



Non-carpet Floor Covering Materials

1 Scope

1.1 Material Description. This standard describes plastic materials that are suitable for non-carpeted floors, as well as for floor mat applications. Testing shall be performed on production intent parts.

1.1.1 Material Identification.

- Type I: Polypropylene
- Type II: Thermoplastic olefin (TPO) film on substrate
- Type III: Polyurethane
- Type IV: Rubber
- Type V: Ethylene-vinyl acetate (EVA) film on substrate
- Type VI: Polyvinyl chloride (PVC) (only for emerging markets)

1.2 Symbols. The code defines the material construction and will be assigned by the responsible department.

1.3 Applicability. Suitable for non-carpet floor applications.

1.4 Remarks. For requirements for vehicles without solar absorbing glass, contact the appropriate Materials Engineer. All interior materials are developed to be used in vehicles with solar glass; therefore, performance may be compromised if used in non-solar glass vehicles.

2 References

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

2.1 External Standards/Specifications.

FMVSS 302	ISO 105-A03	ISO 527	ISO/IEC 17025
ISO 105-A02	ISO 105-B06	ISO 5084	

2.2 GM Standards/Specifications.

GMW3059	GMW3235	GMW14108	GMW15634
GMW3182	GMW3259	GMW14124	GMW15635
GMW3205	GMW3402	GMW14130	GMW16853
GMW3208	GMW3417	GMW14162	
GMW3221	GMW6992	GMW14270	
GMW3232	GMW14102	GMW14444	

2.3 Additional References. None.

3 Requirements

3.1 General Requirements.

3.1.1 Standard Conditions (GMW3221, Code A). All test specimens shall be conditioned to GMW3221, Code A for a minimum of 24 h, unless the test method indicates that standard conditioning is not required or that other conditions apply.

3.1.2 Sampling and Test Specimen Preparation. When multiple test specimens are required, they shall be taken diagonally across the sample. Avoid taking specimens from damaged, contaminated, or defective areas caused by improper handling or manufacturing. Specimens should not be cut within 50 mm of any edge of the sample.

3.1.3 Visual Evaluation of Automotive Trim (GMW6992). The color, pattern, aesthetics and other related qualities shall be approved by the appropriate engineering department as an acceptable match to the standard when viewed under conditions set forth in GMW6992.

3.1.4 Material Construction Specification. All required information shall be reported on the Construction Specification Form (see Appendix A, Data Sheet A1) provided by the Materials Engineer. A form shall be submitted along with each material submitted for engineering approval. Established values for a construction will be reported on and controlled within the limits established on the Construction Specification Form.

3.1.5 Data Reporting. If all individual readings of a specific test meet or exceed the specified requirements, report the average. Unless otherwise stated, any individual reading outside the specified limit does not meet the requirement. Report all individual test results that do not meet the requirements. All required information shall be reported on the appropriate test data reporting forms (see Appendix A, Data Sheet A1 and Appendix B, Data Sheets B1, B2 and B3).

3.1.6 Lab Accreditation. Laboratory testing shall be performed by a laboratory that conforms (meets requirements but may not be formally recognized by a third party) to ISO/IEC 17025 and is acceptable to the responsible GM Department. Test reports must conform to ISO/IEC 17025. Supplier shall submit a letter of compliance.

3.1.7 Deviations from Defined Test Methods. Deviations from the conditions of any test method shall have been agreed upon between supplier and vehicle manufacturer. All deviations shall be specified on the component drawings, material specifications, etc. and shall be indicated on test certificates, reports, etc.

3.1.8 Documentation. Samples of components or materials released to this specification shall be tested for conformity with the requirements of this specification and approved by the responsible GM department prior to the start of delivery of production level components or materials. Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture, requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release. If not otherwise agreed to the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM Department and the supplier.

3.2 Construction Requirements.

3.2.1 Weight (GMW3182). Test three (3) specimens. Report the results in grams per square meter (g/m²). Refer to Appendix A, Data Sheet A1 for the specific requirements.

