



Overhead and Rear Window Trim Substrates

1 Scope

1.1 Material Description. The type refers to the performance attributes.

1.1.1 Materials intended to be used in substrate applications must also meet the assembly performance requirements per GMW14444 as assembled.

1.2 Symbols. Not applicable.

1.3 Applicability. Typical applications include overhead and rear window trim substrate applications.

2 References

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

2.1 External Standards/Specifications.

ISO 178	ISO 5084	ISO 9053	ISO 17025
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2.2 GM Standards/Specifications.

GMW3059	GMW3221	GMW14363	GMW14777
GMW3116	GMW3232	GMW14444	GMW16190
GMW3182	GMW3235	GMW14512	GMW16853
GMW3205	GMW3259		

2.3 Additional References.

GM Materials Reporting Website, www.gmw3059.com.

TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).

3 Requirements

3.1 Requirements on Test Specimens. Reference GMW3221.

3.1.1 Test Data. Laboratory testing is to be performed by a laboratory that conforms to ISO 17025 and is acceptable to the customer (GM). Test reports must conform to ISO 17025.

Note: Meets requirements but may not be formally recognized by a third party.

3.1.2 Standard Conditions (GMW3221, Code A). All test specimens shall be conditioned to GMW3221, Code A, unless the test procedure indicates that standard conditioning is not required. Condition specimens for a minimum of 24 h prior to testing or until moisture equilibrium is reached. If specimens are tested outside the conditioned environment, they shall be tested within 10 minutes of removal.

3.1.3 Sampling and Test Specimen Preparation. For directional properties, samples shall be reported with machine direction and against machine direction. 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 specimens as required in the respective test procedure.

3.1.4 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 (Appendix A, Table A1).

Any additional test requirements shall be provided to GM upon request (i.e., high speed stress strain and compression curves for computer simulation).

3.2 Emissions Testing of Interior Materials and Parts. For all Code E designated parts per GMW14444, reference GMW16853 for emissions testing of interior materials and parts.

3.3 Construction Requirements for Substrate. All testing shall be conducted on a formed part at ideal thickness for physical properties without facing material. Report values in Appendix A, Table A1.

3.3.1 Weight (GMW3182). Test three (3) specimens and report the average in grams per meter squared for the substrate weight. Acceptable production tolerances shall be $\pm 10\%$. Any deviation must be agreed to by appropriate GM engineer. Refer to the construction sheet for weight specifications.

3.3.2 Thickness (ISO 5084). Report the average for three (3) specimens without facing material, in millimeters to the nearest 0.1 mm. Use a 2.0 N load and a 50.5 mm diameter presser foot to achieve a pressure of 1.0 kPa. All readings should be taken after the presser foot has been in contact with the material for at least 5 s. Refer to the construction sheet for thickness.

3.3.3 Flexural Properties (ISO 178). Test five (5) specimens in the machine and against machine direction for nominal thickness without facing material. Test speed 50 mm/minute, 100 mm span, 5 mm support radius, and sample size 75 mm $\times$ 200 mm. Report flexural strength (maximum force over first 25 mm of deflection), flexural stiffness (initial slope of flexural curve), and flexural toughness (percent retention of maximum force compared to force at 25 mm) averages on construction sheet. Submit flexural stress strain curve.

3.3.4 Acoustical Properties (ISO 9053). Test the specific airflow resistance of five (5) specimens each taken from nominal thicknesses. Report specific airflow resistance in liters per cubic meter per second average on construction sheet. Pressure shall be 500 Pa and orifice size of 100 mm².

3.3.5 Fogging (GMW3235, Code B). Report the average of three (3) specimens. The weight change of the used aluminum foil shall be no > 1.5 mg. The bath temperature shall be 90 °C.

3.3.6 Flammability (GMW3232). Test as received and after aging. Report B_{maximum} and $B_{\text{statistical}}$ requirement must be < 100 mm/minute.

3.3.7 Odor (GMW3205). Report both wet and dry results, Codes A and B. Rating of six (6) minimum. Use a 1:50 ratio of specimen size to container.

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

3.3.9 Cantilever Sag (GMW16190). Test three (3) specimens in machine direction and three (3) specimens against machine direction. Specimen size is 75 mm $\times$ 300 mm. Secure fixed side in flat plate, and tight with no > 25 mm of length secured. Measure the initial height of sample at the end of sample opposite fixed end. Measure the height of sample at the end after minimum of 24 h at 85 °C. Report change in height after 85 °C. Each sample should be individually supported.

3.3.10 Moisture Content (GMW14777). Substrates that are susceptible to moisture should be tested for 30 minutes (Code A). Moisture content must be $\leq 8\%$ by mass. Water absorption must be $\leq 40\%$ by mass. Thickness swell must be $\leq 40\%$ by mass.

