



PVC, Black, Exterior Weatherable, Elastomeric, Extrusion Molding Compounds

1 Scope

1.1 Material Description. This specification covers the properties of a black, exterior weatherable and elastomeric, Polyvinyl Chloride (PVC), molding compound. These materials are generally processed by extrusion molding processes, but for some simple applications they may be injected, e.g., glass lace molded corners. Materials are delineated by "Type" indicating indentation hardness, and "Class" indicating compression set and identified in Appendix A, Table A1 and Table A2.

1.2 Symbols. The material abbreviation according to ISO 18064 is > (PVC) <.

1.2.1 Identification. PVC materials approved to this specification will be called out on the engineering drawing with the two attributes, e.g., GMW16048, Type 2, Class C, indicating a 60 ± 5 Shore A hardness PVC with 60% maximum compression set. In addition, if the nominal Shore hardness for a component is different than nominal type stated herein, it shall be called out specifically on the engineering drawing, e.g., Type 4 = 80 ± 5 Shore A, but, 82 Shore D is being used, so $82 \pm X$ Shore A hardness shall be called out. GMW16048 types carrying an "LG" suffix as in, "Type 2LG", indicates the material is a low gloss version.

1.3 Applicability. Typical applications include but are not restricted to the following: extruded fixed glass trim.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ISO 34-1	ISO 815-1	ISO 4892-1	SAE J1545
ISO 37	ISO 868	ISO 4892-2	SAE J1767
ISO 176	ISO 1183	ISO 7724-1	SAE J2527
ISO 188	ISO 2813	ISO 18064	
ISO 527	ISO 3451-1	SAE J323	

2.2 GM Standards/Specifications.

GMW3013	GMW3417	GMW14270	GMW14873
GMW3059	GMW6992	GMW14650	GMW16084
GMW3221			

3 Requirements

3.1 Requirements on Test Specimens. Reference GMW3221.

Tests shall be conducted using the latest issue of the test methods indicated. Suitable precautions should be taken to ensure that applicable safe limits are not exceeded when conducting test procedures, processes, and/or handling the materials required by this specification.

3.1.1 Test specimens shall be die cut from fan gated injection or compression molded plaques having a nominal thickness of $3.2 \text{ mm} \pm 0.2 \text{ mm}$. If specimens are die cut from injection molded plaques, they should be tested with the long axis of the test specimen perpendicular to the direction of flow. Plaque dimensions must be sufficient to permit this.

3.1.2 Tests shall be conducted 40 h minimum after molding and immediately following a conditioning period of 24 h minimum per GMW3221, Code A, unless otherwise specified. All tests shall be performed on unannealed

specimens. In addition, tests specified at temperatures below or above $+22\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum.

3.1.3 The minimum values specified in the property tables must be met by test specimens in natural, black, or in a standard sampled color if natural or black are not available. For colored grades where other pigment and additive systems (e.g., stabilizer) are used, the impact values shall not decrease more than 10% from the specified minimum value.

3.1.4 Low Gloss PVC. GMW16084 types carrying an "LG" suffix as in, "Type 2LG", and indicates the material is a low gloss version. The term "low gloss" in GMW16084 identifies exterior PVC that PGH or less according to the GM Global Gloss Palette.

3.1.4.1 Visual Appearance Assessment - Gloss. When a low gloss material candidate is submitted for GMW16084 approval, the gloss level must be confirmed via production tool molding trial as agreed to by GM Materials Engineering. PVC trial sample gloss shall be confirmed using the GM Global Gloss Palette and GMW6992, Visual Appearance Assessment. Refer to Appendix B, Figure B1. Gloss qualification must be confirmed by the GM Appearance, Define and Develop Team.

3.2 Requirements on Test Specimens. Tests shall be conducted using the latest issue of the test methods indicated. Suitable precautions should be taken to ensure that applicable safe limits are not exceeded when conducting test procedures, processes, and/or handling the materials required by this specification.

3.2.1 Test specimens shall be die cut from fan gated injection or compression molded plaques having a nominal thickness of $3.2\text{ mm} \pm 0.2\text{ mm}$. If specimens are die-cut from injection molded plaques, they should be tested with the long axis of the test specimen perpendicular to the direction of flow. Plaque dimensions must be sufficient to permit this.

3.2.2 Tests shall be conducted 40 h minimum after molding and immediately following a conditioning period of 24 h minimum per GMW3221, Code A, unless otherwise specified. All tests shall be performed on unannealed specimens. In addition, tests specified at temperatures below or above $+22\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum.

3.2.3 The minimum values specified in the property tables must be met by test specimens in natural, black, or in a standard sampled color if natural or black are not available. For colored grades where other pigment and additive systems (e.g., stabilizer) are used, the impact values shall not decrease more than 10% from the specified minimum value.