3.2.2 Thickness (ISO 5084). Report the average for three (3) specimens in millimeters to the nearest 0.01 mm. Use a 4.0 N load and a 200 mm ± 0.8 mm diameter presser foot to achieve a pressure of 0.127 kPa. All readings should be taken after the presser foot has been in contact with the material for at least 5 s. The specimen size shall be 100 mm × 100 mm size. Refer to Appendix A, Data Sheet A1 for the specific requirements.

3.2.3 Tensile Strength (ISO 527, Type 1A, Dumbbell Test Piece, Type 1A, Speed 500 mm/minute) Test six (6) specimens total; three (3) specimens from the Machine Direction (MD) and another three (3) from the Cross-Machine Direction (CMD). Electronic method of calculation shall be used. Repeat testing after aging for 70 h at 70 °C. No individual test results shall be less than the specified value. Refer to Appendix A, Data Sheet A1 for the specific requirements.

3.2.4 Elongation at Break (ISO 527, Type 1A Dumbbell Test Piece, Type 1A, Speed 500 mm/minute). Test six (6) specimens total; three (3) specimens from the MD and another three (3) from the CMD. Electronic method of calculation shall be used. Repeat testing after aging for 70 h at 70 °C. No individual test results shall be less than the specified value. Refer to Appendix A, Data Sheet A1 for the specific requirements.

3.2.5 Cold Flexibility (GMW14108). The sample size of 25 mm × 300 mm of the material must withstand a 180 degrees flex around a 25 mm mandrel at -29 °C with no evidence of cracking.

3.2.6 Abrasion Resistance (GMW3208). Three (3) specimens shall be tested according to GMW3208, CS10 wheels, 500 g load, 800 cycles. No objectionable color contrast shall be visible following 100 cycles.

3.2.7 Resistance to Scuffing and Marring (GMW14130). There shall be no more than a slight scuffing or marring when tested with 750 g weight. For any questionable results, the material shall be exposed for 16 h at 70 °C and retested.

3.2.8 Mildew (GMW3259). Required only for PVC (Type VI materials, see 1.1.1) or if natural fibers are present in the construction. There shall be no visible growth or odor of mildew. See construction form to determine if this is a requirement.

3.2.9 Flammability (GMW3232). Test to GMW3232. For initial approval and routine quality control.

3.2.9.1 After Conditioning (GMW3232). Immediately prior to tests, all test specimens shall be conditioned for a minimum of 24 h according to GMW3221, Code A.

3.2.9.2 After Aging. The test cycle shall commence with 4 h ± 1 h at 40 °C ± 3 °C and 95% ± 5% relative humidity, followed by 168 h ± 1 h at 90 °C ± 3 °C and completed without interruption. Repeat conditioning before testing flammability.

3.2.10 Interior Emissions (GMW16853). Applicable for GMW14444, Code E parts only. For required tests, procedure and limits see tables titled **Overview of Test Procedures required for the Individual Materials and Part Approvals** and **Emission Requirements for Interior Material/Parts/Assembly List** according to GMW16853.

3.2.10.1 Resistance to Odor (GMW3205, Coding A2 and B2). Report results for both wet and dry conditions. A rating of ≥ 6 is required. Use a ratio of specimen size to container volume of 1:100.

3.2.10.2 Fogging (GMW3235, Method B). The bath temperature shall be Coding T2 as specified in GMW3235 (T2 = 100 °C). Test three (3) specimens. The condensable constituents shall be less than 10 mg. Also, if the specimens form crystals, oily film or visible droplets greater than 0.05 mm in diameter at 40X magnification, the sample does not meet the requirement.

3.2.10.3 Volatile Organic Compound/Semi-volatile Organic Compound (VOC/SVOC) (GMW15634). Record total amounts of VOCs and SVOCs in milligram/kilogram and attach a report listing all chemicals detected. Values of total amounts shall be ≤ 150 µg/g for VOCs, and ≤ 300 µg/g for SVOCs.

