

Tecnoflon®



SOLVAY

asking more from chemistry®

Tecnoflon® FKM/FFKM

Fluoroelastomers & Perfluoroelastomers
Materials Guide

**SPECIALTY
POLYMERS**

Tecnoflon® FKM/FFKM

Your Choice for Today, Your Solution for Tomorrow's Challenges

Tecnoflon® FKM and FFKM are synthetic fluorocarbon rubbers designed for use in demanding applications exposed to aggressive chemicals and high heat environments, such as those found in the Automotive, Aeronautics, Oil & Gas, and Semiconductor industries. They are compatible with a wide range of fluids and chemicals including automotive lubricants, fuels, and coolants, and they can provide long service life in severe end-use conditions. Typical applications include O-rings, seals, gaskets, hoses and complex molded parts.

In addition to these applications, Tecnoflon® FKM are the ideal choice for long-lasting wearable devices due to their excellent resistance to staining, oxidation and UV light.

Tecnoflon® materials are comprised of two main product families:

Fluoroelastomers (FKM)

Bisphenol-curable

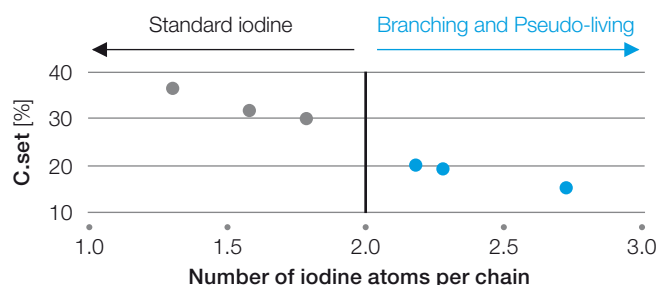
Bisphenol-curable materials show excellent processability and a good balance of mechanical and sealing properties. They are available as base polymers, or formulated with incorporated cure systems (FOR grades). A variety of possible combinations of viscosity, cure rate, and cross-link density make them suitable for any molding process.

Peroxide-Curable

Peroxide-curable grades provide better chemical resistance than bisphenol-curable FKM, making them suitable for even the most severe end-use environments. Thanks to Solvay's proprietary branching and pseudo-living polymerization technology, these grades can be successfully processed by compression, transfer, or injection molding. They also exhibit very good extrusion behavior, making them suitable for the production of hoses and wire jacketing.

This unique polymerization technology also delivers unmatched tensile properties and outstanding long-term sealing performance.

Peroxide-curable branching and pseudo-living technology



Specialties

In addition to the above mentioned families, Tecnoflon® FKM include grades designed for specific performance requirements.

Perfluoroelastomers (FFKM)

Tecnoflon® PFR demonstrate the highest performance of all other elastomers. They are resistant to nearly every chemical class with some grades offering heat resistance up to 300°C. This makes Tecnoflon® PFR the material of choice for extremely demanding sealing applications. Market specific grades have been specifically developed to meet the most stringent requirements of the Semiconductor, Oil & Gas, and Chemical Processing industries.

Fluoroelastomers

Bisphenol-Curable

Depending upon their monomer composition, they are categorized as noted below:

Dipolymers

Dipolymers are versatile polymers based on VDF and HFP monomers and have a fluorine content of 66 %.

Terpolymers

Terpolymers offer better chemical resistance than dipolymers having fluorine content ranging from 68 to 70 %.

Low-Temperature Terpolymers

They provide chemical resistance similar to bisphenol dipolymers and exhibit a lower glass transition temperature; fluorine content is 65.5 %.

Peroxide-Curable

Solvay's family of peroxide-curable materials are available in medium and low viscosity grades and include:

Standard Peroxide-Curable FKM (P Series)

Multi-purpose grades with excellent chemical resistance to different media.

Low-Temperature FKM (PL Series)

These grades provide the same benefits as the P series polymers along with extended low-temperature service. The PL grades are widely used in Automotive, Oil & Gas, and Aerospace applications.

Base-Resistant FKM (BR Series)

This family is designed with a unique monomer composition that imparts superior resistance to basic additives compared to all the other FKM grades. It is particularly suited for applications in contact with aggressive engine oils, gear lubricants, transmission fluids, and coolants.

