



Overhead Substrates

1 Scope

1.1 Material Description. Materials approved to this specification include thermoset and thermoplastic compression molded and moldable composite materials.

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 substrate applications.

1.4 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ISO 178	ISO 5084	ISO 9053-1	ISO/IEC 17025
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2.2 GM Standards/Specifications.

GMW3059	GMW3221	GMW14270	GMW16190
GMW3116	GMW3232	GMW14444	GMW16853
GMW3182	GMW3259	GMW14777	GMW17251

2.3 Additional References.

- CG5025 VIAQ Regulated Volatile External Supplement to GMW16853
- Computer Aided Engineering (CAE) Test Requirements for Thermoplastics, see Appendix F (<http://www.gmsupplypower.covisint.com>)
- Computer Aided Engineering (CAE) Test Requirements for Thermosets, see Appendix E (<http://www.gmsupplypower.covisint.com>)
- Layered Description, see Appendix C, Data Sheet C1 (<http://www.gmsupplypower.covisint.com>)
- Manufacturing Requirements, see Appendix B, Data Sheet B1 (<http://www.gmsupplypower.covisint.com>)
- Submission Checklist, see Appendix D, Data Sheet D1 (<http://www.gmsupplypower.covisint.com>)
- Substrate Construction Certification Form, see Appendix A, Data Sheet A1 (<http://www.gmsupplypower.covisint.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/IEC 17025 and is acceptable to the customer (GM). Test reports must conform to ISO/IEC 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, the specimens 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 (MD) and Against Machine Direction (AMD). 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, Data Sheet A1, Appendix B, Data Sheet B1 and Appendix C, Data Sheet C1). Laboratory test reports may be requested at the discretion of the GM Materials Engineer.

3.2 Construction Requirements for Substrate Alone. All testing shall be conducted on a formed part at ideal thickness for physical properties (report value as nominal in Appendix C, Data Sheet C1) without facing material. Report values in Appendix A. Testing at additional thickness values may be specified by the responsible Materials Engineer. Substrates to meet GMW17251 requirements for flexural properties, acoustical properties sag and thickness as identified by Hard Trim and Overhead System Global Subsystem Leadership Team.

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

3.2.2 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.

3.2.3 Flexural Properties (ISO 178). Test five (5) specimens each for MD and AMD 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. Submit flexural stress strain curve.

3.2.4 Acoustical Properties (ISO 9053-1). 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. Pressure shall be 500 Pa and orifice size of 100 mm².

3.2.5 Fogging (see CG5025 in GMW16853 for Overhead/Headlining Substrates).

3.2.6 Flammability (GMW3232). Test as received and after aging. Reported Maximum Burn Rate ($B_{\max}$) and Maximum Statistical Burn Rate (B_{stat}) must be < 100 mm/minute. Report data by submitting test report format GMW3232 PROT8EFENG available at <http://www.gmsupplypower.covisint.com>.

3.2.7 Odor (see CG5025 in GMW16853 for Overhead/Headlining Substrates).

3.2.8 Volatile (VOC) and Semi-Volatile (SVOC) Organic Compounds (see CG5025 in GMW16853 for Overhead/Headlining Substrates).

3.2.9 Aldehyde and Ketone Emissions (see CG5025 in GMW16853 for Overhead/Headlining Substrates).

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

3.2.11 Cantilever Sag (GMW16190). Test three (3) specimens MD and three (3) specimens AMD. Specimen size is 75 mm $\times$ 300 mm. Secure no more than 25 mm of length in the fixed side flat plate. Report sag (change in height) after 24 h at 85 °C. Each sample should be individually supported.

3.2.12 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.

3.3 Additional Requirements.

3.3.1 Computer Aided Engineering (CAE) Requirements. Material supplier shall be responsible for obtaining and reporting testing specified in Computer Aided Engineering (CAE) Test Requirements for Thermosets (Appendix E) or Computer Aided Engineering (CAE) Test Requirements for Thermoplastics (Appendix F), as appropriate to the material, available at <http://www.gmsupplypower.covisint.com>. Appendix E and Appendix F properties are required for full specification approval on at least one lot. Contact GM Materials Engineer,

Overhead Substrate BOM Family Owner (BFO), and CAE Engineer for guidance on specific requirements for the material seeking approval.

3.3.2 Laboratory Test Certification Package. The Appendix A, Data Sheet A1, Appendix B, Data Sheet B1 and Appendix C, Data Sheet C1 available at <http://www.gmsupplypower.covisint.com>, shall be used to present data to this specification. Appendix B recommendations to be completed by substrate supplier for reference by part molders. Flammability results shall be reported using test report format GMW3232 PROT8EFENG available at <http://www.gmsupplypower.covisint.com>. GMW16853 report format and third party lab reports for emissions shall be submitted in addition to Appendix A.

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

3.5 Part Requirements. Formed parts with facing material must meet requirements per GMW14444 plus requirements listed in 3.5.1 thru 3.5.8.

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

3.5.3 Flexural Properties (ISO 178). Test five (5) specimens for each MD and AMD for nominal composite thickness. 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. Submit flexural stress strain curve.

3.5.4 Cantilever Sag (GMW16190). Test three (3) specimens MD and three (3) specimens AMD. Specimen size is 75 mm $\times$ 300 mm. Secure no more than 25 mm of length in the fixed side flat plate. Report sag (change in height) after 24 h at 85 °C. Each sample should be individually supported.

3.5.5 Acoustical Properties (ISO 9053-1). 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. Pressure shall be 500 Pa and orifice size of 100 mm².

3.5.6 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.

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

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

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

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

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

3.6 All materials supplied to this standard must comply with GMW3059, **Restricted and Reportable Substances**, including the requirement to obtain a GM-approved International Material Data System (IMDS) submission.