Viton™ GBL-600S

Fluoroelastomers

Technical Information

Introduction

Viton™ GBL-600S is a next generation, easy processing, peroxide-cured 68% fluorine fluoroelastomer based on new Advanced Polymer Architecture (APA) technology.

Features

- Cures exceptionally fast to a high state of cure
- Exhibits improved mold release/mold fouling properties compared to Viton™ GBL-200
- Exhibits improved mold flow, less shear sensitivity, and lower extruder die swell for a 65 Mooney FKM
- Exhibits excellent physical properties with high elongation, both original and aged
- Exhibits similar heat, fluids, and low temperature resistance compared to Viton™ GBL-200
- Exhibits excellent compression set resistance with short (2 hr) or no post-cure

Processing

A load factor of >70% for internal mixing of Viton™ GBL-600S is recommended. The recommended process aids for Viton™ GBL-600S are 1 phr of Struktol® HT 290 or combinations of 0.5 phr Armeen® 18D with carnauba wax or Struktol® WS 280. The use of Diak™ No. 8 is NOT recommended, as it causes poor mold release and high compression set. Diak™ No. 7 (TAIC) is the recommended coagent for all Viton™ GBL-600S compounds and is usually used at a 2.5 phr level or lower, unless high modulus is needed. High levels of TAIC can bleed out and cause molding flaws.

Safety and Handling

Before handling or processing Viton™ GBL-600S, be sure to read and be guided by the suggestions in the Chemours technical bulletin, "Handling Precautions for Viton™ and Related Chemicals."

Product Description

Chemical Composition	Copolymer of hexafluoropropylene, vinylidene fluoride, and tetrafluoroethylene with a cure site monomer
Physical Form	Sheet
Appearance	Off-white
Odor	None
Mooney Viscosity, ML 1 + 10 at 121 °C (250 °F)	65
Specific Gravity	1.84
Storage Stability	Excellent
Fluorine, %	~68

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Table 1. Comparison of General Properties of Viton™ GBL-600S

		Viton™ GBL-600S
Viton™ GBL-600S		100
Zinc Oxide		3
N990 (MT Black)		30
Diak™ No. 7 (TAIC)		3
Luperox® 101XL 45		3
Total phr		139
Mooney Scorch at 121 °C (250 °F)		
Minimum, MU		31
2 pt Rise, min		23.6
5 pt Rise, min		25.1
10 pt Rise, min		25.8
ODR at 162 °C (324 °F), 3° Arc, 100 Range, 30 min Clock		
ML, dN.m		16
ts2, min		1.1
t'50, min		2.1
t'90, min		3.2
MH, dN.m		144
MDR 2000 at 177 °C (351 °F), 0.5° Arc, 100 Range, 6 min Clock		
ML, dN.m		1.7
ts2, min		0.4
t'50, min		0.6
t'90, min		0.9
t'95, min		1.1
MH, dN.m		27.8
Rosand Capillary Rheometer at 100 °C (212 °F), 1.5 mm Die, L/D = 0/1 and 10/1		
Piston Speed, mm/min	*Shear Rate, sec^{-1}*	*Pressure, MPa (L/D = 0/1 die)*
5	44	4.4
12.7	113	5.3
50.8	452	6.8
127	1,129	8.1
250	2,222	9.9
Physical Properties at RT—Original, Cured 7 min at 177 °C (351 °F), No Post-Cure		
M10, MPa		0.6
M100, MPa		3.3
Tb, MPa		13.5
Eb, %		332
Hardness, A, pts		67
Hot Tear Strength at 150 °C (302 °F)—Original, Cured 7 min at 177 °C (351 °F), No Post-Cure		
Tear Die B, N/mm		10.4
Physical Properties at RT—Original, Cured 7 min at 177 °C (351 °F), Post-Cured at 232 °C (450 °F)		*2 hr*
M10, MPa		0.7
M100, MPa		4.4
Tb, MPa		20.4
Eb, %		324
Hardness, A, pts		69

continued

Table 1. Comparison of General Properties of Viton™ GBL-600S (continued)

