many types of corrosion inhibitors. Serviceability extends to 400° F for long-term exposure. With combined resistance to corrosion inhibitors and heat, Aflas® seals are able to resist the extremes of heat and pressure present in aggressive downhole oil well environments. Aflas® seals have very low rates of gas permeation and are highly resistant to explosive decompression, making them excellent choices for downhole packing elements.

Aflas® compounds have service temperatures from -10 to + 400° F.