Viton™ A-700

Fluoroelastomers

Technical Information

Introduction

Viton™ A-700* is an "A-family" gum polymer that has demonstrated easy processing. This gum provides:

- Good flow for compression molding
- Good mold release
- Less mold fouling
- Improved compression set resistance
- Improved tear properties

Applications

- Preferred material for fuel systems, such as fuel injector O-rings
- Compression molding of O-rings, gaskets, and other sealing devices
- Extruded cords, profiles, and tubing or calendered sheets, when a blend of gum polymers are used
- Solution coatings of fabrics and other substrates
- Blending with other polymers for viscosity modifications

Product Description

Chemical Composition	Copolymer of hexafluoropropylene and vinylidene fluoride
Physical Form	Pellet
Color	Silver-gray, pale amber
Odor	None
Specific Gravity	1.77
Solubility	Low molecular weight esters and ketones
Storage Stability	Excellent
Mooney Viscosity, ML 1+10 at 121 °C (250 °F)	Nominal 74

Safety and Handling

Before handling or processing Viton™ A-700, read and follow the recommendations in the Chemours technical bulletin, "Handling Precautions for Viton™ and Related Chemicals".

Viton™ A-700 should be handled similar to other types of Viton™. For the safe handling of other compounding ingredients, please refer to the respective manufacturers' information.

*Viton™ A-700 was formerly named VTR-6769.

Chemours™

Table 1. Polymer Comparison for Viton™ A-700

	Viton™ A-700	Viton™ A-500	Viton™ AHV	Viton™ B-600	Viton™ AL-600
Viton™ A-700	97.50	—	—	—	—
Viton™ A-500	—	97.50	—	—	—
Viton™ AHV	—	—	97.50	—	—
Viton™ B-600	—	—	—	97.50	—
Viton™AL-600	—	—	—	—	97.50
MT Black (N-990)	30	30	30	30	30
Maglite® D	3	3	3	3	3
Calcium Hydroxide	6	6	6	6	6
Viton™ Curative No. 50	2.5	2.5	2.5	2.5	2.5
Mooney Scorch, MS at 121 °C (250 °F)					
Minimum Viscosity, units	64	48	96	65	61
Time to 1 pt rise, min	13	12	16	8	—
Time to 2 pt rise, min	—	—	26	11	—
Time to 5 pt rise, min	—	—	—	—	—
Time to 10 pt rise, min	—	—	—	—	—
Pts rise to 30 min	2	2	5	3	0
MDR at 177 °C (350 °F), 0.5° Arc, 6 min Motor					
Minimum Viscosity, ML, N·m (in·lb)	0.3 (2.6)	0.2 (1.7)	0.6 (5.5)	0.3 (2.3)	0.3 (2.5)
Scorch Time, t_s2, min	0.8	0.9	0.7	1.5	0.9
Maximum Torque, M_H, N·m (in·lb)	3.2 (28.1)	3.1 (27.4)	3.8 (34)	31 (27.7)	3.1 (27.6)
50% Cure, M50, N·m (in·lb)	1.7 (15.3)	1.6 (14.6)	2.2 (19.7)	1.7 (15)	1.7 (15.1)
Time to 50% Cure, t'50, min	1.3	1.3	1.4	2.9	1.4
90% Cure, M90, N·m (in·lb)	2.9 (25.5)	2.8 (24.9)	3.5 (31.1)	2.8 (25.1)	2.8 (25.1)
Time to 90% Cure, t'90, min	1.9	2.0	2.2	4.0	2.0
ODR at 177 °C (350 °F), 3°C Arc, 12 min Motor					
Minimum Viscosity, ML, N·m (in·lb)	2.3 (20.5)	1.5 (13.5)	4.3 (38)	2 (17.5)	2.2 (19.5)
Scorch Time, t_s2, min	1.7	2.0	1.7	2.9	1.8
Maximum Torque, M_H, N·m (in·lb)	13.8 (122)	13.3 (117.5)	15.6 (138)	11 (97.5)	13.3 (118)
50% Cure, M50, N·m (in·lb)	8.1 (71.3)	7.4 (65.5)	9.9 (88)	6.5 (57.5)	7.8 (68.8)
Time to 50% Cure, t'50, min	2.7	3.0	3.0	4.8	2.8
90% Cure, M90, N·m (in·lb)	12.6 (111.9)	12.1 (107.1)	14.5 (128)	10.1 (89.5)	12.2 (108.2)
Time to 90% Cure, t'90, min	3.2	3.4	4.6	5.5	3.2
Slabs Cured 10 min at 177 °C (350 °F) and Post-Cured 24 hr at 232 °C (450 °F)					
Stress/Strain—Original at 23 °C (73 °F)					
100% Modulus, MPa (psi)	6.6 (950)	6.4 (925)	7.7 (1,115)	5.6 (810)	6.8 (985)
Tensile Strength at Break, MPa (psi)	13.6 (1,975)	13.9 (2,020)	15.8 (2,295)	12.5 (1,815)	14.8 (2,140)
Elongation at Break, %	210	220	195	230	205
Hardness, Durometer A	73	73	72	74	71
Original, ASTM, Die C Tear, Tested at 23 °C (73 °F)					
kN·m, pli	23.7 (135)	22 (126)	21.4 (122)	20.9 (120)	21.9 (125)

