Viton™ A-331C

Fluoroelastomers

Technical Information

Introduction

Viton™ A-331C* is an incorporated cure "A-family" dipolymer designed for the injection and transfer of molding parts requiring improved demolding "hot tear" resistance. The moderate viscosity level of Viton™ A-331C also allows for satisfactory compression molding of parts.

Features

- Intermediate viscosity level (when compared with related O-ring polymers Viton™ A-202C and Viton™ A-402C)
- Fully precompounded
  - Reduced curative level
  - Incorporated process aid
- Improved processing
  - Increased mold flow
  - Better mold release with less mold fouling
  - Improved demolding "hot tear"
- Good compression set resistance

Product Description

Chemical Composition	Dipolymer of hexafluoropropylene and vinylidene fluoride plus cure chemicals
Physical Form	Sheet
Appearance	Off-white
Odor	None
Mooney Viscosity, ML 1 + 10 at 121 °C (250 °F)	30
Specific Gravity	1.82
Storage Stability	Excellent
Solubility	Low molecular weight esters and ketones

*Viton™ A-331C was formerly VTR-6676.

Applications

- Injection, transfer, and compression molding of:
  - O-rings, seals, and gaskets
  - Other profiles requiring improved demolding "hot tear"
  - Extruded O-ring cord, hose, and other profiles

Safety and Handling

Before handling or processing Viton™ A-331C, read and follow the recommendations in the Chemours technical bulletin, "Handling Precautions for Viton™ and Related Chemicals."

Viton™ A-331C 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.

Chemours™

Table 1. Performance of Viton™ A-331C in Typical Compounds

	Viton™ A-331C	Viton™ E-60	Viton™ A-202C	Viton™ A-402C
Viton™ A-331C	100	—	—	—
Viton™ E-60	—	96	—	—
Viton™ A-202C	—	—	100	—
Viton™ A-402C	—	—	—	100
High-Activity MgO	3	3	3	3
Calcium Hydroxide	6	6	6	6
MT Black (N990)	30	30	30	30
VPA #3	—	1	—	—
Viton™ Curative #20	—	1.5	—	—
Viton™ Curative #30	—	2.5	—	—
Stock Properties				
Viscosity, ML 1 + 10 at 121 °C (250 °F), Units	65	73	54	77
Mooney Scorch, MS at 121 °C (250°F)				
Minimum, in·lb	34	39	29	41
2-pt rise, min	25.8	16.6	>30	29.1
5-pt rise, min	>30	21.7	—	>30
ODR at 177 °C (350 °F), Microdie, 3° Arc, 15 min				
M_L, in·lb	16	18	12	20
t_s2, min	1.4	1.5	1.8	1.6
t_c90, min	3.0	4.8	3.0	3.1
M_c90, in·lb	77	79	111	119
M_H, in·lb	83	85	121	130
Rosand Capillary Rheometer at 100 °C (212 °F), 1.5 mm Die, L/D = 0/1				
Piston Speeds *Shear Rate*			*Pressure, MPa*	
12.7 mm/min 113 s^{-1}	6.9	7.6	7.2	7.8
50.8 mm/min 452 s^{-1}	10.1	13.2	11.5	11.4
127 mm/min 1,130 s^{-1}	16.0	30.9	18.5	18.4
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)	3.3 (475)	4.4 (645)	4.8 (700)
Tensile Strength, MPa (psi)	9.7 (1,410)	8.6 (1,240)	9.1 (1,320)	9.4 (1,370)
Elongation at Break, %	351	304	243	225
Hardness, durometer A, points	71	74	76	78
Stress/Strain at 23 °C (73 °F)—Original, post-cure				
100% Modulus, MPa (psi)	4.5 (655)	5.0 (720)	6.8 (980)	7.1 (1,030)
Tensile Strength, MPa (psi)	13.5 (1,955)	11.8 (1,715)	14.0 (2,030)	13.8 (2,005)
Elongation at Break, %	237	216	190	181
Hardness, durometer A, points	77	75	80	77
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F)				
100% Modulus, MPa (psi)	4.6 (670)	5.1 (740)	7.4 (1,070)	7.3 (1,060)
Tensile Strength, MPa (psi)	14.5 (2,100)	11.9 (1,730)	13.8 (1,995)	13.8 (2,000)
Elongation at Break, %	240	206	171	175
Hardness, durometer A, points	75	77	82	79

Table 1. Performance of Viton™ A-331C in Typical Compounds (continued)

