

Tecnoflon® P 959

Peroxide Curable Terpolymers

Tecnoflon® P 959 is a medium viscosity, high fluorine (70%), peroxide curable fluoroelastomer. Tecnoflon® P 959 exhibits superior resistance to a wide variety of chemicals, coupled with excellent processability and optimum compression set. Tecnoflon® P 959 can be cross-linked using organic peroxides in conjunction with a co-agent.

Some of the basic properties of Tecnoflon® P 959 are:

- Low post cure
- Superior mold flow
- Lack of mold fouling
- Excellent mold release
- Good chemical resistance especially in
 - Alcohol containing fuels
 - Steam
 - Fluids containing amine additives
- FDA compliant

Tecnoflon® P 959 can be used for compression, injection and transfer molding of shaft seals, valve seals, O-rings, gaskets or any item requiring superior chemical resistance. Tecnoflon® P 959 can be combined

with the cure system and other typical fluoroelastomer compounding ingredients. Mixing can be accomplished with two roll mills or internal mixers.

Tecnoflon® P 959 can be extruded into hoses or profiles and can be calendered to make sheet stocks or belting. Finished goods may be produced by a variety of rubber processing methods.

Tecnoflon® P 959 is registered in the FDA Inventory of Effective Premarket Notifications for Food Contact Substances. It can be compounded so that the finished gaskets or seals can be used in food processing equipments (see “Food processing compounds” section on pages 10 and 11).

Handling and safety

Normal care and precautions should be taken to avoid skin contact, eye contact and breathing of fumes. Smoking is prohibited in working areas. Wash hands before eating or smoking. For complete health and safety information, please refer to the safety data sheet.

Basic characteristics of the raw polymer are as follows:

Property	Typical Value	Unit	Test Method
ML (1+10') at 121 °C	48	MU	ASTM D1646
Fluorine content	70	%	Solvay Internal Method – NMR
Specific gravity	1.90	g/cm ³	ASTM D792
Color	Translucent		
Packaging / Form	Slabs		
Solubility	Ketones and esters		

Typical properties

Test Compound	Typical Value	Unit	Test Method
Tecnoflon® P 959	100	phr	
Luperox® 101XL-45	3	phr	
Drimix® TAIC (75%)	4	phr	
ZnO	5	phr	
N-990 MT Carbon Black	30	phr	

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Property	Typical Value	Unit	Test Method
Mooney viscosity ML (1+10') at 121 °C	51	MU	ASTM D1646
Mooney Scorch MS 135 °C			ASTM D1646
MV	24	MU	
t ₁₅	9.1	min	
ODR 12 min at 177 °C arc 3°			ASTM D2084
Minimum torque	14.5	lb·in	
Maximum torque	147	lb·in	
t _{s2}	0.8	min	
t' ₅₀	1.4	min	
t' ₉₀	2.0	min	
MDR 6 min at 177 °C arc 0.5°			ASTM D6601
Minimum torque	1.5	lb·in	
Maximum torque	28.2	lb·in	
t _{s2}	0.4	min	
t' ₅₀	0.6	min	
t' ₉₀	0.9	min	
MDR 12 min at 170 °C arc 0.5°			ASTM D6601
Minimum torque	1.5	lb·in	
Maximum torque	28.9	lb·in	
t _{s2}	0.9	min	
t' ₅₀	1.6	min	
t' ₉₀	3.1	min	
Press cure: 6 min at 170 °C			
100% Modulus	5.1	MPa	ASTM D412C
Tensile strength	17.5	MPa	
Elongation at break	260	%	
Hardness	70	ShoreA	ASTM D2240
Post cure: 4 h at 230 °C			
100% Modulus	6.8	MPa	ASTM D412C
Tensile strength	22.0	MPa	
Elongation at break	230	%	
Hardness	72	ShoreA	ASTM D2240
Compression set			ASTM D395 method B
25% deformation, 70 h at 200 °C			
O-ring #214	20	%	
6 mm buttons	15	%	

