



Viton® B-651C

Introduction

Viton® B-651C* is an incorporated cure “B-family” terpolymer that demonstrates improved processing properties and better metal adhesion when compared with older “B-family” terpolymer fluoroelastomers. The improved properties provide excellent compound flow in molding (injection, transfer, compression) bonded parts where the heat and fluid characteristics of a “B-family” Viton® are needed.

Compared with older “B-family” terpolymers, Viton® B-651C features:

- Fully precompounded with curative and metal adhesion promoter
- Improved processing
 - better mixing
 - increased mold flow
 - easier mold release with less mold fouling
 - better demolding “hot tear”
- Good metal bonding with standard industrial primers

Applications

- Compression, transfer, and injection molding of:
 - O-rings and gaskets
 - Valve stem and crankshaft seals (and other bonded parts requiring terpolymer characteristics)
- Complex-shaped parts

Use of Viton® B-651C

Table 1 compares compounds of Viton® B-651C, Viton® B, and Viton® B-50. *Table 2* compares the effects of carbon black levels in Viton® B-651C, and *Table 3* compares the use of mineral fillers in Viton® B-651C.

Product Description

Chemical Composition	Terpolymer of hexa-fluoropropylene, vinylidene fluoride and tetrafluoroethylene, plus cure chemicals and metal adhesion promoter
Physical Form	Slab
Color	Off-white
Odor	None
Specific Gravity	1.84
Solubility	Low molecular weight esters and ketones
Storage Stability	Excellent
Mooney Viscosity (ML 1 + 10 at 121°C [250°F])	60

Safety and Handling

Before handling or processing Viton® B-651C, read and follow the recommendations in the DuPont Dow Elastomers technical bulletin “Handling Precautions for Viton® and Related Chemicals.”

Viton® B-651C should be handled like other types of Viton®. Keep off skin and wash well after handling. For the safe handling of other compounding ingredients, refer to the respective manufacturers’ literature.

*Viton® B-651C was formerly VT-R-6581.