	Viton™ GBL-600S
Compression Set, Method B, O-Rings	
22 hr at 200 °C (392 °F)	
– No Post-cure	17
– Post-cured at 232 °C (450 °F)	14
336 hr at 200 °C (392 °F)	
– No Post-cure	53
– Post-cured at 232 °C (450 °F)	56
Physical Properties at RT—Heat-Aged 70 hr at 250 °C (482 °F) in Oven (Slabs Post-Cured)	
M10, MPa	0.8
M100, MPa	4.3
Tb, MPa	20.8
Eb, %	306
Hardness, A, pts	71
Pt Change	2
% Change, M10	14
% Change, M100	–1
% Change, Tb	2
% Change, Eb	–6
Physical Properties at RT—Heat-Aged 70 hr at 275 °C (527 °F) in Oven (Slabs Post-Cured)	
M10, MPa	0.8
M100, MPa	3.5
Tb, MPa	15.7
Eb, %	405
Hardness, A, pts	70
Pt Change	1
% Change, M10	7
% Change, M100	–21
% Change, Tb	–23
% Change, Eb	25
Physical Properties at RT—Heat-Aged 168 hr at 150 °C (302 °F) in Oven (Slabs Post-Cured)	
M10, MPa	1.1
M100, MPa	5.1
Tb, MPa	10.1
Eb, %	158
Hardness, A, pts	73
Pt Change	4
% Change, M10	49
% Change, M100	18
% Change, Tb	–51
% Change, Eb	–51
Volume Swell, %	0.9
Volume Swell After Immersion—Time and Temperature as Noted	
Fuel C, 168 hr at 23 °C (73 °F)	3.5
Methanol, 168 hr at 23 °C (73 °F)	54.5
Water, 168 hr at 100 °C (212 °F)	4.3
Compound Specific Gravity	1.860

Table 2. Viton™ GBL-600S—Filler Study

Table 2 is a filler study where various levels of MT Black and different mineral fillers are tested in GBL-600S. The compounds all contain the process aid Armeen® 18D.

	5-MT Black	30-MT Black	60-MT Black	40-Woolastocoat	40-$BaSO_4$
Viton™ GBL-600S	100	100	100	100	100
N990 (MT Black)	5	30	60	—	—
Wollastocoat	—	—	—	40	—
Blanc Fixe (BaS04)	—	—	—	—	40
Armeen® 18D	0.5	0.5	0.5	0.5	0.5
Diak™ No. 7 (TAIC)	3	3	3	3	3
Varox® DBPH-50	3	3	3	3	3
Total phr	111.5	136.5	166.5	146.5	146.5
Mooney Scorch at 121 °C (250 °F)					
Minimum, MU	24	28	39	32	25
2 pt Rise, min	19.5	10.7	6.9	17.3 2	20.6
5 pt Rise, min	>30	13.2	9.3	18.3	21.8
10 pt Rise, min	—	15.2	11.9	19.7	23.8
ODR at 162 °C (324 °F), 3° Arc, 100 Range, 30 min Clock					
ML, dN.m	10	15	17	18	16
ts2, min	2.3	0.8	0.6	0.8	0.9
t'50, min	4.2	1.3	1.2	1.3	1.5
t'90, min	5.4	2.7	2.6	2.0	2.9
MH, dN.m	49	138	173	128	114
MDR 2000 at 177 °C (351 °F), 0.5° Arc, 100 Range, 6 min Clock					
ML, dN.m	0.9	1.6	2.7	1.8	1.5
ts2, min	0.8	0.4	0.3	0.4	0.5
t'50, min	1.1	0.6	0.6	0.6	0.6
t'90, min	2.0	1.0	1.4	0.8	0.9
t'95, min	2.6	1.4	2.1	1.0	1.1
MH, dN.m	16.6	26.7	45.5	25.4	20.7
Physical Properties at RT—Original, Cured 5 min at 177 °C (351 °F), No Post-Cure					
M10, MPa	0.4	0.8	1.4	0.9	0.5
M100, MPa	1.3	3.0	5.9	3.5	1.5
Tb, MPa	11.0	10.7	10.0	11.6	12.2
Eb, %	423	379	300	423	441
Hardness, A, pts	52	69	82	67	60
Physical Properties at RT—Original, Cured 5 min at 177 °C (351 °F), Post-Cured 2 hr at 232 °C (450 °F)					
M10, MPa	0.4	0.9	2.1	0.9	0.6
M100, MPa	1.4	3.9	8.6	5.4	1.8
Tb, MPa	11.7	16.3	16.4	14.5	11.6
Eb, %	379	335	240	406	419
Hardness, A, pts	55	74	87	70	64

continued

Table 2. Viton™ GBL-600S—Filler Study (continued)

