



Wind Management Fabric

1 Scope

1.1 Material Description. This specification describes fabrics used for wind management in sunroof applications. Fabrics covered by this specification are made from fibrous textile materials that are knit in structure. Due to lightfastness requirements, it is recommended that these fabrics be solution dyed.

1.2 Symbols. A unique finish symbol will be given to each fabric by the responsible GM representative at initial development.

1.3 Applicability. This material is used as a covering for panels that flip up to deflect wind when the sunroof is open. The covered panels are stowed when the sunroof is closed. There may be other miscellaneous wind management applications.

1.4 Remarks. None.

2 References

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

2.1 External Standards/Specifications.

ISO 105-A02	ISO 105-X12	ISO 5084	ISO/IEC 17025
ISO 105-A03	ISO 4892-1/2	ISO 13937-2	SAE J1960

2.2 GM Standards/Specifications.

GMW3010	GMW3232	GMW14108	GMW14444
GMW3059	GMW3235	GMW14124	GMW15634
GMW3182	GMW3259	GMW14125	GMW15635
GMW3205	GMW3402	GMW14141	GMW16853
GMW3221	GMW6992	GMW14270	

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 before and after completion of test unless the test method indicates that standard conditioning is not required. If specimens are tested outside of the conditioned environment, they shall be tested within 10 minutes of removal.

3.1.2 Sampling and Test Specimen Preparation. All test specimens shall be taken from the area beyond the initial 2 m of production and at least 50 mm from either selvage edge. Prepare test specimen as required in the respective test method.

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

3.1.4 Deviation from Defined Test Methods. Deviations from the conditions of any test method shall be agreed upon between supplier and vehicle manufacturer. All deviations shall be specified on the component drawings,

material specifications, and Statement of Requirements and shall be indicated as such on test certificates and reports.

3.1.5 Lab Accreditation. Lab testing is to be performed by a laboratory that conforms (meets requirements, may not be formally recognized by a third party) to ISO/IEC 17025 or is acceptable to the customer (General Motors). Test reports must conform to ISO/IEC 17025. Supplier shall submit a letter of compliance.

3.1.6 Material Construction Specification. All required information shall be reported on the Construction Specification Form provided in Appendix A, Data Sheet A1. A specification form shall be submitted along with each fabric for engineering approval. Established values for a construction will be reported on and controlled within the limits established on the Construction Specification Form.

3.1.7 Laboratory Data Forms. Test reports must conform to ISO/IEC 17025. Use of the forms provided in Appendix B, Data Sheets B1 and B2 meets this requirement.

3.1.8 Data Reporting. All required information shall be entered into the appropriate Construction Specification Form (Appendix A, Data Sheet A1), Construction Laboratory or Color Laboratory Data Forms (Appendix B, Data Sheets B1 and B2). If all individual readings of a specific test meet or exceed the specified requirements, report the average. Report all individual test results if any values do not meet the requirements, unless otherwise stated.

3.1.9 Documentation. Samples of components or material 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 manufacturer) 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 and Color Requirements. The following requirements describe the initial testing to be completed when a new fabric construction is being considered.

3.2.1 Weight (GMW3182). Report the average in grams per meter squared (g/m^2). Acceptable production tolerances shall be $\pm 6\%$. Refer to the Construction Specification Form (Appendix A, Data Sheet A1) for the requirement.

3.2.2 Thickness (ISO 5084). Report the average for three (3) specimens, in millimeters (mm) to the nearest 0.01 mm. Use a 2.0 N load and a 50.5 mm diameter pressure foot to achieve a pressure of 1.0 kPa. All readings should be taken after the pressure foot has been in contact with the material for at least 5 s. Acceptable production tolerance will be $\pm 10\%$ unless otherwise specified on the construction specification.

3.2.3 Tensile Strength and Elongation (GMW3010, Code A). In addition to the Machine Direction (MD) and Cross Machine Direction (CMD) directions, test three (3) specimens from the bias left and bias right. Established values for a construction will be reported on and controlled within the limits established on the construction specification form. The minimum tensile requirement at break is 350 N. Report the average elongation at 50 N. In addition, report elongation at 25 N, 100 N, and at break for information only.