Table 1
The Performance of Viton® B-651C in Typical Compounds

	A Viton® B-651C	B Viton® B	C Viton® B-50	D Viton® B-651C "Shaft Seal Compounds"	E Viton® B-651C
Viton® B-651C	100	—	—	100	100
Viton® B	—	94.4	—	—	—
Viton® B-50	—	—	94.4	—	—
High-Activity MgO	3	3	3	6	6
Calcium Hydroxide	6	6	6	3	3
MT Black (N990)	30	30	30	30	—
Nyad® 400 ¹	—	—	—	—	20
Blanc Fixe	—	—	—	—	20
Carnauba Wax	—	—	—	0.5	0.5
Viton® Curative #20	—	2	2	—	—
Viton® Curative #30	—	3.6	3.6	—	—
Stock Properties					
Viscosity, ML 1 + 10 at 121°C [250°F]					
Units	107	144	115	105	107
Mooney Scorch, MS at 121°C [250°F]					
Minimum, in-lb	60	77	57	56	58
5-pt rise, min	>30	8.9	6.9	23.6	>30
ODR at 177°C [350°F], Microdie, 3° Arc, 15 min					
M _L , in-lb	27	32	20	28	30
t _{s2} , min	1.7	3.1	3.8	1.7	1.9
t _{c90} , min	3.2	6.5	7.6	3.9	3.4
M _{c90} , in-lb	73	93	73	79	81
M _H , in-lb	78	100	79	85	86
Rosand Capillary Rheometer at 100°C [212°F], 1.5 mm Die, L/D = 0/1					
<i>Piston Speeds</i>	<i>Shear Rate</i>	<i>Pressure, MPa</i>			
12.7 mm/min	113 s ⁻¹	6.1	8.9	7.7	6.4
50.8 mm/min	452 s ⁻¹	8.3	15.2	10.8	8.7
127 mm/min	1130 s ⁻¹	10.9	27.7	13.9	11.2
Vulcanizate Properties					
Slabs Cure: 10 min at 177°C [350°F] Post Cure: 24 hr at 232°C [450°F]					
Stress/Strain at 23°C [73°F]—Original, no post cure					
100% Modulus, MPa [psi]	3.1 [455]	4.9 [715]	4.1 [600]	3.2 [460]	3.3 [475]
Tensile Strength, MPa [psi]	9.8 [1420]	10.4 [1515]	8.7 [1265]	9.3 [1350]	10.3 [1500]
Elongation at Break, %	392	281	305	383	409
Hardness, durometer A, points	77	80	82	77	70
Stress/Strain at 23°C [73°F]—Original, post cure					
100% Modulus, MPa [psi]	4.3 [630]	7.4 [1080]	6.9 [995]	5.0 [725]	5.9 [850]
Tensile Strength, MPa [psi]	13.9 [2015]	14.3 [2075]	12.7 [1840]	14.4 [2085]	11.2 [1630]
Elongation at Break, %	270	190	186	227	214
Hardness, durometer A, points	77	82	84	79	72
Stress/Strain at 23°C [73°F]—After aging 70 hr at 200°C [392°F]					
100% Modulus, MPa [psi]	4.6 [665]	7.2 [1050]	6.8 [980]	4.9 [715]	6.0 [875]
Tensile Strength, MPa [psi]	13.8 [2005]	14.0 [2030]	13.0 [1890]	14.3 [2080]	11.3 [1645]
Elongation at Break, %	261	188	191	232	215
Hardness, durometer A, points	77	81	82	78	70
Stress/Strain at 23°C [73°F]—After aging 168 hr at 200°C [392°F]					
100% Modulus, MPa [psi]	4.4 [635]	7.2 [1045]	6.7 [975]	5.1 [735]	5.2 [760]
Tensile Strength, MPa [psi]	13.5 [1960]	13.8 [2005]	13.2 [1910]	14.3 [2075]	11.4 [1660]
Elongation at Break, %	256	193	191	237	251
Hardness, durometer A, points	78	79	83	77	70
Stress/Strain at 23°C [73°F]—After aging 70 hr at 232°C [450°F]					
100% Modulus, MPa [psi]	4.5 [650]	7.8 [1125]	7.6 [1095]	4.9 [705]	5.5 [800]
Tensile Strength, MPa [psi]	14.1 [2040]	13.6 [1965]	13.2 [1910]	14.0 [2030]	11.3 [1640]
Elongation at Break, %	241	165	166	225	230
Hardness, durometer A, points	77	82	83	78	70
Compression Set, Method B, O-rings, %					
70 hr at 23°C [73°F]	24	12	18	24	18
70 hr at 200°C [392°F]	31	38	44	31	28
70 hr at 232°C [450°F]	47	53	72	54	43
Fluid Resistance, Volume Swell, %					
Fuel C, 168 hr at 23°C [73°F]	2	2	2	2	2
ASTM #3 Oil, 168 hr at 150°C [302°F]	4	4	4	4	5
Adhesion to Metal (Steel), 90° Peel (primed with 50%/50% Chemlok®¹ 607/methanol)					
No post cure, N/mm [pli]	—	—	—	22.7 [127]*	16.8 [94]*