Extreme Low-Temperature FKM (VPL Series)

Based on Solvay's novel MOVE monomer technology, these unique materials provide outstanding low-temperature sealing properties along with best-in-class chemical resistance. These polymers exhibit very good processing and compression set. A broad selection of grades is available with TR₁₀ values ranging from -30 down to -45 °C. Typical applications include high-performance fuel injector O-rings, oil field and aerospace sealing components.

Specialties

This family includes:

FPA 1

Fluorinated processing aid that improves the flowability of compounds, thereby reducing flow lines and knitting defects.

TN Latex

Water-based terpolymer emulsion (70 % solids) that is a viable alternative to solvent-based fluoro-elastomer coatings.

NM Powder

FKM dipolymer available in fine powder form used as a processing aid for polyolefins.

Perfluoroelastomers

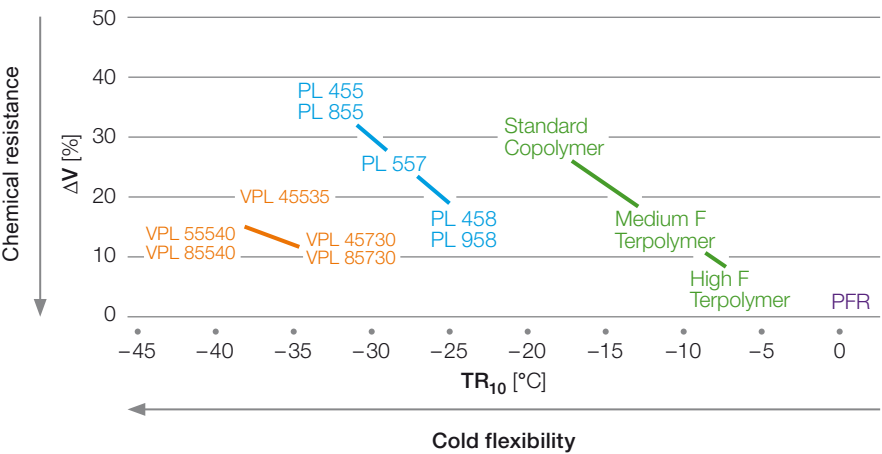
PFR Series

Tecnoflon® PFR FFKM include grades specially designed for the Chemical Process and Oil & Gas industries (PFR 94 and PFR 06HC), delivering the highest chemical resistance among all elastomers; specifically they outperform FKMs when in contact with polar fluids (such as ketones, esters, ethers and aldehydes) and bases (alkalis and amines).

In addition to these, thanks to a Solvay's proprietary cross-linking technology, Tecnoflon® FFKM includes PFR 95 and PFR 95HT grades able to provide superior thermal resistance versus general purpose FFKM, while maintaining their sealing properties at high temperatures and outperforming other high temperature cross-linking technologies under steam at high temperatures.

Tecnoflon® FKM/FFKM Chemical and Low-Temperature Properties

Tecnoflon® FKM/FFKM – Volume swell in M15
168h at 23°C



Tecnoflon® FKM/FFKM – Chemical resistance to aggressive fluids

	Dipolymers	Terpolymers	P Series	PL Series	VPL Series	BR Series	PFR Series
Steam	Poor	Poor	Good	Good	Good	Excellent	Excellent
Acids	Poor	Poor	Excellent	Excellent	Excellent	Excellent	Excellent
Dilute alkali	Poor	Poor	Good	Good	Good	Excellent	Excellent
Amines	Poor	Poor	Poor	Poor	Poor	Good	Excellent
Transmission oils	Good	Good	Excellent	Excellent	Excellent	Excellent	Excellent
Alcohols (Methanol, Ethanol)	Poor	Excellent (High F grades)	Excellent (High F grades)	Excellent (High F grades)	Excellent	Excellent	Excellent



