



PVC, Interior, Integral Colored, Extrusion/Injection Molding Compounds

1 Scope

1.1 Material Description. This specification covers the properties of an integrally colored, interior Polyvinyl Chloride (PVC) molding compound. These materials can be processed by extrusion and/or injection molding. Materials are delineated by "Type" in Appendix A, Table A1, indicating Shore hardness and "Grade" in Table A2, indicating molding process.

1.2 Symbols. The material abbreviation according to ISO 11469 is >PVC<.

1.3 Applicability. Typical interior trim applications include, but are not restricted to interior trim moldings – not intended for use in high heat or high solar load applications such as instrument panel horizontal or rear seat to rear window surfaces.

1.4 Remarks/Identification. PVC materials approved to this specification will be called out on the engineering drawing indicating both attributes above, e.g., GMW16080, Type 4, Grade E is an 80 ± 5 Shore A hardness, extrudable PVC. 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 A is being used, $82 \pm X$ Shore A hardness shall be called out.

2 References

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

2.1 External Standards/Specifications.

AATCC 23	ISO 176	ISO 1183	ISO 11469
ISO 37	ISO 188	ISO 3451-1	SAE J323
ISO 105-G02	ISO 868	ISO 3795	SAE J2412

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW3402	GMW14270
GMW3059	GMW3232	GMW3417	GMW14334
GMW3205	GMW3235	GMW14162	GMW14651

3 Requirements

Materials approved to this specification shall meet the requirements of GMW3013, General Requirements for Handling of Technical Terms of Delivery for Plastics.

3.1 Requirements on Delivery. Important physical, mechanical, and thermal properties that characterize the material are summarized in Table 1.

Note: For each product, the requirements to Table 1 shall be documented by Certification Statement according to GMW3013. The color and gloss shall be specified on drawings, in material specifications and otherwise.

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 injection molded, die cut specimens are to 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 Test samples shall be aged a minimum of 40 h after molding and 24 h immediately following a conditioning period 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 Table 2. A minimum of six (6) lots shall be tested to Table 1, unless otherwise noted. The following are also required for full specification approval. The minimum number of lots per test required is one (1):

- Young's Modulus
- Poisson's Ratio
- Coefficient of Linear Thermal Expansion (CLTE)
- Stress-Strain at $23\text{ }^{\circ}\text{C}$, $85\text{ }^{\circ}\text{C}$, and $-30\text{ }^{\circ}\text{C}$

Suppliers must demonstrate ability to meet integrally colored compound requirements (Table 2) with an appropriate palette of GM visually approved colors (i.e., red, tan, blue, gray) prior to approval of either base compound or colored compounds.

3.3.1 Accelerated Weathering Resistance. Expose to 1240 kJ/m^2 per SAE J2412 or 19 MJ/m^2 per GMW14162 Cycle C and $115\text{ }^{\circ}\text{C}$. Testing is completed using a control retain. Test samples or parts may be used for exposure at the discretion and approval of GM Engineering.

3.3.1.1 Evaluation. Unless otherwise specified, inspect a minimum of mid and full exposed test samples for gloss and color change. Measure test samples before and after exposure per GMW3417.

Table 1: Compound Properties (Black, Natural, or Integrally Colored)

Property	Test Method	Units	Type 1	Type 2	Type 3	Type 4
Shore Hardness	ISO 868, 15-second delay	A or D	$50 \pm 5\text{ A}$	$60 \pm 5\text{ A}$	$70 \pm 5\text{ A}$	$80 \pm 5\text{ A}$
Density	ISO 1183	g/cm^3	1.15 to 1.35	1.15 to 1.35	1.15 to 1.35	1.15 to 1.35
Tensile Stress at Break	ISO 37, Type 1A dumbbell, 500 mm/minute	MPa	≥ 7	≥ 9	≥ 10	≥ 10
Elongation at Break	ISO 37, Type 1A dumbbell, 500 mm/minute	%	≥ 300	≥ 300	≥ 300	≥ 200
Filler Content	ISO 3451-1, Method A	%	0 to 20	0 to 30	0 to 20	0 to 20
Volatile Loss	ISO 176	%	≤ 3.0	≤ 3.0	≤ 3.0	≤ 3.0

Property	Test Method	Units	Type 1	Type 2	Type 3	Type 4
Cold Flexibility Mandrel Test	SAE J323, Method A. Use Table 2 and Table 3 for mandrel size selection based upon hardness. 3.2 mm $\pm$ 0.2 mm sample thickness.	Not applicable	No Cracks			
Properties After Heat Age Exposure	ISO 188 Method B. 168 h at 95 °C followed by indicated property testing.	%	$\pm$ 25% maximum of Hardness, Tensile Stress at Break, Elongation at Break. No tackiness. Note: Perform indicated property testing at 22 °C $\pm$ 3 °C. Use original mechanical property test methods.			
Flammability	GMW3232 OR ISO 3795 (Report values according to GMW3232)	mm/minute	$\leq$ 100			
Fogging	GMW3235-B-T2 condensable constituents	mg	$\leq$ 2			
Chemical Resistance	GMW14334-A	No units	$\geq$ Rating 1			
Odor	GMW3205 Dry Condition		$\geq$ Rating 6			

Table 2: Compound Properties (Integrally Colored)

Property	Test Method	Units	Type 1	Type 2	Type 3	Type 4
Flammability	GMW3232 OR ISO 3795 (Report values according to GMW3232)	mm/minute	$\leq$ 100			
Soil and Cleaner Resistance	GMW3402 Procedure A. Test all soiling agents except for Code E, Code K, and Code L. Apply soiling agent. Allow soiling agent to set for 30 minutes at standard conditions; then clean soiling agent using cleaner 0 within 20 minutes. If soil does not remove, immediately use cleaner 2.	mm/minute	$\geq$ Rating 8, no ring formation or haptic change allowed			
Fogging	GMW3235-B-T2 condensable constituents	mg	$\leq$ 2			
Colorfastness to Burnt Gas (Propane)	AATCC 23 or ISO 105-G02, 168 h at 60 °C, specimen color: light gray or light beige	ΔE ΔYI	$\Delta E \leq 1.5$ $\Delta YI \leq 2.0$			