3.3 Compound Properties. See Table 1 and the supporting information contained within this section.

3.3.1 Accelerated Weathering SAE J2527 - Extended UV Filter Combination or ISO 4892-1, ISO 4892-2. Testing must be completed using a control retain. Test samples or parts may be used for exposure at the discretion and approval of GM Engineering. Evaluate test samples at mid and full cycle exposure minimum. No objectionable defects are allowed.

3.3.1.1 SAE J2527, Extended UV Filter Combination. 2500 kJ/m² exposure required.

3.3.1.2 ISO 4892-1, ISO 4892-2. 3000 kJ/m² exposure required. Use parameters as follows.

- a. Inner and outer filter: Borosilicate
- b. Radiant exposure: 0.50 W/m² at 340 nm
- c. Test program Cam No. 7:
 1. 102 minutes $\pm$ 0.5 minutes light only
 2. 18 minutes $\pm$ 0.5 minutes light and spray
- d. Black-standard temperature: $+80\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$.

3.3.1.3 Evaluation. Unless otherwise specified, inspect a minimum of mid and full exposed test samples for gloss change. Measure test samples initially, prior to exposure. After exposure, wash samples with scrubbing action, using a clean sponge or low lint paint shop quality rag saturated with deionized water at $+23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ for no more than one (1) minute and let air dry overnight.

3.3.1.4 Gloss. Measure the initial and exposed sample gloss per ISO 2813. Report test methods, measurement angles and test equipment used. Wash weathered specimens prior to making measurements and observations. Wash with scrubbing action, using a clean sponge or low lint paint shop quality rag saturated with deionized

water at +23 °C ± 3 °C for no more than one (1) minute. An 80% gloss retention is required after exposure and wash.

3.3.1.5 Color Evaluation. Measure the L*, a*, b* color values of test samples before and after exposure per ISO 7724-1 or SAE J1545, (CIELAB color space, 10 degree observer, illuminant D65, specular component included on the color standard). Report the color differences (ΔL^* , Δa^* , Δb^* , ΔE^*) per SAE J1767. Observe the tested sample and report any objectionable defects. $((\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2)^{1/2} = \Delta E^*$ is the correct equation to be used for SAE J1767.

3.3.1.6 Requirement. The color change shall not exceed three (3) units, ΔE of ≤ 3.0 . If the visual color change is considered objectionable, it shall take precedence over the ΔE measurement.

3.3.2 Natural, Outdoor Weathering of Automotive Exterior Materials for 150K Temperature Normalized Radiation (TNR) Langleys - 3, 6, 12 and 24 Months Exposure per GMW14873 Procedure 1. Technologies have a minimum of 150 TNR Langleys, approximately 24 months natural solar exposure history. **Note:** The calculation for TNR Langleys is referenced in GMW3417. Test samples or parts may be used for exposure at the discretion and approval of GM Engineering.

3.3.2.1 Evaluation. Evaluate test samples at the exposures of 3 months, 6 months, 12 months and 150 TNR Langleys exposure. A retain test sample or part shall be kept for color and gloss comparison to exposed samples. Exposed test samples must meet the gloss and color requirements as called out previously under 3.3.1 "Accelerated Weathering". Outdoor weathering exposure performance takes precedence over accelerated weathering tests.

3.3.2.2 Natural Weathering Test Location Areas. Any of the following locations are considered equivalent as a test sample location. Obtain agreement from the regional GM Engineering group prior to sending test samples out for exposure.

- Miami or Southern Area, Florida, USA
- Juárez, Mexico
- Allunga, Queensland, Australia
- Cruz Alta, Brazil
- Okinawa, Japan

Table 1: Compound Properties (Black)

Property	Test Method	Unit	Type 1	Type 2	Type 3	Type 4
Shore Hardness	ISO 868, 15 s delay	Shore A	50 ± 5 A	60 ± 5 A	70 ± 5 A	80 ± 5 A
Density	ISO 1183	g/cm ³	1.13 to 1.25	1.16 to 1.30	1.20 to 1.35	1.22 to 1.38
Tensile Stress at Break	ISO 37, Type 1A dumbbell, 500 mm/minute	MPa	9 minimum	12 minimum	14 minimum	17 minimum
Elongation at Break	ISO 37, Type 1A dumbbell, 500 mm/minute	%	300 minimum	300 minimum	250 minimum	250 minimum
Tear Strength	ISO 34-1, Method B, angle die, 500 mm/minute	kN/m	20 minimum	20 minimum	20 minimum	20 minimum
Filler Content	ISO 3451-1, Method A	%	See Note 1	See Note 1	See Note 1	See Note 1
Volatile Loss	ISO 176	%	3.0 maximum	3.0 maximum	3.0 maximum	3.0 maximum
Compression Set	ISO 815-1, Type A, 72 h at	%	60 maximum	60 maximum	70 maximum	70 maximum