- Volatile Organic Compounds (VOC) ≤ 150 µg/g
- Semi-volatile Organic Compounds (SVOC) ≤ 300 µg/g

3.2.10.4 Carbonyls (GMW15635). Not applicable.

3.2.11 Density. Report the material's density in kilograms/cube meters (kg/m³) to the nearest tenth, for use in the General Motors Materials Property Database (GMMPD). Calculate as follows:

$$D = M/V \times 106$$

Where:

- D = Density
- M = Mass of specimen in grams (g)
- V = Volume of specimen in millimeters cubed (mm³)

3.3 Color Requirements.

3.3.1 Colorfastness to Artificial Light, Xenon Arc Method. Any of the Xenon Arc methods listed in Tables 1, 2, or 3 may be used.

Note: Xenon testing shall be performed and reported for limited approval status while Nature Weathering testing is ongoing. Natural weathering is the requirement for full approval.

Table 1: Xenon Arc Method (GMW14162, Cycle A)

Application	Requirement	For Information
Floor	225.6 kJ/m ²	451.2 kJ/m ²

Table 2: Xenon Arc Method (GMW14162, Cycle B)

Application	Requirement	For Information
Floor	14 MJ/m ²	28 MJ/m ²

Table 3: Xenon Arc Method (ISO 105-B06, Condition 5)

Application	Requirement	For Information
Floor (Low Ultraviolet (UV))	225.6 kJ/m ²	451 kJ/m ²

3.3.1.1 A rating ≥ 4 is required using the gray scale (ISO 105-A02) for color change. A noticeable value (lightness) and/or chroma (saturation) change with minimum hue change is acceptable. Evaluate specimens as specified in GMW6992. Reference polystyrene or blue wool is to be used to certify the xenon arc apparatus.

3.3.2 Natural Weathering Exposure (GMW3417). Evaluation criteria shall be no greater than a noticeable value (lightness) and or chroma (saturation) change with minimum hue change is acceptable. Evaluate specimens as specified in GMW6992. Natural weathering is the requirement for colorfastness to light approval. GM is responsible for conducting the natural weathering testing. Suppliers shall submit one (1) A4-sized specimen of the color-approved material to the responsible engineer at the developing region. This specimen must be from the same lot of material that is visually approved by GM and shall be submitted along with the color properties test specimen submission package. The specimen shall be labeled "For Natural Weathering Test" and include the supplier's name, piece number, date and GM Finish Symbol and color number. GM will advise the supplier of compliance or lack of compliance to the requirement, see Table 4

Table 4: Natural Weathering Exposure Requirement (Solar Glass)

Application	Temperature (°C)	Requirement (TNR kL)	Information Only
Carpet (Floor-Low UV)	85 °C	15	-

Note: kiloliters (kL), TNR = Temperature Normalized Radiation.

3.3.3 Water Spotting/Colorfastness to Water (GMW14102). Specimen size shall be 400 mm × 400 mm. The solutions used for testing shall be as follows:

- Specimen 1: Test using 1 ml distilled water
- Specimen 2: Test using 1 ml saturated sodium chloride (NaCl) solution

Clean with a damp cloth after 1 h and evaluate. No spot formation or other changes in serviceability allowed.

3.3.4 Cleanability and Soil Resistance (GMW3402). Perform soiling and cleaning of all soiling agents listed, with the exception of Codes E, L and M. A rating ≥ 4 is required for each soil and cleaner. For the evaluation, use the gray scale (ISO 105-A02 and/or ISO 105-A03).

3.3.5 Flammability (GMW3232). For initial approval and routine quality control.

3.3.5.1 After Conditioning. Immediately prior to tests, all test specimens shall be conditioned for a minimum of 24 h according to GMW3221, Code A.

3.3.5.2 After Aging. The test cycle shall commence with 48 h $\pm$ 1 h at 40 °C $\pm$ 3 °C and 95% $\pm$ 5% relative humidity, followed by 168 h $\pm$ 1 h at 90 °C $\pm$ 3 °C, and completed without interruption. Repeat conditioning before testing flammability.

3.4 Laminate, Composite and Substrate Requirements. All floor material testing is to be done on molded floor composites.

3.4.1 Appearance.

3.4.1.1 There shall be no warping of any molded surfaces more than 3 mm from the checking fixture unless otherwise specified on the engineering drawing.

3.4.1.2 There shall be no wrinkles, distortions or stretch marks on the surface of the part in the installed position.