	5-MT Black	30-MT Black	60-MT Black	40-Woolastocoat	40-$BaSO_4$
Physical Properties at RT—Heat-Aged 70 hr at 250 °C (482 °F) in Oven					
M10, MPa	0.3	1.1	2.9	1.0	0.6
M100, MPa	1.2	4.8	10.2	7.7	3.0
Tb, MPa	19.5	18.4	19.1	13.2	15.2
Eb, %	492	341	200	285	440
Hardness, A, pts	56	77	87	71	66
Pt Change	1	3	0	1	2
% Change, M10	–11	24	39	6	5
% Change, M100	–12	22	18	41	60
% Change, Tb	67	13	17	–9	31
% Change, Eb	30	2	–17	–30	5
Physical Properties at RT—Heat-Aged 70 hr at 250 °C (482 °F) in Oven					
M10, MPa	0.4	1.1	3.2	1.2	0.7
M100, MPa	1.5	5.2	9.3	7.0	2.1
Tb, MPa	4.7	10.2	11.7	8.4	3.9
Eb, %	268	179	127	132	253
Hardness, A, pts	58	76	89	73	66
Pt Change	3	2	2	3	2
% Change, M10	–5	22	49	36	18
% Change, M100	10	33	9	29	14
% Change, Tb	–60	–37	–29	–43	–66
% Change, Eb	–29	–46	–47	–68	–40
Volume Change, %	1.4	1.2	1.1	1.2	1.5
Compression Set, Method B, O-Rings	*2 hr*	*2 hr*	*2 hr*	*2 hr*	*2 hr*
22 hr at 200 °C (392 °F)					
– No Post-cure	21	34	37	24	43
– Post-cured at 232 °C (450 °F)	17	29	31	21	28
Volume Swell After Immersion					
Fuel C, 168 hr at 23 °C (73 °F)	6.9	6.0	5.9	4.7	4.9
Methanol, 168 hr at 23 °C (73 °F)	77	51	37	61	78
Water, 168 hr at 100 °C (212 °F)	6.7	3.9	4.0	8.6	9.7
Compound Specific Gravity	1.84	1.84	1.84	2.05	2.19

Table 3. Viton™ GBL-600S—Process Aid Study

In Table 3, various process aids are evaluated in Viton™ GBL-600S. While Armeen® 18D is the preferred process aid, due to its excellent mold release, it can be seen that Armeen® accelerates the cure rate and hurts scorch life. Armeen® also seems to retard the completion of cure in the short post-cure cycle. Compounds with Armeen® do better with a 6 hr, rather than 2 hr, post-cure. Struktol® WS280 and carnauba wax did not seem to affect scorch life as much as Armeen®. Compounds with 1–1.5 phr of process aid seems to need the longer 6–8 hr post-cure to optimize properties. Struktol® WS280 seems to aid mold flow best, followed by carnauba wax (see spider mold results). New process aid Struktol® HT290 was developed after this study was run; but, recent results indicate that at a 1 phr level, it tends to be superior to a 0.5 phr Armeen® 18D/Strucktol® WS280 system.

		A26-01 Viton™ GBL-600S No PA	A26-02 8650 0.5 phr 18D	A26-03 8650 0.5 phr WS280	A26-04 8650 1 phr Carnauba Wax	A26-05 0.5 phr 18D WS280	A26-06 0.8 phr 18D WS280
Viton™ GBL-600S		100	100	100	100	100	100
Zinc Oxide		3	3	3	3	3	3
N990 (MT Black)		30	30	30	30	30	30
Armeen® 18D		—	0.5	—	—	0.5	0.8
Struktol® WS280		—	—	0.5	—	0.5	0.8
Carnauba Wax		—	—	—	1	—	—
Diak™ No. 7 (TAIC)		3	3	3	3	3	3
Varox® DBPH-50		2	2	2	2	2	2
Total phr		138	138.5	138.5	139	139	139.6
Banbury mixed "right side up" (polymer/metal oxide/N990/peroxide in—ram down) with process aids and TAIC added at a 70 °C (158 °F) sweep							
Mooney Scorch at 121 °C (250 °F)							
Minimum, MU		36	30	35	31	29	28
2 pt Rise, min		>30	9.6	>30	29.8	12.3	>10.9
5 pt Rise, min		—	12.8	—	>30	15.6	14.6
10 pt Rise, min		—	15.9	—	—	18.4	17.9
MDR 2000 at 177 °C (351 °F), 0.5° Arc, 100 Range, 6 min Clock							
ML, dN.m		1.7	1.5	1.6	1.5	1.5	1.5
ts2, min		0.5	0.4	0.5	0.5	0.4	0.4
t'50, min		0.7	0.7	0.7	0.7	0.7	0.7
t'90, min		1.2	1.1	1.1	1.2	1.2	1.2
t'95, min		1.5	1.5	1.4	1.6	1.6	1.6
MH, dN.m		27.6	25.5	28.4	26.4	25.7	23.8
Rosand Capillary Rheometer at 100 °C (212 °F), 1.5 mm Die, L/D = 0/1 and 10/1							
Piston Speed, mm/min	*Shear Rate, sec^{-1}*	*Pressure, MPa (L/D = 0/1 short die)*					
5	44	4.0	2.9	0.9	3.2	2.8	1.0
12.7	113	4.9	3.9	4.6	4.1	3.8	3.5
50.8	452	6.3	5.6	6.2	5.6	5.4	5.0
127	1,129	7.4	7.3	7.8	7.1	6.9	6.5
250	2,221	8.9	9.1	9.4	8.8	8.6	8.3
Spider Mold Flow Test—Sprue 0.0625 in (~1.6 mm), Cured 7 min at 177 °C (351 °F)							
Total Shot Weight, g		31.7	31.9	31.9	32.0	31.9	31.4
Weight of Spider, g		12.5	11.7	20.6	18.7	16.1	18.5
Fill Factor, %		39	37	64	58	51	59

continued

Table 3. Viton™ GBL-600S—Process Aid Study (continued)