3.4 Color Requirements. As defined by requirements of facing material specification.

3.5 Part Requirements. Requirements per GMW14444 plus requirements listed in 3.5.1 thru 3.5.8 on formed parts with facing material.

3.5.1 Weight (GMW3182). Test three (3) specimens and report the average in grams per meter squared for the substrate weight. Acceptable production tolerances shall be $\pm 10\%$. Any deviation must be agreed to by appropriate GM engineer. Refer to the construction sheet for weight specifications.

3.5.2 Thickness (ISO 5084). Report the average for three (3) specimens without facing material in millimeters to the nearest 0.1 mm. Use a 2.0 N load and a 50.5 mm diameter presser foot to achieve a pressure of 1.0 kPa. All readings should be taken after the presser foot has been in contact with the material for at least 5 s. Refer to the construction sheet for thickness.

3.5.3 Flexural Properties (ISO 178). Test five (5) specimens in the machine and against machine direction for nominal thickness without facing material. Test speed 50 mm/minute, 100 mm span, 5 mm support radius, and sample size 75 mm $\times$ 200 mm. Report flexural strength (maximum force over first 25 mm of deflection), flexural stiffness (initial slope of flexural curve), and flexural toughness (percent retention of maximum force compared to force at 25 mm) averages on construction sheet. Submit flexural stress strain curve.

3.5.4 Cantilever Sag (GMW16190). Test three (3) specimens in machine direction and three (3) specimens against machine direction. Specimen size is 75 mm × 300 mm. Secure fixed side in flat plate, and tight with no > 25 mm of length secured. Measure the initial height of sample at the end of sample opposite fixed end. Measure the height of sample at the end after minimum of 24 h at 85 °C. Report change in height after 85 °C. Each sample should be individually supported.

3.5.5 Testing of Staining Behavior of Molded Headlining through Dust Deposits (GMW14512). Rating of three (3) or better after vacuuming. Rating of two (2) or better before vacuuming. Testing to be performed by GM Europe. Contact Materials or Validation Engineer for shipping instructions. Samples must be submitted with adequate time to perform testing.

3.5.6 Acoustical Properties (ISO 9053). Test the specific airflow resistance of five (5) specimens each taken from nominal thicknesses. Report average specific airflow resistance in liters per cubic meter per second on construction sheet. Pressure shall be 500 Pa and orifice size of 100 mm².

3.5.7 Indentation Hardness (GMW14363 - A2). Visible side up. Requirement: 2 mm +1.5 mm/-1 mm compression set, tested immediately after indentation hardness; primary force shall be released and the test piece shall be allowed to relieve with only the pre-force applied. After 60 s ± 2 s the remaining penetration of the indenter shall be measured as the compression set. Requirement: < 0.5 mm.

3.5.8 Glass Fiber Outlet on Edge and Cutout. No escape of glass fibers. The edges shall be sealed.

This will be tested as in 3.5.8.1 thru 3.5.8.5.

3.5.8.1 It will be scratched in an angle from 40 degrees with the blunt side of a scalpel on the edge zone also in the hole zone.

3.5.8.2 The scratch process shall be performed four (4) times in the relevant edges.

3.5.8.3 The fibers which may escape will be collected on a polished steel plate.

3.5.8.4 The type of fibers shall be determined with microprobe and infrared analysis.

3.5.8.5 The quantity shall be evaluated subjectively and visually. Rate of glass fiber loss will be defined on part drawing.

4 Manufacturing Process

4.1 Quality Control Monitoring. All quality control processing guidelines provided by material source must be followed by molder. The molder must also show process control in all areas associated with Appendix B, Table B1. All deviations to material source guidelines must be documented in drawing/math notes by engineering work order with sign off by Roof and Rear Window Trim Global Subsystem Leadership Team and Program Materials Engineer.

All approved materials require approval from Materials Engineering and the Roof and Rear Window Trim Global Subsystem Leadership Team.

4.2 Part Performance/Processability. All materials covered by this specification are subject to part performance testing through part validation. All submissions for approval require Appendix B, Table B1 to be filled out completely.

5 Rules and Regulations

5.1 Legal Regulations. All materials must satisfy applicable laws, rules, regulations and recommendations valid in the country of usage.

5.2 Language. In the event of conflict between the English and domestic language, the English language shall take precedence.

5.3 Inspection and Rejection. Samples of components or materials released to a GM material specification shall be tested for conformity with the requirements of this material specification and approved by the responsible Engineering department prior to commencement of delivery of bulk supplies.

A new approval must be received for any changes, e.g., properties, manufacturing process, location of manufacture, etc. If not otherwise agreed, all testing and documentation normally required for initial release must be completed.