Table 1. Polymer Comparison for Viton™ A-700 (continued)

	Viton™ A-700	Viton™ A-500	Viton™ AHV	Viton™ B-600	Viton™ AL-600
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F)					
100% Modulus, MPa (psi)	7.3 (1,060)	6.8 (980)	8.1 (1,170)	5.8 (845)	7 (1,020)
Tensile Strength at Break, MPa (psi)	15.2 (2,205)	14.9 (2,160)	15.4 (2,235)	15.3 (2,215)	15 (2,170)
Elongation at Break, %	200	220	185	245	205
Hardness, Durometer A	74	76	76	74	76
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 200 °C (392 °F)					
100% Modulus, MPa (psi)	7 (1,020)	6.3 (915)	7.3 (1,065)	5.4 (790)	6.8 (980)
Tensile Strength at Break, MPa (psi)	13.6 (1,965)	14.1 (2,050)	13.8 (2,000)	14.5 (2,105)	14.6 (2,115)
Elongation at Break, %	190	220	175	255	205
Hardness, Durometer A	73	75	73	75	74
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 250 °C (482 °F)					
100% Modulus, MPa (psi)	7.4 (1,070)	7.1 (1,030)	8.5 (1,230)	5.9 (855)	7.3 (1,065)
Tensile Strength at Break, MPa (psi)	15.2 (2,210)	15 (2,180)	15.9 (2,300)	15 (2,180)	15 (2,175)
Elongation at Break, %	195	210	180	235	185
Hardness, Durometer A	75	77	75	76	73
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 250 °C (482 °F)					
100% Modulus, MPa (psi)	7.4 (1,080)	7.1 (1,030)	8.3 (1,210)	6 (875)	7.3 (1,065)
Tensile Strength at Break, MPa (psi)	14.1 (2,040)	15.6 (2,255)	16.4 (2,385)	15.1 (2,195)	15.2 (2,200)
Elongation at Break, %	175	210	175	240	190
Hardness, Durometer A	74	78	75	76	73
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F) in IRM-902 Oil					
100% Modulus, MPa (psi)	6.7 (970)	6.3 (910)	7.8 (1,125)	5.4 (785)	6.7 (975)
Tensile Strength at Break, MPa (psi)	13.3 (1,925)	12.7 (1,845)	15.1 (2,185)	13 (1,880)	13.8 (2,000)
Elongation at Break, %	195	210	205	270	205
Hardness, Durometer A	73	74	72	71	70
% Change in Volume	2	4	2	1	2
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 23 °C (73 °F) in 85% Reg. Fuel °C/15% Methanol					
100% Modulus, MPa (psi)	4.8 (695)	4.5 (650)	5.6 (805)	3.6 (520)	4.8 (690)
Tensile Strength at Break, MPa (psi)	7.1 (1,025)	7.1 (1,025)	8 (1,155)	9.3 (1,345)	7.1 (1,035)
Elongation at Break, %	150	160	140	265	155
Hardness, Durometer A	62	62	64	63	60
% Change in Volume	29	29	28	16	29
Compression Set, Method B, O-Rings, %					
70 hr at 150 °C (302 °F)	8	5	5	14	6
70 hr at 200 °C (392 °F)	11	11	11	19	14
168 hr at 200 °C (392 °F)	18	19	15	29	18
22 hr at 232 °C (450 °F)	12	11	7	18	11
Temperature Retraction					
TR-10, °C	–16	–16	–14	–14	–19