	A26-01 Viton™ GBL-600S No PA	A26-02 8650 0.5 phr 18D	A26-03 8650 0.5 phr WS280	A26-04 8650 1 phr Carnauba Wax	A26-05 0.5 phr 18D WS280	A26-06 0.8 phr 18D WS280
Physical Properties at RT—Original, Cured 7 min at 177 °C (351 °F), No Post-Cure						
M10, MPa	0.7	0.7	0.7	0.9	0.7	0.8
M100, MPa	2.9	2.7	2.9	2.9	2.7	2.7
Tb, MPa	12.0	10.9	10.2	10.5	10.8	10.8
Eb, %	370	407	271	380	416	434
Hardness, A, pts	67	67	67	70	68	67
Physical Properties at RT—Original, Cured 7 min at 177 °C (351 °F), 2 hr Post-Cured at 232 °C (450 °F)						
M10, MPa	0.8	0.9	0.6	1.0	0.8	1.0
M100, MPa	3.8	3.5	3.5	3.4	3.2	3.3
Tb, MPa	16.3	14.0	16.4	12.3	12.4	11.4
Eb, %	321	362	337	361	364	379
Hardness, A, pts	69	71	71	73	72	73
Physical Properties at RT—Original, Cured 7 min at 177 °C (351 °F), 5.5 hr Post-Cured at 232 °C (450 °F)						
M10, MPa	0.8	1.0	0.8	1.0	1.0	1.2
M100, MPa	3.8	3.9	3.9	3.8	3.8	4.1
Tb, MPa	17.8	18.5	18.7	16.7	17.5	18.2
Eb, %	295	314	305	336	317	364
Hardness, A, pts	71	74	72	74	72	76
Physical Properties at RT—Original, Cured 7 min at 177 °C (351 °F), 8 hr Post-Cured at 232 °C (450 °F)						
M10, MPa	0.8	1.0	0.8	1.1	1.0	1.2
M100, MPa	3.8	4.2	4.0	4.0	4.0	4.2
Tb, MPa	18.9	20.3	18.5	18.4	18.9	18.0
Eb, %	312	354	293	339	345	325
Hardness, A, pts	71	74	72	75	75	76
Physical Properties at RT—Heat-Aged 70 hr at 250 °C (482 °F) Oven (After 2 hr at 232 °C [450 °F] Post-Cure)						
M10, MPa	0.8	1.1	0.9	1.2	1.1	1.29
M100, MPa	3.7	4.5	4.0	4.8	4.4	4.8
Tb, MPa	18.1	19.2	19.9	19.6	19.6	18.6
Eb, %	296	300	321	313	323	336
Hardness, A, pts	71	74	72	76	75	77
Pt Change	2	3	1	3	3	4
% Change, M10	7	19	9	21	30	29
% Change, M100	4	29	14	42	39	46
% Change, Tb	11	38	21	59	58	63
% Change, Eb	−8	−17	−5	−13	−11	−11
Physical Properties at RT—Heat-Aged 70 hr at 250 °C (482 °F) Oven (After 5.5 hr at 232 °C [450 °F] Post-Cure)						
M10, MPa	0.8	1.1	0.9	1.2	1.1	1.32
M100, MPa	3.8	4.5	4.0	4.8	4.6	5.0
Tb, MPa	18.4	19.2	20.3	19.5	19.3	18.7
Eb, %	296	303	335	306	323	327
Hardness, A, pts	71	74	72	76	76	77
Pt Change	0	0	0	2	4	1
% Change, M10	3	6	10	19	8	9
% Change, M100	2	15	2	28	21	20
% Change, Tb	3	4	9	17	11	2
% Change, Eb	1	−4	10	−9	2	−10

continued

Table 3. Viton™ GBL-600S—Process Aid Study (continued)

