



Viton® B-601C

Introduction

Viton® B-601C* is an incorporated cure “B-family” polymer that demonstrates improved processing properties when compared to older “B-family” terpolymer fluoroelastomers. The improved properties provide excellent compound flow in molding (compression, injection, transfer) parts where the heat and fluid characteristics of a “B-family” Viton® are needed.

Compared with older “B-family” terpolymers, Viton® B-601C provides:

- Fully precompounded
 - O-ring curative level
- Improved processing
 - better mixing
 - excellent scorch safety
 - better mold release with less mold fouling
- Medium to fast cure rate
- Improved compression set

Applications

- O-rings, gaskets, and other molded parts requiring properties of a terpolymer “B-family” Viton®

Use of Viton® B-601C

Table 1 compares compounds of Viton® B-601C, Viton® B, Viton® B-50, and Viton® A-401C. *Table 2* compares the effects of carbon black levels in Viton® B-601C, and *Table 3* compares the effects of varying calcium hydroxide and VPA #3 levels of Viton® B-601C.

*Viton® B-601C was formerly VT-R-6580.

Product Description

| | |
|---|---|
| Chemical Composition | Terpolymer of hexafluoropropylene, vinylidene fluoride and tetrafluoroethylene, plus cure chemicals |
| 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-601C, read and follow the recommendations in the DuPont Dow Elastomers technical bulletin “Handling Precautions for Viton® and Related Chemicals.”

Viton® B-601C should be handled like other types of Viton®. Keep off skin and wash well after handling. For the safe handling of other compounding ingredients, please refer to the respective manufacturers’ literature.

Table 1
Performance of Viton® B-601C in Typical Compounds

| | A Viton® B-601C | B Viton® B | C Viton® B-50 | D Viton® A-401C |
|---------------------|--------------------|---------------|------------------|--------------------|
| Viton® B-601C | 100 | — | — | — |
| Viton® B | — | 94.4 | — | — |
| Viton® B-50 | — | — | 94.4 | — |
| Viton® A-401C | — | — | — | 100 |
| High activity MgO | 3 | 3 | 3 | 3 |
| Calcium Hydroxide | 6 | 6 | 6 | 6 |
| MT Black (N990) | 30 | 30 | 30 | 30 |
| Viton® Curative #20 | — | 2 | 2 | — |
| Viton® Curative #30 | — | 3.6 | 3.6 | — |

Stock Properties

Viscosity, ML 1 + 10 at 121°C [250°F]

| | | | | |
|-------|-----|-----|-----|----|
| Units | 103 | 144 | 116 | 79 |
|-------|-----|-----|-----|----|

Mooney Scorch, MS at 121°C [250°F]

| | | | | |
|----------------|-----|------|-----|-----|
| Minimum, in·lb | 54 | 75 | 52 | 42 |
| 5-pt rise, min | >30 | 24.0 | 6.0 | >30 |

ODR at 177°C [350°F], Microdie, 3° Arc, 15 min

| | | | | |
|--------------------------|-----|-----|-----|-----|
| M _L , in·lb | 24 | 32 | 20 | 19 |
| t _{s2} , min | 2.9 | 3.4 | 4.0 | 2.1 |
| t _{c90} , min | 6.9 | 7.3 | 8.6 | 3.7 |
| M _{c90} , in·lb | 105 | 107 | 82 | 122 |
| M _H , in·lb | 114 | 116 | 88 | 134 |

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 | 6.2 | 7.9 | 7.5 |
| 50.8 mm/min | 452 s ⁻¹ | 8.6 | 11.5 | 10.2 |
| 127 mm/min | 1130 s ⁻¹ | 10.7 | 19.2 | 13.1 |

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] | 4.2 [610] | 4.8 [690] | 4.2 [615] | 4.7 [675] |
| Tensile Strength, MPa [psi] | 10.1 [1470] | 10.2 [1485] | 9.1 [1320] | 8.8 [1270] |
| Elongation at Break, % | 293 | 270 | 303 | 211 |
| Hardness, durometer A, points | 80 | 80 | 82 | 79 |

Stress/Strain at 23°C [73°F]—Original, post cure

| | | | | |
|-------------------------------|--------------|--------------|--------------|--------------|
| 100% Modulus, MPa [psi] | 5.9 [850] | 6.8 [980] | 6.2 [895] | 6.6 [955] |
| Tensile Strength, MPa [psi] | 13.8 [2,005] | 13.4 [1,945] | 13.0 [1,890] | 13.5 [1,960] |
| Elongation at Break, % | 232 | 198 | 214 | 198 |
| Hardness, durometer A, points | 79 | 83 | 83 | 80 |