Table 2. The Effect of Carbon Black Types and Levels

	N-990 65 phr	N-990 45 phr	N-990 30 phr	N-990 15 phr	N-990 5 phr	N-774 30 phr	N-550 30 phr
Viton™ A-700	97.50	97.50	97.50	97.50	97.50	97.50	97.50
MT Carbon Black (N-990)	65	45	30	15	5	—	—
SRF Carbon Black (N-774)	—	—	—	—	—	30	—
FEF Carbon Black (N-550)	—	—	—	—	—	—	30
Maglite® D	3	3	3	3	3	3	3
Calcium Hydroxide	6	6	6	6	6	6	6
Viton™ Curative No. 50	2.5	2.5	2.5	2.5	2.5	2.5	2.5
VPA No. 3	—	—	—	—	—	—	1.0
Mooney Scorch, MS at 121 °C (250 °F)							
Minimum Viscosity, units	84	73	64	57	51	75	89
Time to 1 pt rise, min	—	20	11	—	—	—	19
Time to 2 pt rise, min	—	—	—	—	—	—	24
Pts rise in 30 min	1	2	2	0	0	0	4
MDR at 177 °C (350 °F), 0.5° Arc, 6 min motor							
Minimum Viscosity, M_L, N·m (in·lb)	0.5 (4.8)	0.4 (3.5)	0.3 (2.5)	0.2 (2.1)	0.2 (1.8)	0.4 (3.4)	0.5 (4.6)
Scorch Time, t_s1, min	0.6	0.7	0.8	0.9	1.1	0.8	0.6
Maximum Torque, M_H, N·m (in·lb)	6.3 (55.9)	4.3 (38.1)	3.1 (27.8)	2.2 (19.2)	1.6 (14.5)	3.7 (32.5)	4 (35.5)
50% Cure, M50, N·M (in·lb)	3.4 (30.4)	2.3 (20.8)	1.7 (15.1)	1.2 (10.6)	0.9 (8.1)	2 (18)	2.3 (20)
Time to 50% Cure, t'50, min	1.3	1.2	1.3	1.2	1.3	1.5	1.2
90% Cure, M90, N·m (in·lb)	5.7 (50.8)	3.9 (34.6)	2.9 (25.2)	2 (17.5)	1.5 (13.2)	3.3 (29.6)	3.7 (32.4)
Time to 90% Cure, t'90, min	2.1	1.9	1.9	1.8	1.8	2.4	1.8
ODR at 177 °C (350 °F), Micro Die, 3 Arc, 12 min motor							
Minimum Viscosity, M_L, N·m (in·lb)	3 (26.5)	2.8 (25)	2.4 (21.5)	2.3 (20.5)	2.1 (19)	3 (26.5)	3.9 (34.5)
Scorch Time, t_s2, min	1.5	1.5	1.9	2.2	2.3	1.7	1.4
Maximum Torque, M_H, N·m (in·lb)	17.1 (151.5)	15.8 (140)	14.3 (126.5)	12.4 (110)	10.8 (96)	14.1 (124.5)	15.4 (136)
50% Cure, M50, N·M (in·lb)	10.1 (89)	9.3 (82.5)	8.4 (74)	7.4 (65.3)	6.5 (57.5)	8.5 (75.5)	9.6 (85.3)
Time to 50% Cure, t'50, min	2.6	2.5	3.0	3.3	3.4	3.0	2.6
90% Cure, M90, N·m (in·lb)	15.7 (139)	14.5 (128.5)	13.1 (116)	11.4 (101.1)	10 (88.3)	13 (114.7)	14.2 (125.9)
Time to 90% Cure, t'90, min	3.4	3.1	3.5	3.7	3.8	4.2	4.3
Slabs Cured 10 min at 177 °C (350 °F) and Post-Cured 24 hr at 232 °C (450 °F)							
Stress/Strain—Original at 23 °C (73 °F)							
100% Modulus, MPa (psi)	12 (1,740)	9.2 (1,335)	6.6 (955)	4.1 (600)	2.3 (340)	13.1 (1,895)	17.8 (2,585)
Tensile Strength, MPa (psi)	13.8 (1,995)	14.1 (2,045)	13.7 (1,980)	9.7 (1,410)	11.2 (1,625)	16.2 (2,355)	18.4 (2,675)
Elongation at Break, %	120	165	200	185	265	125	105
Hardness, Durometer A	90	81	75	64	58	83	84
Original, ASTM, Die C Tear, Tested at 23 °C (73 °F)							
kN·m (pli)	31.4 (179)	27.7 (158)	23.6 (135)	21.2 (121)	17.8 (101)	27.1 (155)	28.3 (161)