	A26-01 Viton™ GBL-600S No PA	A26-02 8650 0.5 phr 18D	A26-03 8650 0.5 phr WS280	A26-04 8650 1 phr Carnauba Wax	A26-05 0.5 phr 18D WS280	A26-06 0.8 phr 18D WS280
Physical Properties at RT—Heat-Aged 70 hr at 250 °C (482 °F) Oven (After 8 hr at 232 °C [450 °F] Post-Cure)						
M10, MPa	0.8	1.1	0.9	1.2	1.1	1.29
M100, MPa	3.6	4.6	4.1	4.8	4.6	5.0
Tb, MPa	18.7	19.0	20.4	19.6	20.1	19.1
Eb, %	317	302	336	309	334	344
Hardness, A, pts	72	75	72	76	76	77
Pt Change	1	1	0	1	1	1
% Change, M10	7	4	9	11	8	8
% Change, M100	–4	10	2	21	16	18
% Change, Tb	–1	–6	11	7	7	7
% Change, Eb	2	–15	14	–9	–3	6
Compression Set, Method B, O-Rings						
22 hr at 200 °C (392 °F)						
– No Post-cure	20	31	19	27	34	49
– Post-cured 2 hr at 232 °C (450 °F)	14	20	13	20	20	29
– Post-cured 5.5 hr at 232 °C (450 °F)	16	20	14	19	20	23
– Post-cured 8 hr at 232 °C (450 °F)	14	19	13	14	16	21
70 hr at 200 °C (392 °F)						
– No Post-cure	30	47	29	43	49	63
– Post-cured 2 hr at 232 °C (450 °F)	26	34	23	33	36	46
– Post-cured 5.5 hr at 232 °C (450 °F)	24	29	21	21	31	37
– Post-cured 8 hr at 232 °C (450 °F)	24	29	23	23	29	39
Compression Set, Method B, Plied Discs						
22 hr at 200 °C (392 °F)						
– Post-cured 2 hr at 232 °C (450 °F)	10	15	10	14	16	22
– Post-cured 5.5 hr at 232 °C (450 °F)	11	14	11	13	16	21
– Post-cured 8 hr at 232 °C (450 °F)	12	15	11	14	16	20
70 hr at 200 °C (392 °F)						
– Post-cured 2 hr at 232 °C (450 °F)	12	25	13	20	25	34
– Post-cured 5.5 hr at 232 °C (450 °F)	17	20	14	17	21	27
– Post-cured 8 hr at 232 °C (450 °F)	18	23	16	18	23	30
Volume Swell After Immersion—Time and Temperature as Noted						
Fuel C, 168 hr at 23 °C (73 °F)	12	25	13	20	25	34
CM15 Fuel, 168 hr at 23 °C (73 °F)	17	20	14	17	21	27
Water, 168 hr at 100 °C (212 °F)	18	23	16	18	23	30
Low Temperature Properties, Tg by DSC, °C						
– No Post-cure	–22.4	–22.4	–21.8	–21.2	–21.8	–21.8
– Post-cured 2 hr	–19.2	–18.8	–18.6	–18.6	–18.8	–18.8
– Post-cured 5.5 hr	–18.7	–18.3	–18.1	–18.2	–18.6	–18.9
– Post-cured 8 hr	–18.7	–18.9	–18.5	–18.0	–18.3	–18.5

Table 4. Viton™ GBL-600S—Screening DOE on Diak™ No. 7 Peroxide Levels

A screening design of experiments (DOE) was run on commercial Viton™ GBL600-S, where levels of peroxide and Diak™ No. 7 (TAIC) coagent were varied from 0.5–5 phr. The data shows that, as expected, the Diak™ No. 7 is the primary cross-linker controlling the state-of-cure, and the peroxide controls the rate-of-cure that affects the scorch and cure speed of this new Advanced Polymer Architecture (APA) technology Viton™ fluoroelastomer. It should be noted that 0.5 phr of peroxide and coagent is too low for good curing; a level of 1.0 phr and above is better.

