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To: General Release
cc:

From: Engineering
Date: 7-Dec-06, revised 28-Jan-08,
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RE: General Comparison of FKM (Viton), FEPM (AFLAS) and FFKM (Kalrez)

Comparison of three fluoroelastomers: Fluorocarbon (FKM, a.k.a. Viton), Tetrafluoroethylene-Propylene (FEPM, a.k.a. AFLAS) and Perfluoroelastome (FFKM, a.k.a. Kalrez)

Description:

Fluorocarbon / FKM (DuPont Viton™) is a synthetic rubber used as an elastomeric compound for seals and gaskets. FKM is comprised of several copolymers depending on the grade. The copolymers include hexafluoropropylene (HFP), vinylidene fluoride (VDF), terpolymers of tetrafluoroethylene (TFE), hexafluoropropylene (HFP) and perfluoromethylvinylether (PMVE). Because of the wide array of copolymers and variances in the quality of the base components, FKM characteristics can vary significantly from manufacturer to manufacturer, even location to location.

Tetrafluoroethylene-Propylene / FEPM (Asahi Glass Co. Ltd AFLAS) like FKM, is an elastomeric compound made from copolymers. However, FEPM differs from FKM in composition as different copolymers are used: tetrafluoroethylene and propylene alternating copolymer. These copolymers give FEPM higher operating temperatures and improved chemical compatibility. Additionally, with a more limited range of starting copolymers, the consistent quality of FEPM material can be assured.

Perfluoroelastomer / FFKM (DuPoint Kalrez™) is an amorphous material sharing much of the compatibility and application of a crystalline PTFE / Teflon seal, but unlike Teflon is a flexible and resilient elastomeric compound.

It should be noted that without detailed knowledge of the chemical, temperature and pressure conditions an elastomer will be exposed to, it is impossible to predict the behavior of the elastomer prior to installation in a specific application.

Temperature Range:

FKM / Viton -26 °C to 204 °C [-15 °F to 400 °F]
FEPM / AFLAS -4 °C to 232 °C [25 °F to 450 °F]
FFKM / Kalrez -18 °C to 232 °C [0 °F to 450 °F]

AFLAS loses flexibility at temperatures lower than -4 °C. Viton remains flexible to -26 °C. AFLAS, however, has higher maximum operating temperatures, 232 °C compared to 204 °C for Viton. The values stated for

Kalrez can vary, depending on compound, to a minimum of -26 °C [-18 °F] up to 300 °C [572 °F]

Chemical Compatibility:

Although FKM is incompatible with hydrogen sulphide, it is compatible with sour gas and sour crude oil. Additionally, FKM should not be used with glycol based fluids, ammonia gas, amines, alkalis, superheated steam or organic acids like formic or acetic acid.

FEPM is compatible with hydrogen sulphide, and natural gas. Unlike FKM, FEPM can also be used with amines, steam, as well as bases, phosphate esters, engine oils, as well as pulp & paper liquors. FEPM is not suitable for use with aromatic fuels (i.e. benzene, toluene or xylene), ketones or carbon tetrachloride.

FFKM is also compatible with hydrogen sulphide and natural gas, and most other. Kalrez is contraindicated for fluorinated refrigerants, such as R11, R12 and so on.

Cost

The following is a relative cost comparison based solely on the pressure/vacuum seal in the Hawkeye Marshhawk thief hatch

FKM / Viton: \$
FEPM / AFLAS: \$\$
FFKM / Kalrez: \$

Kalrez is significantly more expensive, on the order of 40 to 50 times, than Viton or Aflas offerings

References

Parker O-Ring handbook, 2001
<http://www.parker.com/o-ring>

Asahi Glass Co. Ltd
<http://www.agc.co.jp/english/chemicals/gomu/aflas.htm>

DuPont Performance Elastomers
<http://www.dupontelastomers.com/Products/Viton/techInfo.asp>

DuPont Performance Elastomers
<http://www.dupontelastomers.com/Products/Kalrez/techInfo.asp>