



Acoustic Wheelhouse Liner Materials

1 Scope

1.1 Material Description. This material shall be comprised of a needle punched non-woven material that is molded and formed to the specific geometry of the wheel opening. The material shall be a moldable, self-supporting composite with a uniform black color surface on the tire side of the parts and shall be suitable for use in exterior vehicle environments for protecting both front and rear wheel openings.

1.1.1 Material and Performance Classification. Identification: The specific performance characteristics required for individual parts shall be called out on the engineering drawings. These properties are: weight per unit area, acoustic absorption level, water pass-through, and flexural rigidity.

Weight per Unit Area: g/m² (grams per square meter).

- 800 g/m²
- 900 g/m²
- 1000 g/m²
- 1100 g/m²
- 1200 g/m²
- 1300 g/m²
- 1400 g/m²

Note: Weights listed represent average area weight of finished part. Actual weight will vary depending on location of wheelhouse liner. This weight is for the finished part and not the blank.

1.1.1.1 Acoustic Absorption Level. Wheelhouse liner shall perform to the acoustic absorption level specified on engineering drawing, Level P (Premium, acoustical treatments per GMW14194 required), S (Standard) or M (Minimum). See 3.2 and Table 3. If no level is specified on the drawing, the default shall be Level S.

1.1.1.2 Water Pass-Through Class.

- Class 1: No water pass-through allowed. Impermeable barrier required either locally or globally. Wheelhouse liner must meet all requirements listed in Table 1, Table 2 and all Class 1 requirements where noted. The fabric and film lamination must be tested.
- Class 2: Minimal water pass-through permitted (full compression in a region). Wheelhouse liner must meet all requirements listed in Table 1 and Table 2 and all Class 2 requirements where noted.
- Class 3: Some water pass-through permitted (regular compression in a region). Wheelhouse liner must meet all requirements listed in Table 1 and Table 2 and all Class 3 requirements where noted.

If no class is specified on the drawing, the default shall be Class 3.

1.2 Symbols. Not applicable.

1.3 Applicability. This material is intended to protect the body and the engine compartment from water splash, road debris, and noise and vibration in the wheel area. The material acts as both a physical barrier and provides acoustic absorption, transmission loss, and internal damping related to impact noise. The material can be attached to body and frame components around the wheelhouse area with standard mechanical fasteners such as pushpins, threaded fasteners, etc. The material can also be welded to itself using sonic, vibration, or heat welding. Any welded areas should fail cohesively within the textile material and not exhibit clean separation.

The appropriate material type shall be selected for each vehicle application based upon the engineering requirements (stiffness, acoustics, water pass-through, geometry, etc.)

1.4 Remarks. This standard describes the requirements for fiber-based acoustic wheelhouse liners attached to the exterior of the vehicle.

1.4.1 Limitations on Usage. The materials described in this specification are designed for use in applications where the component continuous use temperature will not exceed 100 °C and the excursion temperature will not exceed 125 °C. Temperatures higher than 100 °C (continuous) or 125 °C (excursion) require additional insulators or reflectors to be applied and need to be tested in the vehicle.

2 References

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

2.1 External Standards/Specifications.

DIN/EN/ISO 4920	ISO 2589	ISO 9073-17	ISO/IEC 17025
ISO 178	ISO 9053	ISO 9073-18	SAE J913

2.2 GM Standards/Specifications.

GMW3010	GMW3221	GMW14177	GMW14700
GMW3059	GMW3259	GMW14194	GMW14872
GMW3182	GMW3326	GMW14270	GMW15725
GMW3208	GMW14124	GMW14334	GMW16745

2.3 Additional References.

None.

3 Requirements

3.1 Requirements on Test Specimens.

Reference GMW3221.

3.1.1 General Requirements. All materials supplied to this standard must comply with GMW3059, Restricted and Reportable Substances, including the requirement to submit a full material composition disclosure to GM via the International Material Data System (IMDS) or via a completed GMW3059 report form.

3.1.1.1 Test Data. Lab 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 5.10.2 and 5.10.3 of ISO/IEC 17025. Supplier shall submit a letter of compliance.

3.1.2 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.

3.1.3 Material Construction Specification. All required information shall be reported on the Wheelhouse liner Carpet Construction Specification Data Sheet. See Appendix C, Data Sheet C1. A data sheet 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 Data Sheet. See Appendix A, Data Sheet A1.