¹Trademark of Lord Corporation *Stock Tear

Table 2
The Effect of Carbon Black Level in Viton® B-651C

	F 60 phr	G 45 phr	H 30 phr	I 15 phr	J 5 phr	K 2 phr
Viton® B-651C	100	100	100	100	100	100
High-Activity MgO	3	3	3	3	3	3
Calcium Hydroxide	6	6	6	6	6	6
MT Black (N990)	60	45	30	15	5	2
Stock Properties						
Viscosity, ML 1 + 10 at 121°C [250°F]						
Units	142	122	107	89	83	81
Mooney Scorch, MS at 121°C [250°F]						
Minimum, in·lb	76	64	60	48	45	43
5-pt rise, min	21.9	25.7	>30	>30	>30	>30
ODR at 177°C [350°F], Microdie, 3° Arc, 15 min						
M _L , in·lb	32	30	27	24	22	21
t _{s2} , min	1.4	1.6	1.7	2.4	2.8	2.9
t _{c90} , min	3.3	3.4	3.2	4.0	4.5	4.6
M _{c90} , in·lb	88	85	73	82	76	73
M _H , in·lb	94	92	78	88	82	79
Vulcanizate Properties						
Slabs Cure: 10 min at 177°C [350°F] Post Cure: 24 hr at 232°C [450°F]						
Stress/Strain at 23°C [73°F]—Original, no post cure						
100% Modulus, MPa [psi]	5.6[815]	4.5[655]	3.1[455]	2.1[310]	1.4[210]	1.2[180]
Tensile Strength, MPa [psi]	9.0[1310]	9.6[1385]	9.8[1420]	9.0[1305]	7.6[1095]	7.8[1130]
Elongation at Break, %	326	355	392	352	341	372
Hardness, durometer A, points	87	83	77	68	60	58
Stress/Strain at 23°C [73°F]—Original, post cure						
100% Modulus, MPa [psi]	8.0[1165]	6.4[935]	4.3[630]	2.6[370]	1.5[220]	1.3[190]
Tensile Strength, MPa [psi]	13.4[1940]	12.9[1870]	13.9[2015]	12.1[1760]	9.8[1420]	9.2[1340]
Elongation at Break, %	200	219	270	294	310	340
Hardness, durometer A, points	89	87	77	68	60	57
Stress/Strain at 23°C [73°F]—After aging 70 hr at 200°C [392°F]						
100% Modulus, MPa [psi]	8.5[1235]	6.3[920]	4.6[665]	2.7[390]	1.6[225]	1.3[195]
Tensile Strength, MPa [psi]	13.4[1950]	12.6[1820]	13.8[2005]	12.3[1790]	9.4[1370]	8.9[1295]
Elongation at Break, %	179	207	261	287	292	322
Hardness, durometer A, points	87	86	77	67	55	50
Stress/Strain at 23°C [73°F]—After aging 168 hr at 200°C [392°F]						
100% Modulus, MPa [psi]	8.7[1255]	6.9[1000]	4.4[635]	2.7[385]	1.6[225]	1.3[185]
Tensile Strength, MPa [psi]	13.4[1940]	13.7[1980]	13.5[1960]	12.5[1810]	9.6[1390]	8.3[1200]
Elongation at Break, %	176	209	256	289	293	309
Hardness, durometer A, points	90	88	78	67	55	56
Stress/Strain at 23°C [73°F]—After aging 70 hr at 232°C [450°F]						
100% Modulus, MPa [psi]	8.4[1215]	6.9[995]	4.5[650]	2.6[370]	1.5[220]	1.3[185]
Tensile Strength, MPa [psi]	12.7[1840]	13.2[1910]	14.1[2040]	11.9[1730]	8.9[1285]	8.1[1175]
Elongation at Break, %	163	192	241	267	279	307
Hardness, durometer A, points	88	86	77	68	58	56
Compression Set, Method B, O-rings, %						
70 hr at 23°C [73°F]	21	18	24	10	9	6
70 hr at 200°C [392°F]	40	29	31	21	18	21
70 hr at 232°C [450°F]	69	57	47	43	43	44
Fluid Resistance, Volume Swell, %						
ASTM #3 Oil, 168 hr at 150°C [302°F]	1	1	2	2	2	2
Fuel C, 168 hr at 23°C [73°F]	3	4	4	5	6	6