	Viton™ A-331C	Viton™ E-60	Viton™ A-202C	Viton™ A-402C
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 200 °C (392 °F)				
100% Modulus, MPa (psi)	4.5 (655)	5.4 (780)	7.0 (1,010)	7.2 (1,050)
Tensile Strength, MPa (psi)	15.0 (2,180)	12.2 (1,765)	13.5 (1,960)	13.0 (1,880)
Elongation at Break, %	263	209	181	170
Hardness, durometer A, points	72	75	79	78
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 232 °C (450 °F)				
100% Modulus, MPa (psi)	4.9 (710)	5.2 (750)	7.5 (1,085)	7.7 (1,115)
Tensile Strength, MPa (psi)	14.1 (2,040)	11.8 (1,710)	13.9 (2,015)	14.2 (2,060)
Elongation at Break, %	230	202	169	168
Hardness, durometer A, points	76	78	81	80
Compression Set, Method B, O-Rings, %				
70 hr at 23 °C (73 °F)	18	20	9	9
70 hr at 200 °C (392 °F)	21	29	16	14
168 hr at 200 °C (392 °F)	29	37	23	19
70 hr at 232 °C (450 °F)	40	51	39	34

Table 2. Effect of Carbon Black Level in Viton™ A-331C

	A 60 phr	B 45 phr	C 30 phr	D 15 phr	E 5 phr	F 2 phr
Viton™ A-331C	100	100	100	100	100	100
High-Activity MgO	3	3	3	3	3	3
Calcium Hydroxide	6	6	6	6	6	3
MT Black (N990)	60	45	30	15	5	2
Stock Properties						
Viscosity, ML 1 + 10 at 121 °C (250 °F), Units	97	80	65	51	45	39
Mooney Scorch, MS at 121 °C (250 °F)						
Minimum, in·lb	54	43	34	27	23	20
2-pt rise, min	20.1	21.7	25.8	28	>30	>30
5-pt rise, min	29.6	>30	>30	>30	—	—
ODR at 177 °C (350 °F), Microdie, 3° Arc, 15 min						
M_L, in·lb	21	19	16	15	13	12
t_s2, min	1.3	1.4	1.4	1.5	1.8	2.2
t_c90, min	3.9	3.5	3.0	3.0	3.1	3.8
M_c90, in·lb	90	84	77	70	63	59
M_H, in·lb	97	91	83	76	68	64
Vulcanizate Properties						
Slabs Cure: A, B, C, D—10 min at 177 °C (350 °F); E, F—30 min at 166 °C (330 °F); blisters appeared 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)	6.1 (890)	4.8 (700)	3.1 (455)	2.0 (295)	1.3 (195)	1.2 (170)
Tensile Strength, MPa (psi)	9.9 (1,440)	10.1 (1,460)	9.7 (1,410)	8.1 (1,170)	7.7 (1,110)	5.8 (845)
Elongation at Break, %	273	336	351	314	350	315
Hardness, durometer A, points	88	83	71	63	58	54

Table 2. Effect of Carbon Black Level in Viton™ A-331C (continued)

	A 60 phr	B 45 phr	C 30 phr	D 15 phr	E 5 phr	F 2 phr
Stress/Strain at 23 °C (73 °F)—Original, post-cure						
100% Modulus, MPa (psi)	9.9 (1,440)	6.9 (1,005)	4.5 (655)	2.3 (330)	1.5 (220)	1.2 (170)
Tensile Strength, MPa (psi)	15.1 (2,185)	14.4 (2,095)	13.5 (1,955)	12.6 (1,825)	10.0 (1,445)	5.8 (840)
Elongation at Break, %	165	206	237	306	315	288
Hardness, durometer A, points	88	83	77	67	59	53
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F)						
100% Modulus, MPa (psi)	10.2 (1,475)	8.0 (1,155)	4.6 (670)	2.3 (340)	1.5 (215)	1.2 (180)
Tensile Strength, MPa (psi)	14.5 (2,105)	14.8 (2,140)	14.5 (2,100)	13.2 (1,920)	10.3 (1,500)	7.7 (1,120)
Elongation at Break, %	147	183	240	288	304	301
Hardness, durometer A, points	90	84	75	63	58	53
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 200 °C (392 °F)						
100% Modulus, MPa (psi)	10.4 (1,515)	7.8 (1,135)	4.5 (655)	2.5 (365)	1.6 (230)	1.3 (185)
Tensile Strength, MPa (psi)	15.1 (2,185)	15.4 (2,235)	15.0 (2,180)	12.9 (1,875)	10.2 (1,480)	6.2 (895)
Elongation at Break, %	153	201	263	292	308	279
Hardness, durometer A, points	85	80	72	61	53	51
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 232 °C (450 °F)						
100% Modulus, MPa (psi)	10.5 (1,525)	8.0 (1,160)	4.9 (710)	2.3 (340)	1.5 (215)	1.2 (170)
Tensile Strength, MPa (psi)	15.0 (2,180)	14.2 (2,055)	14.1 (2,040)	12.2 (1,775)	10.8 (1,560)	6.7 (975)
Elongation at Break, %	148	171	230	268	308	291
Hardness, durometer A, points	91	84	76	64	56	53
Compression Set, Method B, O-Rings, %						
70 hr at 23 °C (73 °F)	23	20	18	14	13	13
70 hr at 200 °C (392 °F)	29	23	21	17	21	15
168 hr at 200 °C (392 °F)	37	30	29	24	22	18
70 hr at 232 °C (450 °F)	47	43	40	37	35	31