3.1.4 Color Material Specification. All required information shall be reported on the Color Data Sheet. A data sheet shall be submitted along with each textile material submitted for Engineering Approval. Established values for Color Material data will be reported on and controlled within the limits established on the Color Specification Data Sheet. See Appendix B, Data Sheet B1.

3.2 Test Requirements. All testing shall be conducted on mass production representative materials. Flat panels or sections cut from actual parts where the density is near target shall be used for Table 1 testing (if flat panels are used, they must be representative of a molded part, i.e., similar stretching). The part location of where samples are cut from must be provided. This material must be representative of mass production materials and process (weight, thickness, manufacturing process, etc.) Production parts must meet performance requirements as outlined in Table 2 per performance level as indicated on engineering drawings. Document test results in Appendix A, Table A1 and Table A2.

Unless otherwise specified in the appropriate test procedures, at least three (3) test pieces shall be tested. For test procedures that require a complete component, components shall be randomly selected from a minimum of 50 parts, if not otherwise agreed with responsible Materials Engineer.

Table 1: Material Requirements ^{Note 1}

Test	Test Procedure	Requirement
Resistance to Mildew	GMW3259	There shall be no visible growth or odor of mildew
Resistance to Fluids (Engine Compartment)	GMW15725 (4.7: Resistance to Fluids. Test Fluids; A, D, F, G, H, I, K, M)	There shall be no color change, loss of bond, material degradation or tackiness following the test
Resistance to Fluids (Exterior)	GMW14334, Method B	Rating 3
Abrasion Resistance	GMW3208 – 1000 cycles, H38 Wheel, 1000 g weight	There shall be no holes. Wear through top layer (depending on construction, if multi-layer) is allowed
Breaking Force	GMW3010, Code F or ISO 9073-18. (Test both Machine Direction (MD) and Cross Machine Direction (CMD))	Shall be a minimum of: 100 N/cm for 800 g/m ² , 900 g/m ² and 1000 g/m ² 120 N/cm for 1100 g/m ² 140 N/cm for 1200 g/m ² 160 N/cm for 1300 g/m ² 180 N/cm for 1400 g/m ² - As received - After gravelometer Exposure (GMW14700 Method B, five (5) cycles of 473 mL, approximately 700 g, gravel) - After heat aging (168 h at +85 °C)
Salt Staining Resistance	GMW14872	There shall be no physical deterioration or permanent staining Evaluate after Exposure A, Underbody cycle, four (4) salt sprays per cycle, Method 1
Resistance to Water Wicking	SAE J913. (Test MD and CMD.)	Report water wicking after using solution A for 16 h There shall be < 5 mm wicking
Tearing Resistance	GMW3326. (Test MD and CMD.)	Shall be a minimum of: 80 N for 800 g/m ² , 900 g/m ² and 1000 g/m ² 100 N for 1100 g/m ² 120 N for 1200 g/m ² 140 N for 1300 g/m ² 160 N for 1400 g/m ² - As received - After gravelometer - Exposure (GMW14700, Method B, five (5) cycles of 473 mL, approximately 700 g, gravel) - After heat aging (168 h at +85 °C)
Acoustic Performance (not required for Class 1)	GMW14177 (400 Hz to 10 000 Hz).	See Table 3

Test	Test Procedure	Requirement
Freeze - Thaw	Expose plaques to 14 cycles of GMW14124, Cycle K. (Test plaques in both a vertical and horizontal position.)	The plaques shall exhibit no objectionable degradation after the test such as wrinkling, distortion, delaminating, expansion, shrinkage or other distortion that will interfere with normal function
Stone Impact Testing (Gravelometer)	GMW14700, Method B Five (5) cycles of 473 mL, approximately 700 g gravel. Test in the following conditions: As received = after 16 h at +23 °C, 50% relative humidity (RH). At low temperature = tested at -30 °C. At low temperature = tested at -30 °C after soaking in water for 16 h.	There shall be no holes, fuzziness, separation, or other changes that impact the function of the wheelhouse liner or reduce the perceived quality of the vehicle
Flexural Rigidity	ISO 178, 10 mm deflection, span set at 50.8 mm, sample size of 25.4 mm x 152.4 mm, crosshead speed of 12.7 mm/minute. (Test MD and CMD.)	Shall be a minimum of: 5 N for 800 g/m ² , 900 g/m ² and 1000 g/m ² 7 N for 1100 g/m ² 8 N for 1200 g/m ² 9 N for 1300 g/m ² 10 N for 1400 g/m ² The wheelhouse liner material shall be of sufficient rigidity to be self-supporting in application and resist deflection in use. All test samples shall meet the minimum requirement: - As received - After gravelometer Exposure (GMW14700, Method B, five (5) cycles of 473 mL, approximately 700 g, gravel) - After heat aging (168 h at +85 °C)
Water Barrier Film – Peel Strength (Class 1 only)	Perform peel at an angle of 180 degrees on a power driven machine with a constant rate of 300 m/minute jaw separation. Perform peel test: - As received. - After each cycle of the Temperature – Humidity cycle (Dimensional Stability) (total of two (2) peel tests).	Minimum peel strength of 525 Nm, or cohesive failure of one or both of the fabric and film

