



Carpet Materials for Non-floor Applications

1 Scope

1.1 Material Description. Carpet materials shall be constructed using synthetic fibers, dyed and finished with an approved backing to become acceptable in color, pattern and physical properties as outlined in this specification.

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

1.3 Applicability. Suitable for non-floor applications, such as rear seat to back window covering, lower door trim, toe bar covers, trunk lining, load floor areas, lower Instrument panels, consoles.

1.4 Remarks. 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. For requirements of vehicles without solar absorbing glass, contact the appropriate Materials Engineer.

2 References

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

2.1 External Standards/Specifications.

ISO 105-A01	ISO 105-B06	ISO 5084	ISO/IEC 17025
ISO 105-A02	ISO 178	ISO 13937-2	SAE J1530
ISO 105-A03			

2.2 GM Standards/Specifications.

GMW3010	GMW3232	GMW3417	GMW14162
GMW3059	GMW3235	GMW4217	GMW14270
GMW3182	GMW3259	GMW6992	GMW14444
GMW3205	GMW3326	GMW14102	GMW15634
GMW3208	GMW3387	GMW14124	GMW15635
GMW3211	GMW3402	GMW14128	GMW16853
GMW3221	GMW3405	GMW14141	

2.3 Additional References.

- Editable construction/certification data forms available at www.gmsupplypower.com, (see Appendix A and Appendix B for examples).

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 so that no two (2) test specimens overlap in the same row of yarns. 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. See the appropriate construction specification for pattern and finish information.

3.1.4 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.

3.1.5 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 of modification to the product/process, and to apply for a new release.

Unless 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.

3.1.6 Laboratory 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.

Note: Conform means that the laboratory meets requirements, although it may not be formally recognized by a third party.

3.1.7 Material Construction Specification. All required information shall be reported on the Carpet Construction Specification Forms (see Appendix A, Data Sheets A1 and A2). A form shall be submitted along with each carpet 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.

3.1.8 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 Construction Certification Forms (see Appendix B, Data Sheets B1, B2 and B3).

Note: See Appendix B, Data Sheets B1, B2, and B3 for examples of the Construction Certification Forms. Editable forms can be downloaded from <http://www.gmsupplypower.com> using the GM SupplyPower folder path: Document Library, Engineering, Global, Product Design. Folder title: "Textile GMW's – Forms, Templates, and Finish Symbols". Document: "GMW16597 Rev. 2017 Carpet Materials for Non-floor Applications Data Forms".

3.1.9 Test Specimens. All tested specimens submitted to GM by suppliers shall be stapled to size A4 (or letter size) white cardstock. On each card, list the test report number, material specification and section number, test date, observations, and disposition. The sheets must be arranged so that they are in order by section number and submitted in a ring binder.

3.2 Rolled Good Carpet Construction Requirements.

3.2.1 Weight (GMW3182). Test three (3) specimens. Report the results in g/m² (grams/square meter). Refer to the Construction Certification Form (Appendix B, Data Sheets B21, B3 and B3) for weight specification requirements.

3.2.2 Thickness (ISO 5084). Refer to the construction form (see Appendix A, Data Sheets A1 and/or A2). Report the average for three (3) specimens 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 100mm × 100 mm.

3.2.3 Trouser Tear Strength (ISO 13937-2). Test six (6) specimens, three (3) from the Machine Direction (MD) and another three (3) from the Cross-Machine Direction (CMD). Electronic method of calculation shall be used. The minimum value is 25 N.

3.2.4 Breaking Load (GMW3010, Code A). Test six (6) specimens, three (3) from the MD and another three (3) from the CMD.

3.2.4.1 Unbacked Fused: Minimum 400 N.

3.2.4.2 Trunk Floor/Heat sealed backside: Minimum 445 N.

3.2.4.3 All Others: Minimum 310 N.

3.2.5 Elongation (GMW3010, Code A). Non-woven construction only. Test six (6) specimens, three (3) from the MD and another three (3) from the CMD and reported as an average of three (3) tests.

3.2.5.1 Unbacked Fused: 40% maximum when taken at 290 N.

3.2.6 Trapezoid Tear Strength (GMW3326). The reported value shall be the average of the individual results in each direction: MD and CMD.

3.2.6.1 Tufted Non-Floor: Minimum 45 N.

3.2.6.2 Non-woven.

3.2.6.2.1 Backcoated: Minimum 135 N.

3.2.6.2.2 Unbacked Fused Back: Minimum 150 N.

3.2.7 Abrasion Resistance (GMW3208) Three (3) specimens per type shall be tested per GMW3208.

3.2.7.1 Tufted carpet: 1000 g load and H18 Taber abrasion wheels, 600 cycles. There shall be no backing fabric visible, Rating 6 minimum.

3.2.7.2 Non-woven.

3.2.7.2.1 Trunk Carpet and Seat Back: 500 g load and H18 Taber abrasion wheels, 600 cycles. There shall no backing visible and no pilling of the fibers, Rating 6 minimum.

3.2.7.2.2 Non-floor and Trunk Trim: 500 g load and H38 Taber abrasion wheels, 600 cycles. There shall be no backing visible, and no pilling of the fibers, Rating 6 minimum.

3.2.8 Dimensional Stability (GMW4217). For both the MD and CMD, a maximum of 1.5% change is allowed.

3.2.8.1 Expose the sample in the oven at 80 °C for 1 .

3.2.8.2 Expose the sample in the Humidity Chamber at 37 °C and 95% ± 2% Relative Humidity (RH) for 24 h.

3.2.9 Bearding (SAE J1530, Paragraph 5). Non wovens only. There shall be no bearding or complete pullout of fiber. New abradant material shall be used every 100 cycles during the test. The specimen shall be weighted before and after the test and the results recorded in the report.