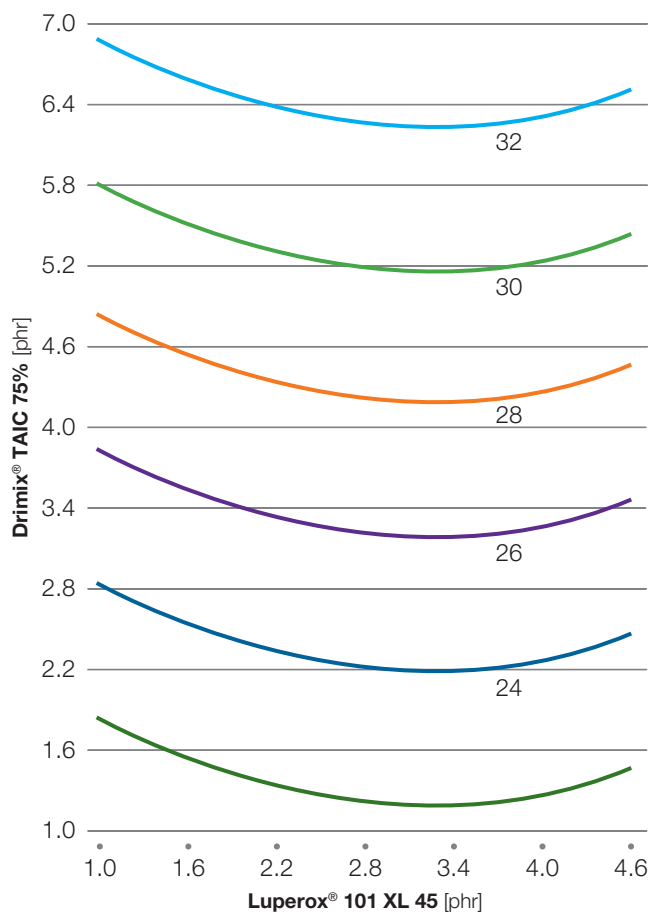
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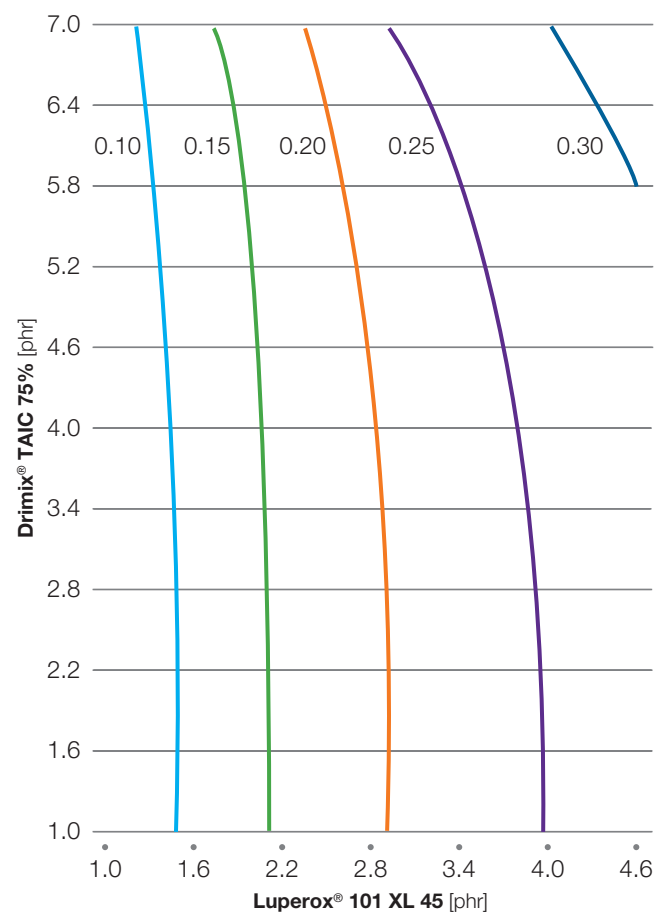
Effect of curative levels

Property	Typical Value	Unit	Test Method
Tecnoflon® P 959	100	phr	
Luperox® 101XL-45	See picture	phr	
Drimix® TAIC (75%)	See picture	phr	
ZnO	5	phr	
N-990 MT Carbon Black	30	phr	

Δ torque (MH-ML) [lb·in]