Tecnoflon® FKM Grades

Standard compound recipes and suggested post-cure conditions

Compound Code	Unit	1BN	2BN	3BN	1BY	2BY	1P
Polymer		100	100	100	100	100	100
Tecnoflon® FOR M1	phr	4	3	5			
Tecnoflon® FOR M2	phr	1.5	2	3.5			
Luperox® 101XL-45	phr						1.5
Drimix® TAIC 75 %	phr						4
MgO DE	phr	3	3	3	3	7	
Ca(OH) ₂	phr	6	6	6	6		
MT Black N 990	phr	30	30	30	30	30	30
Post cure		(8 + 16) h at 250 °C	(8 + 16) h at 250 °C	(8 + 16) h at 250 °C	(8 + 16) h at 250 °C	1 h at 250 °C	4 h at 230 °C

Bisphenol-curable Dipolymers

Base polymers

Compound recipe: 1BN

Property	Unit	N 215/U	N 535	NM	N 935	Test Method
Mooney viscosity, (1+10) at 121 °C	MU	10	27	45	62	
Tensile strength	MPa	14.5	17.5	18.5	19.5	ASTM D412C
Elongation at break	%	190	185	170	190	ASTM D412C
Hardness	Shore A	73	74	76	75	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	22	14	16	13	ASTM D395 Method B
TR ₁₀	°C	-17	-17	-17	-17	ASTM D1329
Compliance			FDA*	FDA*	FDA*	

* With compliant curatives only

Cure incorporated

Compound recipe: 1BY

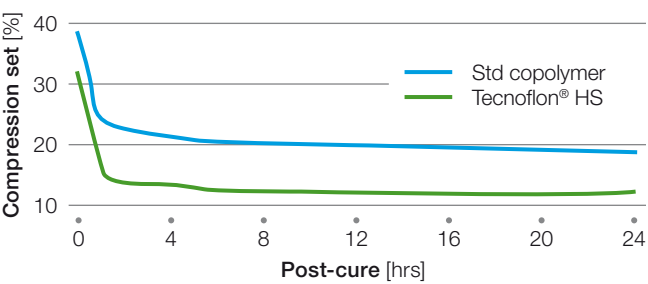
Property	Unit	FOR 210	FOR 335	FOR 539	FOR 4353	FOR 5351	FOR 60K/U	FOR 5312K	FOR 7353	Test Method
Mooney viscosity, (1+10) at 121 °C	MU	10	20	20	20	24	31	42	38	
Cure rate	Slow	Slow	Medium	Medium	Fast	Slow	Medium	Fast		
Tensile strength	MPa	15.0	17.0	16.5	15.5	16.0	17.5	17.5	18.0	ASTM D412C
Elongation at break	%	185	170	190	175	250	225	255	180	ASTM D412C
Hardness	Shore A	74	76	76	76	72	72	74	78	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	22	16	18	15	18	18	18	16	ASTM D395 Method B
TR ₁₀	°C	-17	-17	-17	-17	-17	-17	-17	-17	ASTM D1329
Compliance					FDA				FDA	

HS grades

Based on an innovative polymerization technology that allows curing without Ca(OH)_2 . Benefits include enhanced scorch safety, improved mechanical properties, lower C-set and shorter post-cure time. While not required, Ca(OH)_2 can be used to modify cure rate.

Compound recipes: 1BN for base polymers
2BY for cure incorporated grades

Tecnoflon® HS – Compression set



Property	Unit	Base Polymers		Cure Incorporated					Test Method
		N 60HS	N 90HS	FOR 501HS	FOR 50HS	FOR 801HS	FOR 80HS	FOR 900HS	
Mooney viscosity, (1+10) at 121 °C	MU	27	45	23	23	40	38	53	
Tensile strength	MPa	16.0	15.0	15.0	18.0	17.5	18.0	16.5	ASTM D412C
Elongation at break	%	220	190	270	230	260	200	305	ASTM D412C
Hardness	Shore A	69	70	65	70	65	71	69	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	13	14	17	13	17	13	16	ASTM D395 Method B
TR ₁₀	°C	-17	-17	-17	-17	-17	-17	-17	ASTM D1329
Compliance		FDA*	FDA*						