Table 2. The Effect of Carbon Black Types and Levels (continued)

	N-990 65 phr	N-990 45 phr	N-990 30 phr	N-990 15 phr	N-990 5 phr	N-774 30 phr	N-550 30 phr
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F)							
100% Modulus, MPa (psi)	12.9 (1,865)	9.5 (1,380)	6.7 (970)	4.4 (635)	2.6 (370)	13.4 (1,945)	0 (0)
Tensile Strength, MPa (psi)	15 (2,170)	15.6 (2,260)	14 (2,035)	12.8 (1,860)	11.1 (1,615)	16.2 (2,355)	17.7 (2,565)
Elongation at Break, %	120	170	200	225	240	120	100
Hardness, Durometer A	89	82	73	65	57	83	85
Stress/Strain at 23°C (73°F)— After aging 168 hr at 200 °C (392 °F)							
100% Modulus, MPa (psi)	12.8 (1,860)	9.7 (1,405)	7 (1,015)	4.5 (655)	2.6 (370)	13.6 (1,970)	0 (0)
Tensile Strength, MPa (psi)	15 (2,180)	15.6 (2,255)	14 (2,030)	11.8 (1,715)	11 (1,590)	15.7 (2,275)	17.6 (2,545)
Elongation at Break, %	125	175	200	210	240	115	95
Hardness, Durometer A	88	80	74	65	58	83	85
Stress/Strain at 23 °C (73 °F)— After aging 70 hr at 250 °C (482 °F)							
100% Modulus, MPa (psi)	14.2 (2065)	10.7 (1545)	7.7 (1110)	4.5 (655)	2.7 (390)	13.1 (1905)	16.9 (2445)
Tensile Strength, MPa (psi)	15.6 (2260)	15.9 (2300)	14.6 (2110)	13.6 (1965)	10.8 (1560)	14.7 (2125)	18.3 (2655)
Elongation at Break, %	110	155	180	220	225	110	105
Hardness, Durometer A	90	82	74	64	55	82	85
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 250 °C (482 °F)							
100% Modulus, MPa (psi)	14.5 (2,100)	10.9 (1,585)	7.3 (1,065)	4.2 (605)	2.4 (350)	12.4 (1,795)	16.1 (2,330)
Tensile Strength, MPa (psi)	15.1 (2,195)	15.8 (2,285)	14.5 (2,105)	13.4 (1,940)	9.3 (1,350)	14.6 (2,115)	17.3 (2,515)
Elongation at Break, %	110	150	180	225	210	115	110
Hardness, Durometer A	88	81	73	64	56	83	86
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F) in IRM-902 Oil							
100% Modulus, MPa (psi)	11.2 (1,620)	8.4 (1,215)	6.2 (905)	3.9 (565)	2.4 (355)	11.8 (1,710)	15.8 (2,285)
Tensile Strength, MPa (psi)	12.6 (1,825)	11.2 (1,630)	11.3 (1,635)	10.9 (1,575)	9.8 (1,425)	15.6 (2,260)	18.8 (2,730)
Elongation at Break, %	130	155	190	245	285	135	125
Hardness, Durometer A	87	79	73	63	57	80	84
% Change in Volume	2	2	2	1	3	2	2
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 23 °C (73 °F) in 85% Reg, Fuel °C/15% Methanol							
100% Modulus, MPa (psi)	8.3 (1210)	6.1 (890)	4.8 (695)	3.3 (480)	2.2 (320)	0 (0)	0 (0)
Tensile Strength, MPa (psi)	9.2 (1,340)	8 (1,155)	6.2 (905)	4.1 (595)	2.7 (395)	7.7 (1,120)	9.9 (1,435)
Elongation at Break, %	120	135	130	125	110	90	85
Hardness, Durometer A	74	65	61	52	47	67	71
% Change in Volume	25	29	32	38	43	31	31
Compression Set, Method B, O-Rings, %							
70 hr at 150 °C (302 °F)	16	11	9	10	14	14	15
70 hr at 200 °C (392 °F)	25	19	12	12	18	24	26
168 hr at 200 °C (392 °F)	31	22	18	17	15	28	31
22 hr at 232 °C (450 °F)	18	11	12	3	7	16	18
Temperature Retraction, using 50% elongation							
TR-10, °C	–16	–16	–16	–16	–16	–17	–18

