V76I

Precision Polymer Engineering

Fluorosurfactant-free chemically resistant fluoroelastomer

V76I is a fluoro-surfactant free alternative to V76F, a PPE grade recommended for high performance sealing applications in aggressive industrial environments. It provides outstanding resistance to solvents, fuels, hot water and steam (above 150°C/302°F).

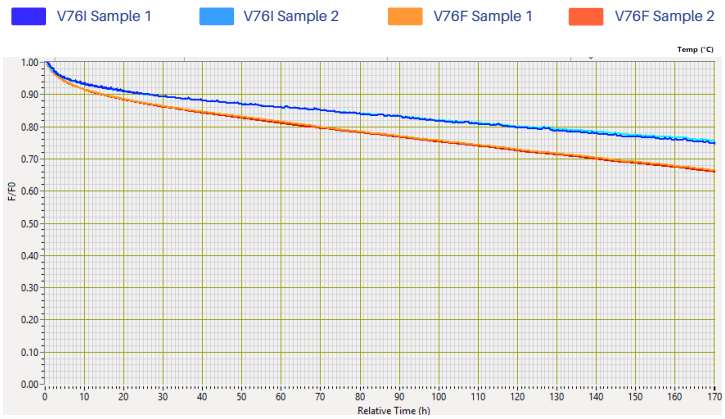
It also offers superior resistance to acids, oils, coolants and hydraulic fluids, making it ideal for use in fuel systems, chemical processing equipment and certain critical diesel engine locations.
The two materials use similar FKM base polymers, with V76I utilizing a fluoro-surfactant free version.

Extensive testing has been carried out that show, as detailed in this document, good alignment between the original and NFS (non-fluorosurfactant) versions from a thermal and mechanical perspective.

Material Properties	Method	V76F	V76I
Hardness (Shore A)	ASTM D2240	73	77
Hardness (IRHD)	ASTM D1415	78	79
Density (g/cm^3)	ASTM D792	1.88	1.81
Tensile Strength (MPa)	ASTM D412	25.5	16.0
Elongation at Break (%)		200	245
Modulus @ 50% (MPa)		3.6	3.8
Modulus @ 100% (MPa)		10.1	7.9
Compression Set% (72h @ 200°C / 392°F)	ASTM D395 Method B	13	17
Compression Set% (72h @ 200°C / 392°F)	ISO 815 Method B	16	24
Compression Set% (72h @ 200°C / 392°F)	ISO 815 Method C	10	15
Compression Set% (24h @ 250°C / 392°F)	ASTM D395 Method B	16	25

Table comparing typical properies of original material against new NFS version

Thermal Performance: (High Temperature)



High temperature performance has been compared using compressive stress relaxation ISO 3384-1 Method B at a constant temperature of 200°C (410°F) for 168 hours with -214 O-Rings under 25% compression.

The results show a high degree of correlation between the original and NFS materials under these conditions.

Stress relaxation is a reduction in the counter-force for maintaining the applied strain; the force is not constant but decreases with time when the material ages.

V76I is part of PPE's range of fluorosurfactant-free fluoroelastomer materials.
It has been developed to be more environmentally sustainable.

FLUORO-SURFACTANT FREE

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Thermal Expansion:

The Coefficient of thermal expansion (CTE) has been compared using a thermomechanical analyser (TMA).

The results show a good degree of correlation between the original and NFS materials.

Material Grade	Coefficient of Thermal Expansion µm/(m °C)
V76F	202 µm/(m °C)
V76I	233 µm/(m °C)

TMA: Comparable Coefficient of Thermal Expansion

Thermal Performance: (Low Temperature)

Low temperature flexibility has been compared using the midpoint Glass Transition Temperature (Tg) obtained through Differential Scanning Calorimetry (DSC) ASTM D3148.

The results show a high degree of correlation between the original and NFS materials.

Material Grade	Glass Transition Temperature (°C)
V76F	-5.3°C / 22°F
V76I	-5.0°C / 23°F

DSC: Comparable Glass Transition Temperature

Steam Resistance:

The performance in steam of the two materials has been assessed by exposing both materials to steam for 168 hrs at 150°C in a pressure vessel and evaluating the tensile properties, hardness, weight and volume changes as a consequence of the exposure itself. The results show a high degree of correlation between the original and NFS material.

							ΔModulus (%)	
Material Grade	ΔMass (%)	ΔVolume (%)	ΔDensity (%)	ΔShore A (points)	ΔTensile Strength (%)	ΔElongation at Break (%)	50%	100%
V76F	2	3	2	0	-11	6	25	14
V76I	0	2	0	-3	3	-7	20	14

Property changes after 168 hrs exposure to steam (150°C)

Biodiesel Resistance:

The performance in biodiesel of the two materials has been assessed by exposing both materials for 70 hrs at 100°C to B20 low emission automotive diesel fuel incorporating up to 20% FAME (fatty acid methyl ester) in a vessel and evaluating the tensile properties, hardness, weight and volume changes as a consequence of the exposure itself. The results show a high degree of correlation between the original and NFS material.

							ΔModulus (%)	
Material Grade	ΔMass (%)	ΔVolume (%)	ΔDensity (%)	ΔShore A (points)	ΔTensile Strength (%)	ΔElongation at Break (%)	50%	100%
V76F	1	2	2	-6	-12	-11	15	-15
V76I	1	3	1	-8	-13	-10	0	-10

Property changes after 70 hrs in Biodiesel (100°C)