* With compliant curatives only



Bisphenol-curable Terpolymers

Base polymers

Compound recipes: 2BN for TN 50A and TN
3BN for T 538 and T 938

Property	Unit	TN 50A	TN	T 538	T 938	Test Method
Fluorine content	Weight %	68	68	68.5	68.5	
Specific gravity	g/cm ³	1.86	1.86	1.88	1.88	ASTM D792
Mooney viscosity, (1+10) at 121 °C	MU	23	67	26	66	ASTM D1646
Tensile strength	MPa	13.5	18.0	12.0	15.5	ASTM D412C
Elongation at break	%	300	230	250	220	ASTM D412C
Hardness	Shore A	72	77	75	78	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	29	29	31	24	ASTM D395 Method B
TR ₁₀	°C	−14	−14	−13	−13	ASTM D1329
Compliance			FDA*		FDA*	

* With compliant curatives only

Cure incorporated

Compound recipe: 1BY

Property	Unit	FOR 7380K	FOR 5381	FOR 9385F	FOR 9383	FOR 4391	Test Method
Fluorine content	Weight %	68	68.5	68.5	68.5	70	
Specific gravity	g/cm ³	1.86	1.88	1.88	1.88	1.89	ASTM D792
Mooney viscosity, (1+10) at 121 °C	MU	31	21	45	60	49	ASTM D1646
Cure rate		Medium	Fast	Fast	Medium	Fast	
Tensile strength	MPa	16.0	15.0	11.5	17.0	16.0	ASTM D412C
Elongation at break	%	250	200	350	285	240	ASTM D412C
Hardness	Shore A	75	80	75	74	78	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	30	23	40	32	32	ASTM D395 Method B
TR ₁₀	°C	−14	−13	−13	−13	−7	ASTM D1329

Bisphenol-Curable Low-Temperature Terpolymers

Due to the specific monomer composition, these grades show improved cold-temperature flexibility compared to bisphenol terpolymers and dipolymers.

Base polymers and cure incorporated

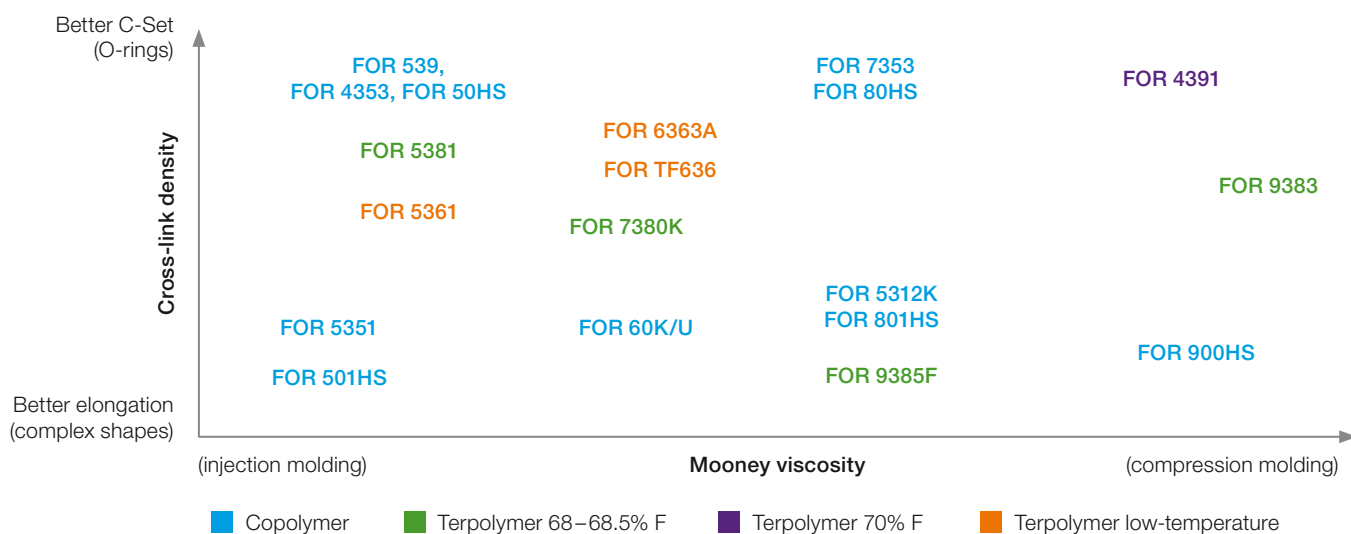
Compound recipes: 1BN for base polymers

1BY for cure incorporated grades

Property	Unit	T 636/L	T636	FOR 5361*	FOR 6363A*	FOR TF636*	Test Method
Mooney viscosity, (1+10) at 121 °C	MU	22	34	21	30	31	ASTM D1646
Cure rate				Fast	Medium	Fast	
Tensile strength	MPa	17.5	18.5	18.0	20.0	18.5	ASTM D412C
Elongation at break	%	190	190	175	175	165	ASTM D412C
Hardness	Shore A	73	74	74	75	76	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	15	13	17	16	13	ASTM D395 Method B
TR ₁₀	°C	-19	-19	-19	-19	-19	ASTM D1329