Stress/Strain at 23°C [73°F]—After aging 70 hr at 200°C [392°F]

| | | | | |
|-------------------------------|--------------|--------------|--------------|--------------|
| 100% Modulus, MPa [psi] | 5.9 [860] | 7.3 [1,065] | 7.1 [1,025] | 6.8 [985] |
| Tensile Strength, MPa [psi] | 14.5 [2,100] | 14.4 [2,085] | 13.2 [1,915] | 13.4 [1,940] |
| Elongation at Break, % | 232 | 195 | 189 | 183 |
| Hardness, durometer A, points | 80 | 82 | 85 | 81 |

Stress/Strain at 23°C [73°F]—After aging 168 hr at 200°C [392°F]

| | | | | |
|-------------------------------|--------------|--------------|--------------|--------------|
| 100% Modulus, MPa [psi] | 5.8 [840] | 7.4 [1,070] | 7.1 [1,030] | 6.7 [975] |
| Tensile Strength, MPa [psi] | 12.1 [1,755] | 13.6 [1,965] | 13.5 [1,960] | 13.6 [1,970] |
| Elongation at Break, % | 194 | 181 | 190 | 187 |
| Hardness, durometer A, points | 81 | 82 | 83 | 79 |

Stress/Strain at 23°C [73°F]—After aging 70 hr at 232°C [450°F]

| | | | | |
|-------------------------------|--------------|--------------|--------------|--------------|
| 100% Modulus, MPa [psi] | 6.7 [970] | 7.8 [1,125] | 7.1 [1,030] | 7.1 [1,035] |
| Tensile Strength, MPa [psi] | 13.6 [1,975] | 14.4 [2,085] | 12.8 [1,860] | 12.9 [1,875] |
| Elongation at Break, % | 186 | 177 | 173 | 158 |
| Hardness, durometer A, points | 81 | 82 | 85 | 79 |

Compression Set, Method B, O-rings, %

| | | | | |
|------------------------|----|----|----|----|
| 70 hr at 23°C [73°F] | 12 | 11 | 17 | 7 |
| 70 hr at 200°C [392°F] | 21 | 31 | 47 | 13 |
| 70 hr at 232°C [450°F] | 43 | 59 | 75 | 30 |

Fluid Resistance, Volume Swell, %

| | | | | |
|---------------------------------|----|----|----|----|
| Fuel C, 168 hr at 23°C [73°F] | 4 | 4 | 4 | 5 |
| Methanol, 168 hr at 23°C [73°F] | 15 | 16 | 15 | 62 |