- Self-face construction 25 cycles
- Pressure Sensitive Adhesive (PSA), Latex, other backcoats 100 cycles
- Unbacked Fusedback 500 cycles

3.2.10 Seam Fatigue (GMW3405). For seating applications only, the joining seam on the sewn carpet material shall resist slippage (pullout) of any one (1) yarn of the tufting substrate or extreme elongation of the holes, fractures of the sew line. It should not have needle holes larger than 2 mm, or an objectionable seam appearance after 2500 cycles. Seam appearance shall be judged on a sew line when observed from the face side. A seam evaluation may also be conducted on a sewn assembly. Disposition shall be made in accordance with these results.

3.2.11 Stretch and Set (GMW3211). For seating applications only. Test three (3) specimens each from the MD and CMD; report the average for each direction. The maximum allowable value for Stretch is 25%. The maximum allowable value for Set is 5%.

3.2.12 Mildew (GMW3259). Required only if natural fibers are present in the construction. There shall be no visible growth or odor of mildew. See Construction Certification form (Appendix B, Data Sets B1, B2 and B3) to determine if this is a requirement.

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

3.2.13.1 Resistance to Odor (GMW3205, Coding A2 and B2). Report results for wet and dry conditions. Use a ratio of specimen size to container volume of 1:50. A rating of ≥ 6 is required.

3.2.13.2 Fogging (GMW3235, Method B). Test temperature is T2 (100 °C) except for Code 1 parts (see GMW14444 for reference). The condensable constituents, or the fogging value G, shall be ≤ 2 mg. No droplets, or crystals are acceptable upon visual examination.

3.2.13.3 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 ≤ 300 $\mu\text{g/g}$ for VOCs, and ≤ 300 $\mu\text{g/g}$ for SVOCs.

3.2.13.4 Carbonyls (GMW15635). Record the amounts of each chemical listed along with the sum of C² to C⁶ Carbonyls. Values shall be Formaldehyde: ≤ 8 mg/kg, Acetaldehyde: ≤ 8 mg/kg, Acrolein: ≤ 8 mg/kg, Acetone: report value, Sum C² to C⁶ Carbonyls: ≤ 20 mg/kg.

3.2.14 Flammability (GMW3232).

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

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

3.2.15 Sound Transparency (GMW14128). If a carpet is intended to be used as a speaker covering, it must meet this requirement.

3.2.16 Density. Report the material's density in kilograms/cubic meters (kg/m³) to the nearest tenth for use in the GM Materials Property Database (GMMPD). Calculate as follows:

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

Where:

D = Density

M = Mass of specimen, in grams

V = Volume of specimen in cubic millimeters (mm³)

3.3 Color Requirements. The following requirements describe the testing to be completed for each color once the initial construction has been approved. The testing may be done on a carpet material or on a carpet composite following the initial construction approval. All construction requirements are expected to match the initial construction approval even though these properties are not all retested for each color.

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

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
Carpet	320 kJ/m ²	640 kJ/m ²

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

Application	Requirement	For Information
Carpet	14 MJ/m ²	2 MJ/m ²

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

Application	Requirement	For Information
Carpet (Low Ultraviolet (UV))	112 kJ/m ²	Not applicable
Carpet (High UV)	451 kJ/m ²	Not applicable

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). Natural weathering is the requirement for Colorfastness to light approval. GM is responsible for conducting the natural weathering test. Suppliers shall submit one (1) A4 or letter size specimen of the color-approved material to the responsible engineer in a developing region. The 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 as "For Natural Weathering Test" with a supplier's name, piece number, date, GM Finish Symbol and color number. GM will advise the supplier of compliance or lack of compliance to the requirement. A rating of ≥ 4 per ISO 105-A02 grey scale for color change, with no greater than a noticeable value (lightness) and or chroma (saturation) change with minimum hue change is acceptable. Evaluate specimens as specified in GMW6992. See Table 4 for exposure requirements.

Note: Non-solar glass vehicles revert to regional requirement.

Table 4: Natural Weathering Exposure Requirement (Solar Glass)

Application	Temperature (°C)	Requirement (TNR kLy) ^{Note 1}	Information Only
Carpet (Low UV)	85	15	40
Carpet (High UV)	102	105	50

Note 1: TNR kLy = Total Normalized Radiation kiloLangley.

3.3.3 Fiber Degradation (GMW3387). Perform fiber degradation before and after Xenon testing and natural weathering. A rating ≥ 8 is required.

3.3.4 Dye Migration (GMW14141). A rating ≥ 4 is required using the gray scale (ISO 105-A03) for staining.

3.3.5 Color Crock (ISO 105-A01). A rating ≥ 4 is required using the gray scale (ISO 105-A03) for staining. Use the "Round Finger" and ten (10) strokes (to and fro).

3.3.6 Water Spotting/Colorfastness to Water (GMW14102). Specimen size shall be 400 mm × 400 mm. Amount of water used shall be 50 mL. No penetration through the carpet when applying the water. No staining, ringing, haptic change or shrinkage allowed.

3.3.7 Cleanability and Soil Resistance (GMW3402). Perform soiling and cleaning of all soiling agents listed in GMW3402, with the exception of Codes E, L, M, N and P. 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).

3.3.8 Flammability (GMW3232).

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

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

3.4 Molded Laminate, Composite and Substrate Requirements (Production Intended Parts). All carpet testing is to be done on molded floor composites, or carpets with backings intended for production.