	A03-01	A03-02	A03-03	A03-04	A03-05	A03-06	A03-07	A03-08	A03-09	A03-10
Viton™ GBL-600S	100	100	100	100	100	100	100	100	100	100
Zinc Oxide	3	3	3	3	3	3	3	3	3	3
N990 (MT Black)	30	30	30	30	30	30	30	30	30	30
Diak™ No. 7 (TAIC)	0.5	0.5	0.5	2.75	2.75	2.75	2.75	5	5	5
Luperox® 101XL45	0.5	2.75	5	0.5	2.75	2.75	5	0.5	2.75	5
Total phr	134	136.25	138.5	136.25	138.5	138.5	140.75	138.5	140.75	143
Mooney Scorch at 121 °C (250 °F)										
Minimum, MU	42	39	36	36	34	34	32	31	29	26
2 pt Rise, min	>30	>30	27.8	>30	23.9	28.1	11.6	>30	19.3	11.6
5 pt Rise, min	—	—	>30	—	25.5	>30	13.1	—	21.4	12.9
10 pt Rise, min	—	—	—	—	28.8	—	14.2	—	23.1	14.0
ODR at 162 °C (324 °F), 3° Arc, 100 Range, 30 min Clock										
ML, dN.m	18	18	18	15	16	16	17	13	14	15
ts2, min	4.7	2.3	1.4	2.5	1.3	1.5	1.0	2.5	1.3	1.1
t'50, min	15.5	5.1	2.9	5.8	2.7	2.9	2.0	6.0	2.5	2.2
t'90, min	24.8	8.5	4.5	9.9	5.5	4.6	3.9	9.9	3.8	3.7
MH, dN.m	91	113	121	135	140	142	155	108	130	157
MDR 2000 at 177 °C (351 °F), 0.5° Arc, 100 Range, 6 min Clock										
ML, dN.m	1.9	2.1	2.2	1.6	1.9	1.8	2.1	1.3	1.7	1.8
ts2, min	1.5	0.6	0.5	0.7	0.4	0.4	0.3	0.7	0.4	0.3
t'50, min	2.7	0.9	0.6	1.4	0.6	0.6	0.5	1.7	0.6	0.5
t'90, min	4.9	1.6	0.9	2.8	1.0	1.1	0.7	3.6	1.0	0.8
t'95, min	5.4	2.1	1.2	3.6	1.3	1.5	0.9	4.3	1.4	1.1
MH, dN.m	15.4	22.2	21.6	28.2	29.4	29.5	28.8	30.2	32.4	32.6
Spider Mold Flow Test—0.0625 in, 1.6 mm Sprue/1900 psi, ~131 bar Transfer Pressure, Cured 5 min at 177 °C (351 °F)										
Spider Weight, g	24.2	17.8	15.8	17.1	12.2	14.5	13.5	18.1	16.2	20.4
Scrap in Transfer Pot, g	7.7	13.7	16.1	15.4	19.7	17.5	18.4	13.8	15.6	10.8
Fill Factor, %	76	57	49	53	38	45	42	57	51	65
Physical Properties at RT—Original, Cured 5 min at 177 °C (351 °F), No Post-Cure										
M10, MPa	0.7	0.7	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.9
M100, MPa	1.8	2.5	2.5	2.9	3.5	3.5	3.8	3.4	4.2	4.7
Tb, MPa	6.1	8.7	9.2	11.9	13.9	13.6	13.5	14.9	16.6	15.4
Eb, %	671	476	456	408	347	333	323	394	323	273
Hardness, A, pts	65	64	64	66	68	68	69	69	69	71

continued

Table 4. Viton™ GBL-600S—Screening DOE on Diak™ No. 7 Peroxide Levels (continued)