Table 2
Effect of Carbon Black Level in Viton® B-601C

| | E 45 phr | F 30 phr | G 15 phr | H 5 phr | I 2 phr | J 2 phr |
|---|---------------------------|---------------------------|---------------------------|--------------------------|--------------------------|--------------------------|
| Viton® B-601C | 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) | 45 | 30 | 15 | 5 | 2 | 2 |
| Stock Properties | | | | | | |
| Viscosity, ML 1 + 10 at 121°C [250°F] | | | | | | |
| Units | 123 | 103 | 90 | 85 | 83 | 77 |
| Mooney Scorch, MS at 121°C [250°F] | | | | | | |
| Minimum, in-lb | 68 | 54 | 50 | 46 | 45 | 40 |
| 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 | 24 | 22 | 20 | 24 | 18 |
| t _{s2} , min | 2.2 | 2.9 | 4.0 | 5.0 | 6.1 | 6.9 |
| t _{c90} , min | 5.6 | 6.9 | 7.6 | 8.2 | 8.3 | 11.7 |
| M _{c90} , in-lb | 108 | 105 | 97 | 87 | 84 | 83 |
| M _H , in-lb | 117 | 114 | 105 | 95 | 91 | 91 |
| 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] | 5.3 [765] | 4.2 [610] | 2.7 [390] | 1.7 [245] | 1.5 [215] | 1.3 [195] |
| Tensile Strength, MPa [psi] | 8.9 [1,285] | 10.1 [1,470] | 9.6 [1,390] | 6.8 [990] | 5.7 [830] | 5.3 [770] |
| Elongation at Break, % | 220 | 293 | 290 | 247 | 244 | 237 |
| Hardness, durometer A, points | 87 | 80 | 68 | 60 | 58 | 57 |
| Stress/Strain at 23°C [73°F]—Original, post cure | | | | | | |
| 100% Modulus, MPa [psi] | 7.8 [1,135] | 5.9 [850] | 3.3 [485] | 1.9 [275] | 1.7 [240] | 1.4 [205] |
| Tensile Strength, MPa [psi] | 14.3 [2,075] | 13.8 [2,005] | 11.9 [1,730] | 9.1 [1,320] | 9.3 [1,350] | 6.6 [950] |
| Elongation at Break, % | 198 | 232 | 232 | 234 | 254 | 231 |
| Hardness, durometer A, points | 89 | 79 | 68 | 60 | 59 | 56 |
| Stress/Strain at 23°C [73°F]—After aging 70 hr at 200°C [392°F] | | | | | | |
| 100% Modulus, MPa [psi] | 8.1 [1,175] | 5.9 [860] | 3.6 [520] | 1.9 [280] | 1.6 [230] | 1.4 [205] |
| Tensile Strength, MPa [psi] | 14.8 [2,140] | 14.5 [2,100] | 12.6 [1,825] | 9.7 [1,405] | 8.8 [1,275] | 8.6 [1,245] |
| Elongation at Break, % | 189 | 232 | 226 | 229 | 242 | 248 |
| Hardness, durometer A, points | 89 | 80 | 68 | 62 | 58 | 57 |
| Stress/Strain at 23°C [73°F]—After aging 168 hr at 200°C [392°F] | | | | | | |
| 100% Modulus, MPa [psi] | 8.3 [1,205] | 5.8 [840] | 3.6 [525] | 2.0 [290] | 1.7 [245] | 1.4 [205] |
| Tensile Strength, MPa [psi] | 14.4 [2,095] | 12.1 [1,755] | 12.2 [1,775] | 9.0 [1,300] | 7.6 [1,105] | 7.9 [1,140] |
| Elongation at Break, % | 180 | 194 | 219 | 219 | 222 | 242 |
| Hardness, durometer A, points | 89 | 81 | 69 | 62 | 59 | 57 |
| Stress/Strain at 23°C [73°F]—After aging 70 hr at 232°C [450°F] | | | | | | |
| 100% Modulus, MPa [psi] | 9.0 [1,300] | 6.7 [970] | 3.5 [505] | 1.9 [270] | 1.7 [240] | 1.3 [195] |
| Tensile Strength, MPa [psi] | 16.0 [2,320] | 13.6 [1,975] | 13.0 [1,885] | 9.5 [1,375] | 8.8 [1,280] | 8.0 [1,160] |
| Elongation at Break, % | 175 | 186 | 221 | 228 | 241 | 249 |
| Hardness, durometer A, points | 88 | 81 | 69 | 60 | 57 | 55 |
| Compression Set, Method B, O-rings, % | | | | | | |
| 22 hr at 177°C [350°F] | 12 | 12 | 6 | 6 | 6 | 6 |
| 22 hr at 200°C [392°F] | 21 | 21 | 15 | 15 | 15 | 12 |
| 70 hr at 200°C [392°F] | 46 | 43 | 35 | 38 | 38 | 43 |
| Fluid Resistance, Volume Swell, % | | | | | | |
| Fuel C, 70 hr at 23°C [73°F] | 3 | 4 | 5 | 5 | 6 | 6 |
| Methanol, 70 hr at 23°C [73°F] | 10 | 15 | 16 | 18 | 19 | 20 |