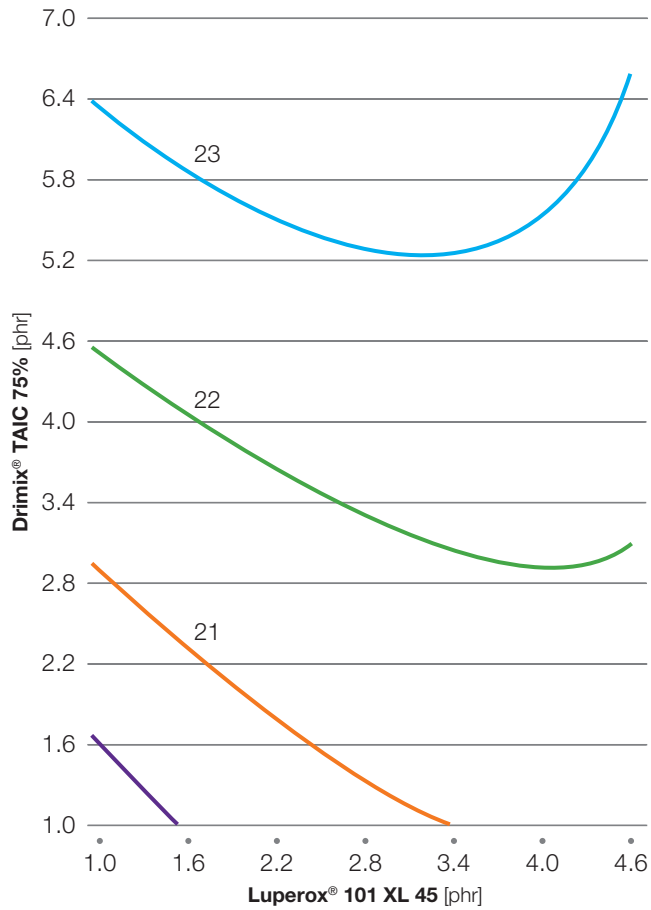


Curing rate (MH-ML)/(t'90-t's2) [lb·in/s]

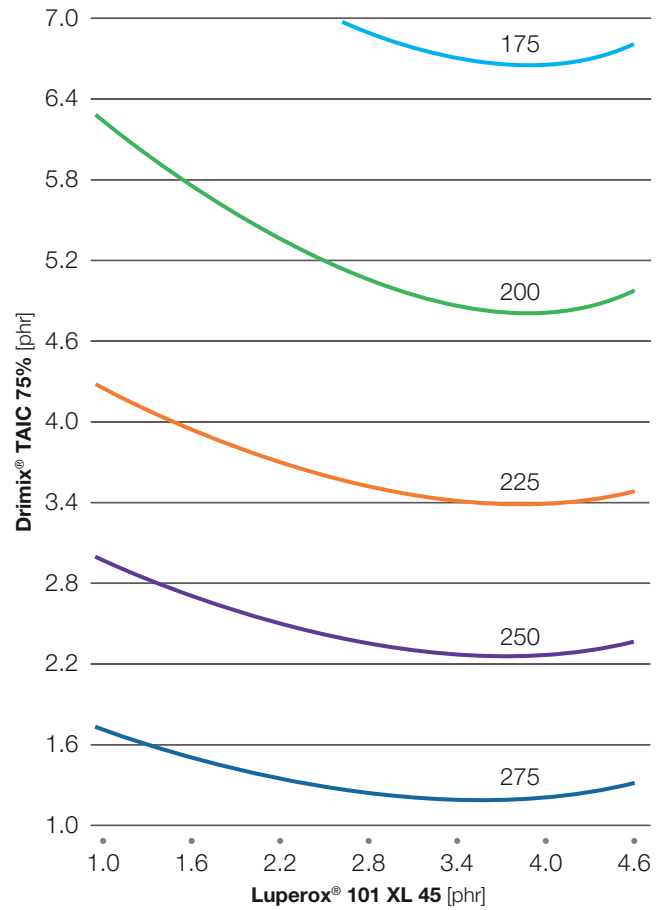


Mechanical properties after post cure 4 h at 230 °C

Tensile strength [MPa]