* Cure incorporated

Tecnoflon® FOR grades selection chart



Standard Peroxide-Curable

Compound recipe: 1P

Property	Unit	P 457	P 757	P 459	P 959	P X647*	P 549L*	Test Method
Fluorine content	Weight %	67	67	70	70	67	70	
Specific gravity	g/cm ³	1.83	1.83	1.90	1.90	1.83	1.90	ASTM D792
Mooney viscosity, (1+10) at 121 °C	MU	21	45	24	48	33	29	ASTM D1646
Tensile strength	MPa	22.5	23.5	23.5	22.0	20.4	22.6	ASTM D412C
Elongation at break	%	240	290	205	230	305	260	ASTM D412C
Hardness	Shore A	72	71	76	72	73	74	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	22	22	19	20			ASTM D395 Method B
TR ₁₀	°C	- 15	- 15	-5	-5	- 15	-5	ASTM D1329
Compliance			FDA		FDA			

* Improved elongation at break, suitable for hoses and wire jacketing

Peroxide-Curable Low-Temperature

Compound recipe: 1P

Property	Unit	PL 458	PL 958	PL 557	PL 455	PL 855	Test Method
Fluorine content	Weight %	66	66	65.5	64	64	
Specific gravity	g/cm ³	1.83	1.83	1.81	1.78	1.78	ASTM D792
Mooney viscosity, (1+10) at 121 °C	MU	29	53	35	19	54	ASTM D1646
Tensile strength	MPa	21.0	20.5	19.5	21.5	21.0	ASTM D412C
Elongation at break	%	185	190	210	225	250	ASTM D412C
Hardness	Shore A	73	72	71	70	69	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	18	18	21	23	23	ASTM D395 Method B
TR ₁₀	°C	-24	-24	-29	-30	-30	ASTM D1329



Peroxide-Curable Base-Resistant

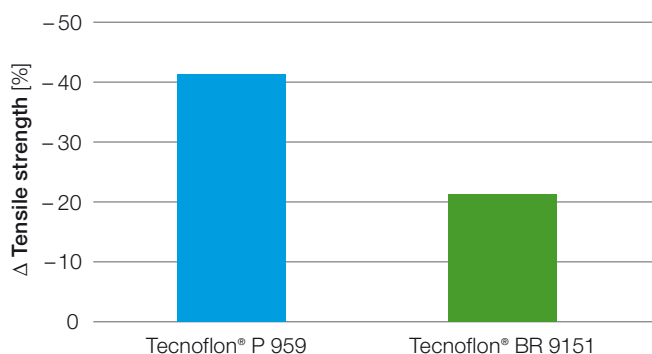
Compound recipe: 1P (suggested post cure 8h at 230 °C)

Property	Unit	BR 9151	BR 9171*	Test Method
Fluorine content	Weight %	66	66.5	
Specific gravity	g/cm ³	1.82	1.84	ASTM D792
Mooney viscosity, (1+10) at 121 °C	MU	48	44	ASTM D1646
Tensile strength	MPa	21.5	19.5	ASTM D412C
Elongation at break	%	205	175	ASTM D412C
Hardness	Shore A	72	74	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	41	37	ASTM D395 Method B
TR ₁₀	°C	-7	-9	ASTM D1329