Table 3. The Effect of Mineral Fillers

	N-990	Albaglos®	Nyad® 400	Blanc Fixe	Blanc Fixe	Celite® 350	Ti-Pure™ R-960
Viton™ A-700	97.50	97.50	97.50	97.50	97.50	97.50	97.50
MT Carbon Black (N-990)	30	—	—	—	—	—	—
Albaglos®	—	30	—	—	—	—	—
Nyad® 400	—	—	30	—	—	—	—
Blanc Fixe	—	—	—	30	60	—	—
Celite® 350	—	—	—	—	—	30	—
Ti-Pure™ R-960	—	—	—	—	—	—	30
Maglite® D	3	3	3	3	3	3	3
Calcium Hydroxide	6	6	6	6	6	6	6
Viton™ Curative No. 50	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Mooney Scorch, MS at 121 °C (250 °F)							
Minimum Viscosity, units	63	67	58	55	66	77	58
Time to 1 pt rise, min	13	22	—	—	—	—	—
Time to 2 pt rise, min	—	28	—	—	—	—	—
Pts rise in 30 min	1	2	0	0	0	0	0
MDR at 177 °C (350 °F), 0.5° Arc, 6 min motor							
Minimum Viscosity, M_L, N·m (in·lb)	0.3 (2.5)	0.4 (3.2)	0.3 (2.7)	0.3 (2.4)	0.4 (3.3)	0.4 (3.8)	0.3 (2.3)
Scorch Time, t_s1, min	0.9	0.7	0.8	0.9	0.7	0.8	0.9
Maximum Torque, M_H, N·m (in·lb)	3.1 (27.2)	2.5 (22.1)	2.3 (20.7)	2 (17.9)	2.7 (23.7)	3.3 (29.1)	1.9 (16.9)
50% Cure, M50, N·M (in·lb)	1.7 (14.8)	1.4 (12.7)	1.3 (11.7)	1.1 (10.1)	1.5 (13.5)	1.9 (16.4)	1.1 (9.6)
Time to 50% Cure, t'50, min	1.3	0.9	1.0	1.2	1.0	1.0	1.2
90% Cure, M90, N·m (in·lb)	2.8 (24.7)	2.3 (20.2)	2.1 (18.9)	1.8 (16.3)	2.4 (21.7)	3 (26.5)	1.7 (15.4)
Time to 90% Cure, t'90, min	1.9	1.2	1.4	1.7	1.6	1.5	1.8
ODR at 177 °C (350 °F), Micro Die, 3° Arc, 12 min motor							
Minimum Viscosity, M_L, N·m (in·lb)	2.3 (20.5)	3.2 (28.5)	2.8 (24.5)	2.7 (23.5)	3.1 (27.5)	3.2 (28.5)	2.5 (22.5)
Scorch Time, t_s2, min	1.8	1.7	1.6	2.1	1.5	1.6	1.9
Maximum Torque, M_H, N·m (in·lb)	14 (124)	13.9 (123)	13.4 (118.5)	12.1 (107)	13.4 (119)	15.1 (134)	11.6 (103)
50% Cure, M50, N·M (in·lb)	8.2 (72.3)	8.6 (75.8)	8.1 (71.5)	7.4 (65.3)	8.3 (73.3)	9.2 (81.3)	7.1 (62.8)
Time to 50% Cure, t'50, min	2.8	2.5	2.4	3.0	2.4	2.4	3.0
90% Cure, M90, N·m (in·lb)	12.8 (113.7)	12.8 (113.6)	12.3 (109.1)	11.1 (98.7)	12.4 (109.9)	13.9 (123.5)	10.7 (95)
Time to 90% Cure, t'90, min	3.3	3.0	2.7	3.5	3.1	2.8	3.7
Slabs Cured 10 min at 177 °C (350 °F) and Post-Cured 24 hr at 232 °C (450 °F)							
Stress/Strain—Original at 23 °C (73 °F)							
100% Modulus, MPa (psi)	6.9 (1,000)	6.6 (950)	10.3 (1,495)	4.1 (600)	6.5 (945)	—	4.9 (710)
Tensile Strength, MPa (psi)	13.5 (1,960)	11.4 (1,660)	12.1 (1,755)	12 (1,740)	12.1 (1,750)	14.5 (2,100)	12.7 (1,840)
Elongation at Break, %	200	155	130	230	180	100	185
Hardness, Durometer A	73	69	68	63	61	78	66
Original, ASTM, Die C Tear, Tested at 23 °C (73 °F)							
kN·m (pli)	23.7 (135)	17.7 (101)	18.6 (106)	18.5 (106)	21.7 (124)	20.8 (119)	20.4 (116)