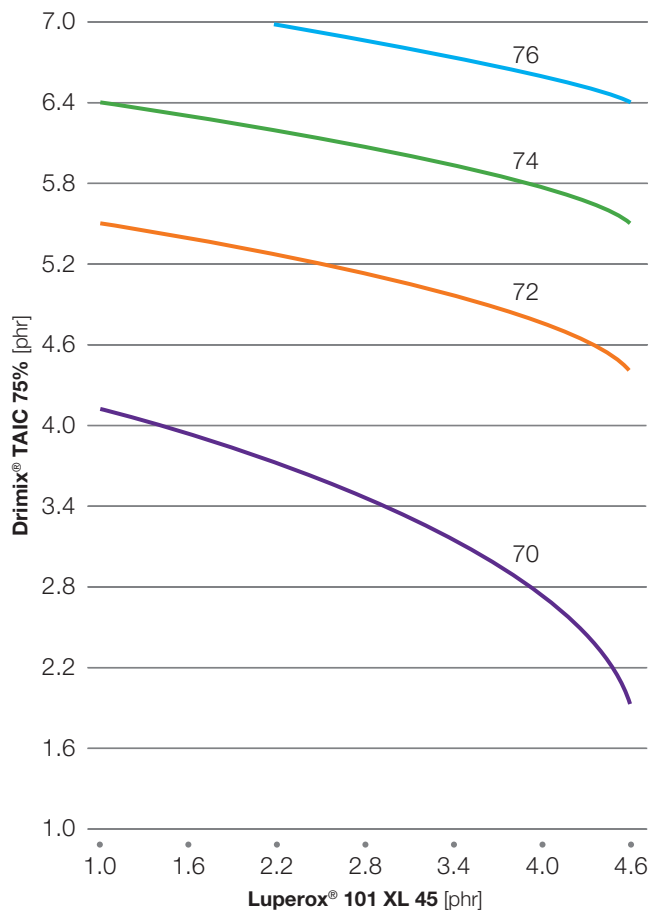
Elongation at break [%]



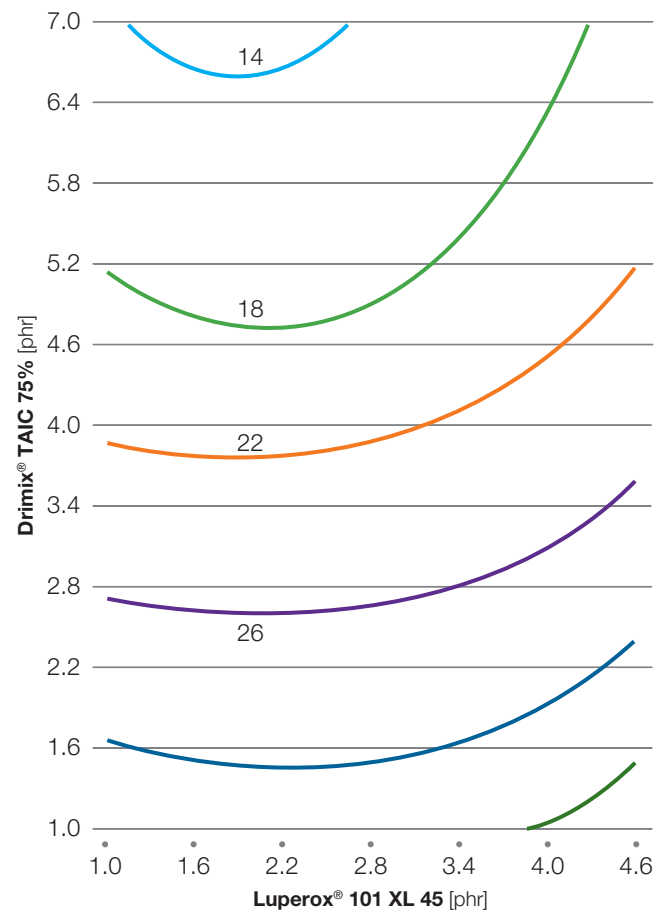
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Hardness [ShoreA]



Compression set (70 h at 200°C) O-ring #214 [%]



Fluid resistance

Property	Typical Value	Unit	Test Method
Fuel C, 70 h at 23°C			
Δ Tensile strength	-12	%	
Δ Elongation at break	-13	%	
Δ Hardness	3	Shore A	
Δ Volume	1	%	
Methanol, 70 h at 23°C			
Δ Tensile strength	-16	%	
Δ Elongation at break	-14	%	
Δ Hardness	1	Shore A	
Δ Volume	3	%	
Methanol, 168 h at 23°C			
Δ Tensile strength	-21	%	
Δ Elongation at break	-23	%	
Δ Hardness	-5	Shore A	
Δ Volume	6	%	
M15 (Fuel C/Methanol 85/15%), 70 h at 23°C			
Δ Tensile strength	-17	%	
Δ Elongation at break	-13	%	
Δ Hardness	-1	Shore A	
Δ Volume	5	%	
Toluene, 168 h at 23°C			
Δ Tensile strength	-19	%	
Δ Elongation at break	-22	%	
Δ Hardness	-3	Shore A	
Δ Volume	7	%	
Steam, 70 h at 150°C			
Δ Tensile strength	-10	%	
Δ Elongation at break	10	%	
Δ Hardness	-1	Shore A	
Δ Volume	2	%	
HNO₃ 4%, 30 days at 60°C			
Δ Tensile strength	2	%	
Δ Elongation at break	-15	%	
Δ Hardness	-7	Shore A	
Δ Volume	13	%	