Table 3
The Effect of Mineral Fillers in Viton® B-651C

	L MT Black	M Albaglos®	N Nyad® 400	O Celite® 350	P Blanc Fixe	Q Ti-Pure® R960
Viton® B-651C	100	100	100	100	100	100
High-Activity MgO	3	3	3	3	3	3
Calcium Hydroxide	6	6	6	6	6	6
MT Black (N990)	30	—	—	—	—	—
Albaglos®	—	30	—	—	—	—
Nyad® 400	—	—	30	—	—	—
Celite® 350	—	—	—	30	—	—
Blanc Fixe	—	—	—	—	30	—
Ti-Pure® R960	—	—	—	—	—	30
Stock Properties						
Viscosity, ML 1 + 10 at 121°C [250°F]						
Units	107	114	111	136	104	105
Mooney Scorch, MS at 121°C [250°F]						
Minimum, in·lb	60	60	58	73	55	55
5-pt rise, min	>30	>30	>30	>30	>30	>30
ODR at 177°C [350°F], Microdie, 3° Arc, 15 min						
M _L , in·lb	27	30	29	33	27	28
t _{s2} , min	1.7	2.0	2.3	2.0	2.4	2.4
t _{c90} , min	3.2	3.3	3.5	3.2	3.8	4.0
M _{c90} , in·lb	73	84	84	82	81	73
M _H , in·lb	78	90	90	88	87	78
Vulcanizate Properties						
Slabs Cure: 10 min at 177°C [350°F]						
Post Cure: 24 hr at 232°C [450°F]						
Stress/Strain at 23°C [73°F]—Original, no post cure						
100% Modulus, MPa [psi]	3.1 [455]	2.8 [405]	3.9 [560]	5.1 [740]	2.0 [290]	2.0 [295]
Tensile Strength, MPa [psi]	9.8 [1420]	11.4 [1650]	8.6 [1240]	9.9 [1435]	9.7 [1405]	10.0 [1450]
Elongation at Break, %	392	357	367	335	395	429
Hardness, durometer A, points	77	71	68	78	64	67
Stress/Strain at 23°C [73°F]—Original, post cure						
100% Modulus, MPa [psi]	4.3 [630]	3.4 [500]	6.7 [975]	10.7 [1550]	2.5 [360]	2.5 [360]
Tensile Strength, MPa [psi]	13.9 [2015]	15.1 [2185]	11.1 [1615]	16.4 [2380]	12.2 [1775]	13.5 [1960]
Elongation at Break, %	270	277	227	172	335	303
Hardness, durometer A, points	77	69	70	78	65	67
Stress/Strain at 23°C [73°F]—After aging 70 hr at 200°C [392°F]						
100% Modulus, MPa [psi]	4.6 [665]	3.5 [505]	6.8 [985]	11.2 [1620]	2.6 [370]	2.5 [360]
Tensile Strength, MPa [psi]	13.8 [2005]	13.8 [1995]	11.1 [1605]	16.3 [2365]	11.9 [1730]	14.7 [2125]
Elongation at Break, %	261	232	213	153	294	294
Hardness, durometer A, points	77	66	68	79	63	66
Stress/Strain at 23°C [73°F]—After aging 168 hr at 200°C [392°F]						
100% Modulus, MPa [psi]	4.4 [635]	3.6 [525]	7.0 [1010]	11.8 [1715]	2.4 [350]	2.3 [340]
Tensile Strength, MPa [psi]	13.5 [1960]	14.9 [2165]	11.2 [1620]	17.4 [2520]	12.5 [1810]	14.3 [2080]
Elongation at Break, %	256	244	212	157	319	290
Hardness, durometer A, points	78	70	71	75	61	65
Stress/Strain at 23°C [73°F]—After aging 70 hr at 232°C [450°F]						
100% Modulus, MPa [psi]	4.5 [650]	3.6 [520]	6.7 [965]	11.3 [1640]	2.3 [340]	2.3 [335]
Tensile Strength, MPa [psi]	14.1 [2040]	14.1 [2050]	11.0 [1600]	17.0 [2460]	11.3 [1640]	14.1 [2045]
Elongation at Break, %	241	237	217	162	296	293
Hardness, durometer A, points	77	67	68	80	63	65
Compression Set, Method B, O-rings, %						
70 hr at 23°C [73°F]	24	18	15	21	15	18
70 hr at 200°C [392°F]	31	25	22	28	24	29
70 hr at 232°C [450°F]	47	52	41	50	43	49
Fluid Resistance, Volume Swell, %						
ASTM #3 Oil, 168 hr at 150°C [302°F]	2	2	2	2	2	2
Fuel C, 168 hr at 23°C [73°F]	4	5	4	4	5	4

Test Procedures

Property Measured	Test Procedure
Compression Set	ASTM D395, Method B (25% deflection)
Compression Set, O-Rings	ASTM D1414
Hardness	ASTM D2240, durometer A
Mooney Scorch	ASTM D1646, using 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 100% Modulus Tensile Strength Elongation at Break	ASTM D412, pulled at 8.5 mm/s (20 in/min)
Volume Change in Fluids	ASTM D471

Note: Test temperature is 24°C [75°F] except where specified otherwise.

Proprietary Materials

Sources of compounding ingredients used in developing the information in this bulletin are listed below. This is not to imply that comparable ingredients from other sources might not be equally usable.

Material	Composition	Supplier
Albaglos®	Calcium Carbonate (precipitated)	Pfizer, Inc. M.P.M. Division New York, NY 10017
Blanc Fixe	Barium Sulfate (precipitated)	Whittaker, Clark & Daniels (Distributor) South Plainfield, NJ 07080
Celite® 350	Diatomaceous Silica	Manville Corp. & Subsidiaries Denver, CO 80217
Nyad 400®	Calcium Metasilicate	Interpace Corporation Parsippany, NJ 07054
Ti-Pure® R960	Rutile Titanium Oxide	DuPont Company Wilmington, DE 19898

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