Table 3. The Effect of Mineral Fillers (continued)

	N-990	Albaglos®	Nyad® 400	Blanc Fixe	Blanc Fixe	Celite® 350	Ti-Pure™ R-960
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F)							
100% Modulus, MPa (psi)	7.4 (1,075)	7.7 (1,120)	5.7 (825)	4.3 (620)	6.8 (980)	14.2 (2,065)	5.6 (815)
Tensile Strength, MPa (psi)	14.3 (2,080)	10.3 (1,500)	10.7 (1,555)	12.4 (1,800)	11.3 (1,635)	14.4 (2,095)	12.8 (1,860)
Elongation at Break, %	200	130	185	230	165	100	175
Hardness, Durometer A	73	70	70	68	71	77	67
Stress/Strain at 23°C (73°F)— After aging 168 hr at 200 °C (392 °F)							
100% Modulus, MPa (psi)	7 (1,015)	8 (1,165)	5.9 (860)	4.5 (655)	7.6 (1,105)	0 (0)	5.8 (835)
Tensile Strength, MPa (psi)	14 (2,030)	10.6 (1,540)	11.5 (1,670)	12.1 (1,755)	11.4 (1,650)	15.3 (2,225)	12 (1,735)
Elongation at Break, %	195	125	175	200	145	95	160
Hardness, Durometer A	74	70	69	64	70	77	67
Stress/Strain at 23 °C (73 °F)— After aging 70 hr at 250 °C (482 °F)							
100% Modulus, MPa (psi)	7.5 (1,090)	7.9 (1,150)	9.7 (1,410)	3.7 (540)	6.8 (990)	14.2 (2,066)	5.2 (760)
Tensile Strength, MPa (psi)	14.6 (2,115)	10.4 (1,515)	12.1 (1,755)	11.9 (1,720)	10.8 (1,560)	14.4 (2,095)	13.8 (2,005)
Elongation at Break, %	175	125	140	230	160	100	185
Hardness, Durometer A	74	71	69	63	73	77	67
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 250 °C (482 °F)							
100% Modulus, MPa (psi)	7.3 (1,065)	8.9 (1,295)	8.6 (1,250)	3.9 (570)	7 (1,020)	12.7 (1,835)	5.2 (755)
Tensile Strength, MPa (psi)	14 (2,035)	10.8 (1,565)	11.2 (1,630)	12.1 (1,750)	11.8 (1,715)	13.8 (2,005)	13.4 (1,940)
Elongation at Break, %	175	120	145	230	165	120	190
Hardness, Durometer A	76	72	69	63	72	79	67
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F) in IRM-902 Oil							
100% Modulus, MPa (psi)	6.8 (985)	8.2 (1,190)	0 (0)	4.9 (705)	7.4 (1,075)	0 (0)	5.5 (795)
Tensile Strength, MPa (psi)	12.4 (1,800)	11 (1,600)	10 (1,450)	12.7 (1,835)	12.8 (1,860)	12.9 (1,865)	12.1 (1,760)
Elongation at Break, %	190	125	95	195	170	85	165
Hardness, Durometer A	71	66	66	60	70	76	63
% Change in Volume	2	2	2	3	2	2	2
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 23 °C (73 °F) in 85% Reg. Fuel °C/15% Methanol							
100% Modulus, MPa (psi)	4.6 (670)	0 (0)	0 (0)	3.1 (450)	3.5 (505)	5.8 (835)	3.3 (475)
Tensile Strength, MPa (psi)	6 (866)	3.7 (535)	3.1 (450)	3.8 (545)	4.6 (660)	6 (866)	4.6 (660)
Elongation at Break, %	130	90	65	120	135	105	135
Hardness, Durometer A	59	57	8	52	57	64	53
% Change in Volume	31	31	31	32	31	31	33
Compression Set, Method B, O-Rings, %							
70 hr at 150 °C (302 °F)	8	6	6	6	6	6	7
70 hr at 200 °C (392 °F)	12	14	14	15	15	15	15
168 hr at 200 °C (392 °F)	18	25	23	24	24	25	23
22 hr at 232 °C (450 °F)	12	14	12	7	14	14	14
Temperature Retraction (Only Compound #245 tested using 50% elongation)							
TR-10, °C	–16	–16	–16	–16	–16	–15	–16