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Property	Typical Value	Unit	Test Method
IRM 903, 70 h at 150 °C			
Δ Tensile strength	5	%	
Δ Elongation at break	-2	%	
Δ Hardness	1	Shore A	
Δ Volume	1	%	
IRM 903, 168 h at 150 °C			
Δ Tensile strength	14	%	
Δ Elongation at break	-6	%	
Δ Hardness	1	Shore A	
Δ Volume	0	%	
Engine coolants (Prestone), 70 h at 150 °C			
Δ Tensile strength	-3	%	
Δ Elongation at break	2	%	
Δ Hardness	-2	Shore A	
Δ Volume	2	%	
Engine coolants (Prestone), 168 h at 150 °C			
Δ Tensile strength	4	%	
Δ Elongation at break	-1	%	
Δ Hardness	0	Shore A	
Δ Volume	3	%	
ATF Dexron III, 70 h at 150 °C			
Δ Tensile strength	5	%	
Δ Elongation at break	-2	%	
Δ Hardness	2	Shore A	
Δ Volume	0	%	
ATF Dexron III, 168 h at 150 °C			
Δ Tensile strength	-3	%	
Δ Elongation at break	2	%	
Δ Hardness	2	Shore A	
Δ Volume	0	%	
ATF Dexron III, 336 h at 150 °C			
Δ Tensile strength	1	%	
Δ Elongation at break	-10	%	
Δ Hardness	3	Shore A	
Δ Volume	0	%	

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Property	Typical Value	Unit	Test Method
ATF Dexron III, 500 h at 150 °C			
Δ Tensile strength	0	%	
Δ Elongation at break	-13	%	
Δ Hardness	6	Shore A	
Δ Volume	0	%	
ATF Dexron III, 1000 h at 150 °C			
Δ Tensile strength	5	%	
Δ Elongation at break	-10	%	
Δ Hardness	6	Shore A	
Δ Volume	0	%	
SH motor oil (Quaker State 5 W – 30 W), 70 h at 150 °C			
Δ Tensile strength	6	%	
Δ Elongation at break	-2	%	
Δ Hardness	3	Shore A	
Δ Volume	0	%	
SH motor oil (Quaker State 5 W – 30 W), 168 h at 150 °C			
Δ Tensile strength	-14	%	
Δ Elongation at break	-4	%	
Δ Hardness	1	Shore A	
Δ Volume	1	%	
Synthetic gear (Mobil SHC 634), 70 h at 150 °C			
Δ Tensile strength	17	%	
Δ Elongation at break	9	%	
Δ Hardness	0	Shore A	
Δ Volume	0	%	
Synthetic gear (Mobil SHC 634), 168 h at 150 °C			
Δ Tensile strength	8	%	
Δ Elongation at break	-1	%	
Δ Hardness	1	Shore A	
Δ Volume	1	%	
Synthetic gear (Mobil SHC 634), 336 h at 150 °C			
Δ Tensile strength	2	%	
Δ Elongation at break	-7	%	
Δ Hardness	2	Shore A	
Δ Volume	1	%	

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Low temperature properties

Property	Typical Value	Unit	Test Method
TR ₁₀	-5	°C	ASTM D1329

Cold brittleness test

Property	Typical Value	Unit	Test Method
Press cure: 6 min at 170 °C, post cure: 24 h at 230 °C			
Brittleness temperature	-39	°C	ASTM D2137

Gehman's torsional brittleness test

Property	Typical Value	Unit	Test Method
Press cure: 6 min at 170 °C			
T ₂	-5	°C	ASTM D1053
T ₅	-6	°C	
T ₁₀	-11	°C	
T ₁₀₀	-16	°C	
Post cure: 1 h at 230 °C			
T ₂	-1	°C	ASTM D1053
T ₅	-5	°C	
T ₁₀	-7	°C	
T ₁₀₀	-14	°C	
Post cure: 24 h at 230 °C			
T ₂	-2	°C	ASTM D1053
T ₅	-5	°C	
T ₁₀	-8	°C	
T ₁₀₀	-12	°C	