* Improved chemical resistance vs. BR 9151

Tecnoflon® FKM – Chemical resistance

ASTM 105 G, 168h at 150°C



Peroxide-Curable Extreme Low-Temperature

Compound recipe: 1P

Property	Unit	VPL 45730	VPL 85730	VPL 45535	VPL 55540	VPL 85540	VPL X75545	Test Method
Fluorine content	Weight %	67	67	65	65	65	65	
Specific gravity	g/cm ³	1.87	1.87	1.85	1.83	1.83	1.83	ASTM D792
Mooney viscosity, (1+10) at 121 °C	MU	25	45	25	25	45	32	ASTM D1646
Tensile strength	MPa	19.5	19.0	14.5	15.0	16.0	14.0	ASTM D412C
Elongation at break	%	175	190	166	170	175	200	ASTM D412C
Hardness	Shore A	74	72	68	68	67	62	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	19	22	23	21	20	22	ASTM D395 Method B
TR ₁₀	°C	-30	-30	-35	-40	-40	-45	ASTM D1329

Tecnoflon® FFKM Grades

Standard compound recipes and suggested post-cure conditions

Compound Code	Unit	2P	3P	4P
Polymer		100	100	100
Luperox® 101XL-45	phr	1.5	4	1.5
Drimix® TAIC 75 %	phr	2		
MT Black N 990	phr	15	7	7
Austin Black 325	phr		8	8
Post cure		4 h at 230 °C	(8 + 16) h at 250 °C	(8 + 16) h at 250 °C

Perfluoroelastomers

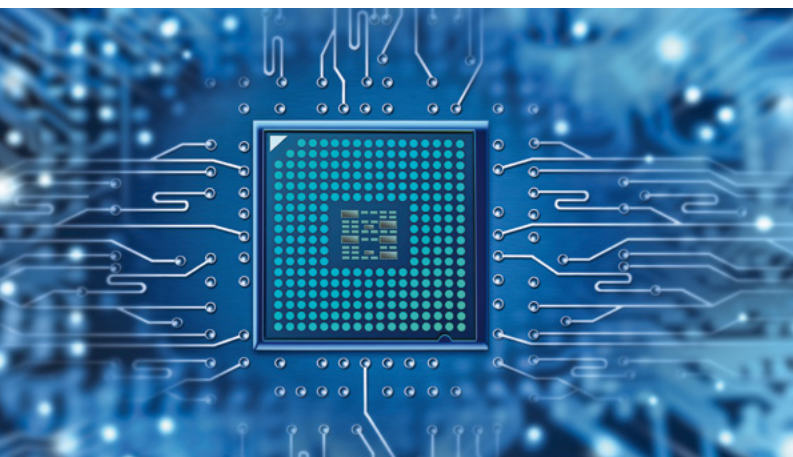
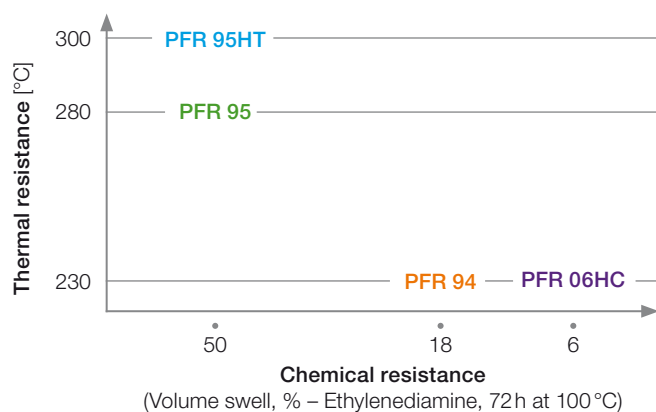
Compound recipes: 2P for PFR 94 and PFR 06HC

3P for PFR 95

4P for PFR 95HT

Property	Unit	PFR 94	PFR 06HC	PFR 95	PFR 95HT	Test Method
Specific gravity	g/cm ³	2.06	2.05	2.03	2.05	ASTM D792
Mooney viscosity, (1+10) at 121 °C	MU	35	75	35	75	ASTM D1646
Tensile strength	MPa	20.0	19.0	16.5	18.0	ASTM D412C
Elongation at break	%	155	190	175	200	ASTM D412C
Hardness	Shore A	71	70	69	69	ASTM 2240
Compression set, 70h at 200 °C on #214 O-ring	%	18	20	18	19	ASTM D395 Method B
TR ₁₀	°C	-2	-2	-1	-1	ASTM D1329

Tecnoflon® PFR FFKM – Thermal vs. chemical resistance





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