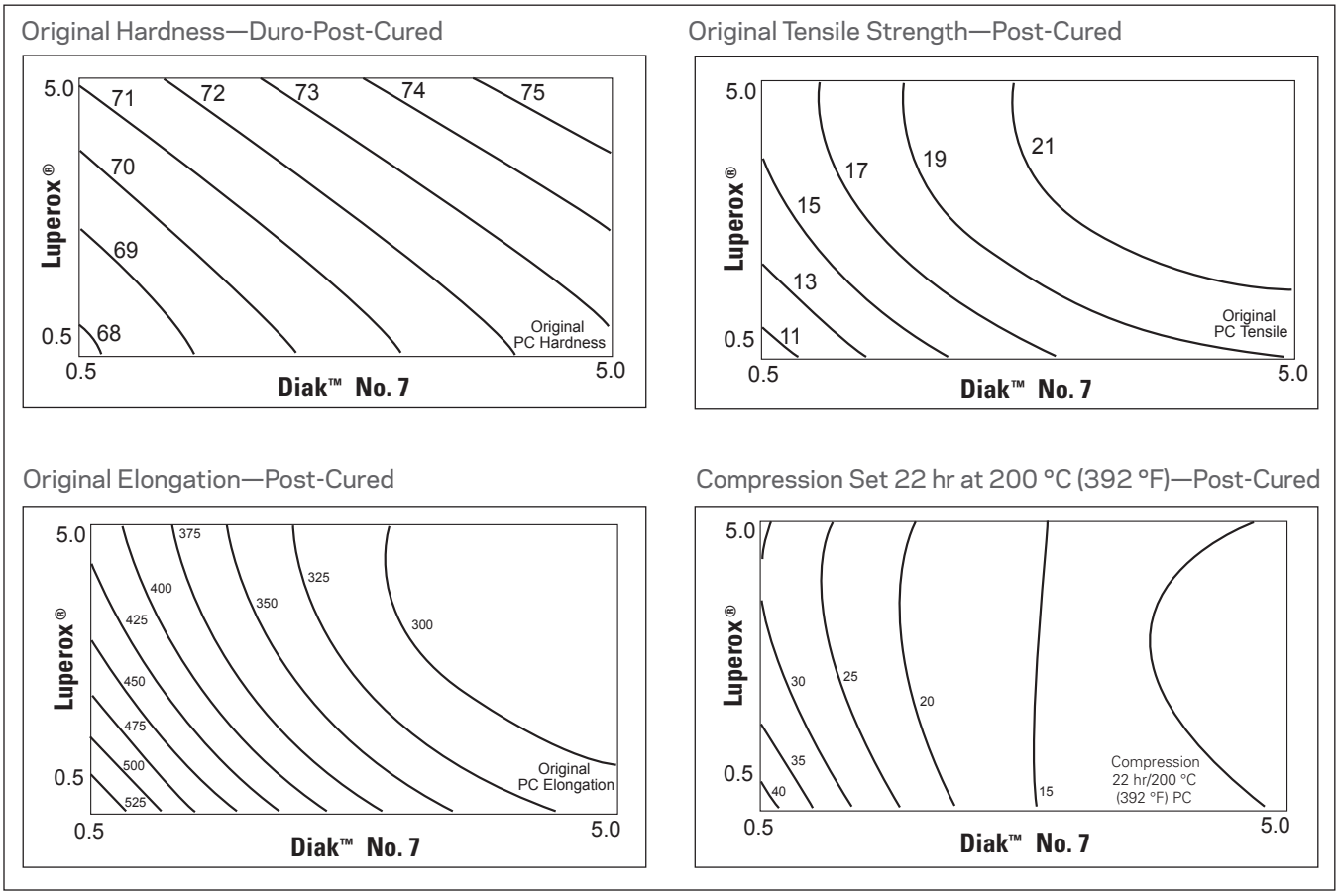
	A42-01	A42-02	A42-03	A42-04	A42-05	A42-06	A42-07	A42-08	A42-09	A42-10
Diak™ No. 7/TAIC level	0.5	0.5	0.5	2.75	2.75	2.75	2.75	5	5	5
Luperox® 101XL level	0.5	2.75	5	0.6	2.75	2.75	5	0.5	2.75	5
Physical Properties at RT—Original, Cured 5 min at 177 °C (351 °F), Post-Cured 2 hr at 232 °C (450 °F)										
M10, MPa	0.8	0.9	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.2
M100, MPa	2.0	3.0	3.1	3.6	4.2	4.3	4.6	4.1	5.4	6.3
Tb, MPa	9.1	14.3	15.9	18.1	19.8	19.8	20.4	18.0	22.9	23.1
Eb, %	567	440	424	380	335	314	315	312	300	278
Hardness, A, pts	68	69	71	70	72	72	74	73	74	76
Compression Set, Method B, O-Rings, 22 hr at 200 °C (392 °F)										
No Post-Cure	63	36	43	24	23	21	24	20	20	23
Post-Cured 2 hr at 232 °C (450 °F)	44	29	32	13	16	20	13	17	17	17
Physical Properties at RT—Heat-Aged 70 hr at 250 °C (482 °F) in Oven (Run on Post-Cured Samples)										
M100, MPa	2.6	3.0	3.0	3.4	4.0	4.0	4.6	4.0	5.0	5.7
Tb, MPa	13.7	14.0	13.4	19.0	18.4	18.6	18.0	20.3	20.6	20.9
Eb, %	592	503	470	430	386	384	356	341	303	310
Hardness, A, pts	72	72	74	72	74	74	75	73	75	78
Pt Change	4	3	3	2	2	2	1	0	1	2
% Change, M100	30	0	−3	−6	−5	−6	−1	−2	−8	−9
% Change, Tb	51	−3	−16	5	−7	−6	−12	12	−10	−10
% Change, Eb	4	14	11	13	15	22	13	9	1	12
Physical Properties at RT—Heat-Aged 70 hr at 275 °C (527 °F) in Oven										
M100, MPa	2.2	2.3	2.4	3.0	3.2	3.4	3.6	4.0	4.5	5.0
Tb, MPa	9.8	8.6	8.1	13.7	12.5	12.9	12.0	15.5	14.6	13.9
Eb, %	548	503	478	390	397	394	379	378	336	327
Hardness, A, pts	72	72	73	72	73	74	75	74	76	79
Pt Change	4	3	2	2	1	2	1	1	2	3
% Change, M100	11	−23	−25	−16	−23	−20	−23	—	−18	−20
% Change, Tb	8	−40	−49	−24	−37	−35	−41	−14	−36	−40
% Change, Eb	−3	14	13	3	19	26	21	21	12	17
Physical Properties at RT—ASTM Test Oil 1006, Aged 168 hr at 150 °C (302 °F) in Oven										
M100, MPa	2.9	3.9	4.1	4.4	5.5	5.2	6.1	4.9	6.7	7.2
Tb, MPa	9.0	10.3	9.9	12.0	12.0	12.0	11.9	12.6	12.6	13.2
Eb, %	344	236	224	215	183	184	177	205	161	168
Hardness, A, pts	72	73	75	73	75	76	77	74	77	78
Pt Change	4	4	4	3	3	4	3	1	3	2
% Change, M100	45	32	30	23	32	23	32	19	23	14
% Change, Tb	−1	−28	−37	−34	−39	−39	−42	−30	−45	−43
% Change, Eb	−39	−46	−47	−43	−46	−41	−44	−34	−46	−40
Volume Change, %	1	1	1	1	1	1	1	1	1	1
Physical Properties at RT—Fuel C, Aged 168 hr at 40 °C (104 °F) in Oven										
M100, MPa	1.2	2.0	2.2	2.5	3.3	3.4	3.6	2.9	4.0	4.4
Tb, MPa	7.8	12.8	13.3	13.7	15.4	14.8	15.5	14.5	15.8	16.0
Eb, %	628	433	437	327	298	277	294	311	247	246
Hardness, A, pts	72	73	75	73	75	76	77	74	77	78
Pt Change	4	4	4	3	3	4	3	1	3	2
% Change, M100	−41	−31	−29	−32	−22	−21	−22	−29	−27	−30
% Change, Tb	−15	−11	−16	−24	−22	−25	−24	−19	−31	−31
% Change, Eb	11	−2	3	−14	−11	−12	−7	0	−18	−11
Volume Change, %	13	12	12	12	12	12	12	12	12	12