Table 4. The Effect of Curative and Acid Acceptor Levels

	A-4	B-4	C-4	D-4	E-4	F-4
Viton® A-700	97.0	97.5	98.0	98.5	97.5	97.5
MT Carbon Black (N-990)	30	30	30	30	30	30
Maglite® D	3	3	3	3	6	3
Calcium Hydroxide	6	6	6	6	3	3
Viton® Curative No. 50	3.0	2.5	2.0	1.5	2.5	2.5
Mooney Scorch, MS at 121 °C (250 °F)						
Minimum Viscosity, unit	62	62	60	62	58	55
Time to 1 pt rise, min	9	13	27	—	11	15
Time to 2 pt rise, min	17	—	—	—	—	—
Pts rise in 30 min	3	2	1	0	2	2
MDR at 177 °C (350 °F), 0.5° Arc, 6 min rotor						
Minimum Viscosity, M_L, N·m (in·lb)	0.3 (2.5)	0.3 (2.5)	0.3 (2.6)	0.3 (2.7)	0.3 (2.4)	0.3 (2.2)
Scorch Time, t_s1, min	0.9	0.8	0.7	0.7	0.8	1.1
Maximum Torque, M_H, N·m (in·lb)	3.8 (33.4)	3.1 (27.9)	2.6 (22.9)	1.9 (17)	3 (26.4)	3.1 (27.3)
50% Cure, M50, N·m (in·lb)	2 (18)	1.7 (15.2)	1.4 (12.8)	1.1 (9.8)	1.6 (14.4)	1.7 (14.7)
Time to 50% Cure, t'50, min	1.5	1.3	1.1	1.0	1.4	2.0
90% Cure, M90, N·m (in·lb)	3.4 (30.3)	2.9 (25.3)	2.4 (20.9)	1.8 (15.6)	2.7 (24)	2.8 (24.7)
Time to 90% Cure, t'90, min	2.3	2.0	1.7	1.6	2.2	3.2
ODR at 177 °C (350 °F), 3° Arc, 12 min rotor						
Minimum Viscosity, M_L, N·m (in·lb)	2.1 (19)	2.2 (19.5)	2.4 (21)	2.5 (22)	2.2 (19.5)	2 (17.5)
Scorch Time, t_s2, min	1.9	1.7	1.8	1.4	1.9	2.5
Maximum Torque, M_H, N·m (in·lb)	16.1 (142.5)	14.1 (125)	11.9 (105.5)	9.5 (84)	13.5 (119.5)	14 (123.5)
50% Cure, M50, N·m (in·lb)	9.1 (80.8)	8.2 (72.3)	7.1 (63.3)	6 (53)	7.9 (69.5)	8 (70.5)
Time to 50% Cure, t'50, min	3.1	2.7	2.8	2.3	3.2	4.2
90% Cure, M90, N·m (in·lb)	14.7 (130.2)	12.9 (114.5)	11 (97.1)	8.8 (77.8)	12.4 (109.5)	12.8 (112.9)
Time to 90% Cure, t'90, min	3.8	3.3	3.4	3.4	3.9	4.9
Slabs Cured 10 min at 177 °C (350 °F) and Post-Cured 24 hr at 232 °C (450 °F)						
Stress/Strain—Original at 23 °C (73 °F)						
100% Modulus, MPa (psi)	7.9 (1,150)	6.9 (1,000)	5.5 (800)	4.3 (625)	6.1 (880)	5.9 (855)
Tensile Strength at Break, MPa (psi)	12.7 (1,845)	14.2 (2,060)	14.1 (2,040)	14.8 (2,150)	13.8 (1,995)	12.8 (1,855)
Elongation at Break, %	160	200	235	290	215	210
Hardness, Durometer A	76	73	73	69	72	72
Original, ASTM, Die C Tear, Tested at 23 °C (73 °F)						
kN·m (pli)	21.3 (122)	24.3 (139)	23.6 (135)	24.5 (140)	24 (137)	21.4 (122)

Table 4. The Effect of Curative and Acid Acceptor Levels (continued)