Table 3. Effect of Mineral Fillers on Viton™ A-331C

	MT Black	Albaglos®	Nyad® 400	Celite® 350	Blanc Fixe	Ti-Pure™ R960
Viton™ A-331C	100	100	100	100	100	100
High-Activity MgO	3	3	3	3	3	3
Calcium Hydroxide	6	6	6	6	6	3
MT Black (N990)	30	—	—	—	—	—
Albaglos®	—	30	—	—	—	—
Nyad® 400	—	—	30	—	—	—
Celite® 350	—	—	—	30	—	—
Blanc Fixe	—	—	—	—	30	—
Ti-Pure™ R960	—	—	—	—	—	30

Table 3. Effect of Mineral Fillers on Viton™ A-331C (continued)

	MT Black	Albaglos®	Nyad® 400	Celite® 350	Blanc Fixe	Ti-Pure™ R960
Stock Properties						
Viscosity, ML 1 + 10 at 121 °C (250 °F), Units	65	65	60	84	56	58
Mooney Scorch, MS at 121 °C (250 °F)						
Minimum, in·lb	34	35	32	46	31	31
2-pt rise, min	25.8	17.1	23.7	19.6	22.6	24.2
5-pt rise, min	>30	20.6	29.0	23.6	27.1	29.4
ODR at 177 °C (350 °F), Microdie, 3° Arc, 15 min						
M_L, in·lb	16	20	18	21	17	16
t_s2, min	1.4	1.3	1.4	1.4	1.5	1.8
t_c90, min	3.0	2.9	2.5	3.0	2.9	4.2
M_c90, in·lb	77	77	75	75	71	59
M_H, in·lb	83	83	81	81	77	64
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 (400)	3.5 (505)	4.8 (695)	1.9 (280)	1.9 (280)
Tensile Strength, MPa (psi)	9.7 (1,410)	10.2 (1,480)	8.3 (1,210)	9.3 (1,345)	8.6 (1,250)	10.0 (1,455)
Elongation at Break, %	351	334	371	369	384	438
Hardness, durometer A, points	71	65	67	78	63	64
Stress/Strain at 23 °C (73 °F)—Original, post-cure						
100% Modulus, MPa (psi)	4.5 (655)	3.5 (510)	5.8 (845)	9.8 (1,420)	2.3 (340)	2.4 (355)
Tensile Strength, MPa (psi)	13.5 (1,955)	13.7 (1,990)	11.4 (1,650)	16.1 (2,340)	12.0 (1,735)	13.8 (2,000)
Elongation at Break, %	237	242	242	176	324	297
Hardness, durometer A, points	77	68	69	77	65	66
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 200 °C (392 °F)						
100% Modulus, MPa (psi)	4.6 (670)	3.7 (540)	5.8 (840)	10.0 (1445)	2.5 (360)	2.5 (360)
Tensile Strength, MPa (psi)	14.5 (2,100)	12.7 (1,840)	10.8 (1,565)	16.1 (2,340)	10.9 (1,580)	13.5 (1,955)
Elongation at Break, %	240	218	214	175	281	281
Hardness, durometer A, points	75	66	68	79	62	65
Stress/Strain at 23 °C (73 °F)—After aging 168 hr at 200 °C (392 °F)						
100% Modulus, MPa (psi)	4.5 (655)	3.6 (515)	5.6 (815)	11.0 (1,590)	2.4 (345)	2.6 (375)
Tensile Strength, MPa (psi)	15.0 (2,180)	12.8 (1,850)	10.9 (1,575)	16.4 (2,375)	11.6 (1,680)	13.1 (1,905)
Elongation at Break, %	263	233	244	168	323	280
Hardness, durometer A, points	72	70	68	79	62	66
Stress/Strain at 23 °C (73 °F)—After aging 70 hr at 232 °C (450 °F)						
100% Modulus, MPa (psi)	4.9 (710)	3.6 (515)	5.3 (765)	10.0 (1,455)	2.3 (340)	2.3 (340)
Tensile Strength, MPa (psi)	14.1 (2,040)	13.4 (1,940)	10.7 (1,555)	16.0 (2,320)	11.1 (1,605)	14.2 (2,055)
Elongation at Break, %	230	241	231	172	301	303
Hardness, durometer A, points	76	68	68	81	61	67
Compression Set, Method B, O-Rings, %						
70 hr at 23 °C (73 °F)	18	11	12	15	12	17
70 hr at 200 °C (392 °F)	21	20	18	22	17	23
168 hr at 200 °C (392 °F)	29	30	25	32	23	29
70 hr at 232 °C (450 °F)	40	44	40	44	37	43

Test Procedures

Property Measured	Test Procedure
Compression Set	ASTM D3955, Method B (25% deflection)
Compression Set, O-Rings	ASTM D1414
Hardness	ASTM D2240, 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 100% Modulus Tensile Strength Elongation at Break	ASTM D412, pulled at 8.5 mm/sec (20 in/min)
Volume Change in Fluids	ASTM D471

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