continued

Table 4. Viton™ GBL-600S—Screening DOE on Diak™ No. 7 Peroxide Levels (continued)

	A42-01	A42-02	A42-03	A42-04	A42-05	A42-06	A42-07	A42-08	A42-09	A42-10
Physical Properties at RT—Water, Distilled, Aged 168 hr at 100 °C (212 °F) in Oven										
M100, MPa	2.1	2.9	3.0	3.6	4.3	4.1	4.5	4.0	5.4	5.6
Tb, MPa	11.7	15.6	16.4	16.3	18.6	18.6	19.3	17.2	19.8	20.1
Eb, %	573	469	448	358	329	344	345	352	318	287
Hardness, A, pts	69	70	70	70	71	71	72	72	72	74
Pt Change	1	1	−1	0	−1	−1	−2	−1	−2	−2
% Change, M100	5	−3	−3	1	3	−4	−3	−2	−1	−11
% Change, Tb	29	9	3	−10	−6	−6	−5	−5	−14	−13
% Change, Eb	1	7	6	−6	−2	10	10	13	6	3
Volume Change, %	5	3	6	4	4	3	5	3	4	4
Physical Properties at RT—Sulfuric Acid 96% Aged 168 hr at 70 °C (158 °F)										
M100, MPa	2.5	3.6	3.9	3.9	4.9	4.7	5.5	4.3	5.8	6.5
Tb, MPa	11.3	16.8	17.9	19.2	20.8	21.0	21.4	20.3	22.3	24.3
Eb, %	525	420	383	379	326	339	322	345	295	288
Hardness, A, pts	71	72	72	71	73	74	75	73	75	77
Pt Change	3	3	1	1	1	2	1	0	1	1
% Change, M100	27	21	25	9	18	11	19	5	6	4
% Change, Tb	25	17	13	7	6	6	5	13	−3	5
% Change, Eb	−7	−5	−10	0	−3	8	2	10	−2	4
Volume Change, %	2	2	3	2	2	2	3	2	2	2

Figure 1.



Test Procedures

Property Measured	Test Procedure
Compression Set	ASTM D3955, Method B (25% deflection)
Compression Set—Low Temperature	ASTM D1299, Method B (25% deflection)
Compression Set, O-Rings	ASTM 1414
Hardness	ASTM D2240, durometer A
Mooney Scorch	ASTM D1646, using the small rotor. Minimum viscosity and time to a 1-, 5-, or 10-unit rise are reported.
Mooney Viscosity	ASTM D1646, ten pass 100 °C (212 °F) and 121 °C (250 °F) (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 100% Modulus Tensile Strength) Elongation at Break	ASTM D412, pulled at 8.5 mm/sec (20 in/min)
Stiffness, Torsional, Clash-Berg	ASTM D1043
Temperature Retraction	ASTM D1329
Volume Change In Fluids	ASTM D471

Test temperature is 24 °C (75 °F), except where specified otherwise.

For more information, visit Viton.com

Replaces: VTE-A10086-00-D0710
C-11011 (10/16)