	A-4	B-4	C-4	D-4	E-4	F-4
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F)						
100% Modulus, MPa (psi)	7.8 (1,135)	7.3 (1,055)	5.9 (850)	4.6 (670)	6.4 (925)	6.2 (905)
Tensile Strength at Break, MPa (psi)	13.8 (1,995)	14.1 (2,045)	13.8 (2,000)	14.1 (2,045)	13.8 (1,995)	13.5 (1,955)
Elongation at Break, %	170	190	225	275	205	205
Hardness, Durometer A	76	74	74	71	74	74
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 200 °C (392 °F)						
100% Modulus, MPa (psi)	8.8 (1,280)	7 (1,010)	6.1 (885)	4.9 (715)	6.6 (960)	6.3 (915)
Tensile Strength at Break, MPa (psi)	14.3 (2,075)	14.2 (2,065)	15 (2,175)	15 (2,180)	14.3 (2,070)	14.1 (2,045)
Elongation at Break, %	165	200	230	265	205	210
Hardness, Durometer A	76	75	71	74	75	73
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 250 °C (482 °F)						
100% Modulus, MPa (psi)	8.9 (1,285)	7.5 (1,085)	5.9 (860)	4.7 (685)	6.6 (955)	6.5 (940)
Tensile Strength at Break, MPa (psi)	14.1 (2,050)	14.6 (2,110)	13.9 (2,020)	14.1 (2,045)	14.4 (2,085)	14.3 (2,080)
Elongation at Break, %	155	180	205	245	195	200
Hardness, Durometer A	76	74	73	71	73	74
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 250 °C (482 °F)						
100% Modulus, MPa (psi)	8.1 (1,180)	7.1 (1,025)	5.8 (835)	4.5 (650)	6.2 (905)	6.1 (880)
Tensile Strength at Break, MPa (psi)	14 (2,025)	13.4 (1,945)	14.1 (2,040)	13.7 (1,980)	14.2 (2,055)	13.4 (1,950)
Elongation at Break, %	165	175	220	250	200	200
Hardness, Durometer A	77	74	73	71	73	73
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F) in IRM-903 Oil						
100% Modulus, MPa (psi)	8.4 (1,215)	6.9 (1,005)	5.8 (835)	4.3 (630)	5.8 (845)	6 (865)
Tensile Strength at Break, MPa (psi)	12.4 (1,795)	13.4 (1,940)	12.8 (1,855)	12.9 (1,875)	12.9 (1,875)	12.1 (1,760)
Elongation at Break, %	165	210	245	295	250	230
Hardness, Durometer A	76	73	71	70	73	78
% Change in Volume	3	3	2	3	2	3
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 23 °C (73 °F) in 85% Reg. Fuel °C/15% Methanol						
100% Modulus, MPa (psi)	5.9 (855)	4.8 (700)	4 (575)	2.9 (415)	4.2 (605)	4.3 (625)
Tensile Strength at Break, MPa (psi)	6.4 (935)	6.8 (985)	6.9 (1,005)	7.8 (1,130)	6.6 (950)	5.6 (810)
Elongation at Break, %	110	140	180	245	155	135
Hardness, Durometer A	65	61	58	52	60	62
% Change in Volume	30	30	30	31	29	30
Compression Set, Method B, O-Rings, %						
70 hr at 150 °C (302 °F)	4	8	10	17	9	5
70 hr at 200 °C (392 °F)	11	14	16	20	13	12
168 hr at 150 °C (302 °F)	19	20	21	30	23	21
22 hr at 232 °C (450 °F)	12	9	11	18	10	10

Test Procedures

Property Measured	Test Procedure
Compression Set	ASTM D395-89, Method B (25% deflection)
Compression Set, O-Rings	ASTM D1414
Hardness	ASTM D2240-91, durometer A
Mooney Scorch	ASTM D1646, using the small rotor. Minimum viscosity and time to a 1-, 2-, 5-, and 10-unit rise are reported.
Mooney Viscosity	ASTM D1646, ten pass, 121 °C (250 °F)
ODR (vulcanization characteristics measured with an oscillating disk cure meter)	ASTM D2084
Property Change After Oven Heat-Aging	ASTM D573
Stress/Strain Properties	ASTM D412, dumbell specimens tested at 50 m/min (20 in/min)
Volume Change in Fluids	ASTM D471
Temperature Retraction	ASTM D1329

All testing conducted at 23 °C (73 °F) unless otherwise specified.