Table 3
Effect of Calcium Hydroxide/Process Aids on Viton® B-601C

| | K | L | M | N | O |
|---|--------------|--------------|--------------|--------------|--------------|
| Viton® B-601C | 100 | 100 | 100 | 100 | 100 |
| High activity MgO | 3 | 3 | 3 | 3 | 3 |
| Calcium Hydroxide | 6 | 3 | 6 | 6 | 6 |
| MT Black (N990) | 30 | 30 | 30 | 30 | 30 |
| VPA #3 | — | — | 0.5 | 1 | 1 |
| Carnauba Wax | — | — | — | — | 1 |
| Stock Properties | | | | | |
| Viscosity, ML 1 + 10 at 121°C [250°F] | | | | | |
| Units | 103 | 95 | 108 | 108 | 106 |
| Mooney Scorch, MS at 121°C [250°F] | | | | | |
| Minimum, in·lb | 54 | 53 | 59 | 59 | 58 |
| 2-pt rise, min | >30 | >30 | >30 | >30 | >30 |
| ODR at 177°C [350°F], Microdie, 3° Arc, min | | | | | |
| M _L , in·lb | 24 | 22 | 26 | 26 | 24 |
| t _{s2} , min | 2.9 | 3.5 | 2.6 | 2.3 | 2.4 |
| t _{c90} , min | 6.9 | 9.5 | 5.5 | 4.6 | 4.9 |
| M _{c90} , in·lb | 105 | 104 | 105 | 106 | 113 |
| M _H , in·lb | 114 | 114 | 114 | 115 | 122 |
| 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] | 4.2 [610] | 3.9 [570] | 4.2 [605] | 4.3 [625] | 4.0 [575] |
| Tensile Strength, MPa [psi] | 10.1 [1,470] | 8.7 [1,260] | 9.3 [1,350] | 9.0 [1,305] | 7.2 [1,045] |
| Elongation at Break, % | 293 | 241 | 279 | 259 | 234 |
| Hardness, durometer A, points | 80 | 76 | 80 | 80 | 80 |
| Stress/Strain at 23°C [73°F]—Original, post cure | | | | | |
| 100% Modulus, MPa [psi] | 5.9 [850] | 5.1 [740] | 6.0 [875] | 6.0 [870] | 7.1 [1,035] |
| Tensile Strength, MPa [psi] | 13.8 [2,005] | 12.2 [1,770] | 12.6 [1,830] | 12.0 [1,740] | 13.5 [1,960] |
| Elongation at Break, % | 232 | 217 | 207 | 192 | 177 |
| Hardness, durometer A, points | 79 | 79 | 82 | 81 | 82 |
| Stress/Strain at 23°C [73°F]—After aging 70 hr at 200°C [392°F] | | | | | |
| 100% Modulus, MPa [psi] | 5.9 [860] | 5.3 [775] | 6.1 [885] | 6.5 [940] | 7.7 [1,115] |
| Tensile Strength, MPa [psi] | 14.5 [2,100] | 13.6 [1,975] | 13.1 [1,905] | 13.7 [1,985] | 14.3 [2,070] |
| Elongation at Break, % | 232 | 221 | 200 | 196 | 184 |
| Hardness, durometer A, points | 80 | 80 | 82 | 82 | 82 |
| Stress/Strain at 23°C [73°F]—After aging 168 hr at 200°C [392°F] | | | | | |
| 100% Modulus, MPa [psi] | 5.8 [840] | 5.5 [795] | 6.7 [970] | 6.7 [965] | 6.9 [1,000] |
| Tensile Strength, MPa [psi] | 12.1 [1,755] | 12.5 [1,810] | 13.6 [1,970] | 12.5 [1,810] | 12.1 [1,760] |
| Elongation at Break, % | 194 | 207 | 200 | 182 | 182 |
| Hardness, durometer A, points | 81 | 79 | 80 | 82 | 83 |
| Stress/Strain at 23°C [73°F]—After aging 70 hr at 232°C [450°F] | | | | | |
| 100% Modulus, MPa [psi] | 6.7 [970] | 5.7 [820] | 7.0 [1,020] | 7.4 [1,070] | 7.6 [1,105] |
| Tensile Strength, MPa [psi] | 13.6 [1,975] | 13.0 [1,885] | 13.6 [1,965] | 14.6 [2,120] | 13.7 [1,980] |
| Elongation at Break, % | 186 | 192 | 177 | 181 | 170 |
| Hardness, durometer A, points | 81 | 79 | 82 | 82 | 82 |
| Compression Set, Method B, O-rings, % | | | | | |
| 70 hr at 23°C [73°F] | 12 | 9 | 9 | 9 | 9 |
| 70 hr at 200°C [392°F] | 21 | 16 | 18 | 18 | 25 |
| 70 hr at 232°C [450°F] | 43 | 35 | 41 | 43 | 54 |
| Fluid Resistance, Volume Swell, % | | | | | |
| Fuel C, 70 hr at 23°C [73°F] | 4 | 4 | 4 | 4 | 4 |
| Methanol, 70 hr at 23°C [73°F] | 15 | 16 | 15 | 15 | 17 |

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/sec (20 in/min) |
| Volume Change in Fluids | ASTM D471 |

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

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