3.2.4 Trouser Tear Strength (ISO 13937-2). Test three (3) specimens from the MD and three (3) specimens from the CMD; for Trouser Tear consider the short direction of the test specimen the direction of test. Report the average for each direction in Newtons (N). The minimum tear strength shall be 36 N.

3.2.5 Linear Abrasion Testing (GMW14125). Test the material using a brush type specified in GMW14125, Appendix C with 100 stroke length for 10 cycles at the speed of 15 cycles/minute using 1 ± 0.01 N pressure force (GMW14125, Coding B, Coding X3). Three (3) specimens should be tested.

Note: No wear through is allowed.

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

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

3.2.6.2 Aging (GMW3232). The test cycle shall commence with 48 h $\pm$ 1 h at 40 °C $\pm$ 3 °C and 93% $\pm$ 5% Relative Humidity (RH) followed by 168 h $\pm$ 1 h at 90 °C $\pm$ 3 °C and completed without interruption. Repeat conditioning before testing flammability.

Note: Fabric or fabric laminates that will not be 100% bonded to a substrate, (e.g., cut and sew application), are required to meet GMW3232 as rolled goods. Fabric or fabric laminates that will be 100% bonded to a substrate, must meet GMW3232 as a composite (fabric/fabric laminate plus part substrate).

3.2.7 Mildew (GMW3259). Required only if natural fibers are present in the construction. There shall be no visible growth or odor of mildew.

3.2.8 Overall 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** according to GMW16853.

3.2.8.1 Resistance to Odor (GMW3205). Report results for wet and dry conditions. Use a ratio of specimen size to container volume of 1:50. A rating of $\geq$ 6 is required.

3.2.8.2 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 $\leq$ 2 mg. No droplets, or crystals are acceptable upon visual examination.

3.2.8.3 Volatile Organic Compound/Semi-volatile Organic Compound (VOC/SVOC) (GMW15634). Required only for non-laminated materials. Record total amounts of VOCs and SVOCs in milligram/kilogram and attach a report listing all chemicals detected. Required limits vary according to material type. See GMW16853 Table titled **Emission Requirements for Interior Material/Parts/Assembly List** for specific requirements.

3.2.8.4 Carbonyls (GMW15635). Required only for adhesive laminated materials. Record the amounts of each chemical listed along with the sum of C² to C⁶ Carbonyls. See GMW16853 Table titled **Emission Requirements for Interior Material/Parts/Assembly List** for specific requirements.

3.2.9 Dimensional Stability (GMW14124, Cycle M, Performed Twice). Report dimensional change after each condition of the cycle. There shall be no greater than 2.5% dimensional changes in either direction.

3.2.10 Soil and Cleaner Resistance (GMW3402).

- For Procedure A: Soil Resistance test using Code I only. The requirement is $\geq$ 4 per ISO 105-A02 Grey Scale for Color Change.
- For Procedure B: Cleaner Resistance, test all cleaning agents. The requirement is $\geq$ 3 per ISO 105-A03 Grey Scale for Staining and $\geq$ 4 per ISO 105-A02 Grey Scale for Color Change.

3.2.11 Crocking (ISO 105-X12). The results shall be 4 or greater when compared to the ISO 105-A03 Grey Scale for Staining after ten strokes for both wet and dry.

3.2.12 Dye Migration (GMW14141). The results shall be 4 or greater when compared to the ISO 105-A03 Grey Scale for Staining.

3.2.13 Water Spotting (GMW14108). Specimen size shall be 400 mm $\times$ 400 mm. Amount of water used shall be 1.5 mL. No staining, ringing, haptic change or shrinkage is allowed. If the water wicks to the edge of the specimen, increase the specimen size.

3.2.14 Colorfastness to Artificial Light. The procedure and requirement will be defined on the Color Laboratory Data Form (Appendix A, Data Sheet B2) by approving region from Table 1.

Table 1: Xenon Methods and Requirements

Xenon Method	Requirement	For Information
SAE J1960	1250 kJ/m ²	2500 kJ/m ²
ISO 4892-1/2	1500 kJ/m ²	3000 kJ/m ²