Food processing compounds

Tecnoflon® P 959 is registered in the FDA Inventory of Effective Food Contact Substances (FCS) Notifications, being the subject of Food Contact Notification (FCN #127), with an effective date July 21, 2001. See the list of effective notifications for FCN available on the Agency's web site at:

<http://www.accessdata.fda.gov/scripts/fdcc/?set=FCN>

The finished compounds are intended for repeated use as components of gaskets or seals used in food processing equipment intended to contact food Types I through VII as described in Table 1 of 21 CFR 176.170(c) as follows:

Table 1: Types of Raw and Processed Foods

- I. Nonacid, aqueous products; may contain salt or sugar or both (pH above 5.0)
- II. Acid, aqueous products; may contain salt or sugar or both, and including oil-in-water emulsions of low- or high-fat content
- III. Aqueous, acid or nonacid products containing free oil or fat; may contain salt, and including water-in-oil emulsions of low- or high-fat content
- IV. Dairy products and modifications:
 - A Water-in-oil emulsions, high- or low-fat
 - B Oil-in-water emulsions, high- or low-fat
- V. Low-moisture fats and oil
- VI. Beverages:
 - A Containing up to 8 percent of alcohol
 - B Non-alcoholic
 - C Containing more than 8 percent alcohol
- VII. Bakery products other than those included under Types VIII or IX of this table:
 - A Moist bakery products with surface containing free fat or oil
 - B Moist bakery products with surface containing no free fat or oil
- VIII. Dry solids with the surface containing no free fat or oil (no end test required)
- IX. Dry solids with the surface containing free fat or oil

Data for establishing compliance with the FDA standards for Tecnoflon® P 959 based compounds were obtained from cured items having the formulation shown below:

Tecnoflon® P 959	100 phr
Luperox® 101 (98%)	1.35 phr
TAIC (100%)	3 phr

Extraction tests were performed on slabs that were presscured for 10 min at 170 °C, followed by an oven post-cure of 24 h at 200 °C.

Compounding guidelines for food processing

To design FDA compliant compounds, some restrictions have to be taken into account as far as the curatives, the fillers and the process aids are concerned.

1. Curatives

the following restrictions apply in terms of curatives amount:

Tecnoflon® P 959	100 phr
Luperox® 101 (98%)	≤ 1.35 phr
TAIC (100%)	≤ 3 phr

2. Fillers

The following fillers are approved for use in items intended for repeated food contact use, under 21 CFR 177.2600, section v., and provide at the same time excellent processing behavior and physical properties:

- Barium sulfate
- Silica
- Titanium dioxide
- Carbon black
(channel process or furnace combustion process; total carbon black not to exceed 50 % by weight of rubber product; furnace combustion black content not to exceed 10 % by weight of rubber products intended for use in contact with milk or edible oils)

3. Process aids

- Carnauba wax
- Struktol® HT 290
(concentration must not exceed 5% by weight of the rubber compound)

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Food processing compounds

Test Compound	Unit	White	Black	Test Method
Tecnoflon® P 959	phr	100	100	
Luperox® 101 liquid (98 %)	phr	1	1	
TAIC liquid (98 %) – DIAK 7	phr	3	3	
TiO ₂ (Ti-Pure® R-960)	phr	3	–	
BaSO ₄ (Blanc Fixe HD 80)	phr	70	20	
Carnauba wax	phr	0.5	–	
N 550 FEF	phr	–	12	

Property	Unit	White	Black	Test Method
Mooney viscosity ML (1+10') at 121 °C	MU	45	42	ASTM D1646
MDR 12 min at 160 °C arc 3°				ASTM D6601
Minimum torque	lb · in	1.5	1.38	
Maximum torque	lb · in	31.0	28.9	
t _{s2}	min	0.7	0.9	
t' ₅₀	min	1.4	2.1	
t' ₉₀	min	2.1	4.4	
Post cure: 4 h at 230 °C				
100 % modulus	MPa	3.6	7.2	ASTM D412C
Tensile strength	MPa	13.5	21.8	
Elongation at break	%	321	205	
Hardness	Shore A	71	73	ASTM D2240
Compression set				ASTM D395
25 % deformation, O-ring #214				method B
70 h at 200 °C	%	20	22	

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