Note 1: Test samples are typically plaques and shall be 2.0 mm nominal thickness for 800 g/m²; 2.5 mm nominal thickness for 900 g/m² and 1000 g/m² materials; 3 mm nominal thickness for 1100 g/m², 1200 g/m² and 1300 g/m²; and 3.5 mm nominal thickness for 1400 g/m² materials.

Table 2: Part Performance Requirements

Test	Test Procedure	Requirement
Weight per Unit Area	GMW3182	Report values. Typical values: 800 g/m ² to 1400 g/m ² , based on performance needs. Measurements should be made over the entire part.
Thickness	ISO 2589	Report values. Measurements should be made over the entire part.
Freeze - Thaw	Expose entire wheelhouse liner assembly to fourteen (14) Cycles of GMW14124, Cycle K. Test an entire wheelhouse liner in "vehicle position" mounted in a rack, or fixture. (Test one (1) part only.)	The wheelhouse liner part shall exhibit no objectionable degradation after the test such as wrinkling, distortion, delaminating, expansion shrinkage or other distortion that will interfere with normal function after.
Resistance of Material to Heat Aging	Expose entire wheelhouse liner assembly for 168 h at +85 °C. Test an entire wheelhouse liner in "vehicle position" mounted in a rack, or fixture. (Test one (1) part only.)	The wheelhouse liner part shall exhibit no objectionable degradation after the test such as wrinkling, distortion, delaminating, expansion shrinkage or other distortion that will interfere with normal function after.
Resistance to Temperature – Humidity Cycle (Dimensional Stability)	This cycle shall be carried out two (2) times without interruption: 17 h ± 0.5 h at -30 °C ± 3 °C. 72 h ± 1 h at +85 °C ± 3 °C. 24 h ± 1 h at +40 °C ± 3 °C and 93% ± 5% RH. 7 h ± 0.5 h at -30 °C ± 3 °C. 24 h ± 1 h at +40 °C ± 3 °C and 93% ± 5% RH. 24 h ± 1 h at +22 °C ± 3 °C. Test entire wheelhouse liner in "vehicle position" mounted in a rack, or fixture.	The wheelhouse liner part shall exhibit no objectionable degradation after the test such as wrinkling, distortion, delaminating, expansion shrinkage or other distortion that will interfere with normal function after. The parts must be checked on the checking fixture before and after the environmental cycle.
Stone Impact Testing (Gravelometer)	GMW14700, Method B Five (5) cycles of 473 mL, approximately 700 g gravel. Test in the following conditions: - As received = after 16 h at +23 °C, 50% RH. - At low temperature = tested at -30 °C. - At low temperature = tested at -30 °C after soaking in water for 16 h.	There shall be no holes, fuzziness, separation, or other changes that impact the function of the wheelhouse liner or reduce the perceived quality of the vehicle.

Test	Test Procedure	Requirement
High Pressure Cleaning Resistance	GMW16745, Method B The wheelhouse part shall be subjected to high pressure spraying with water on the tire side per GMW16745, Method B with the following substitutions: - Pressure: 8.27 MPa (1200 psi). - Spray Impingement: 90 degrees to Surface. 25 degree Nozzle Fan. 75 mm Nozzle to Surface. 15 cm/s sweep (parallel to surface). 10 s duration for each sweep (sweep is forward and back). 520 sweeps. See Appendix C, Figure C1 and Figure C2 for Setup.	The wheelhouse liner part shall exhibit no holes, fuzziness, separation or other distortion that will interfere with normal function. Class 1 – no water pass through. Class 2 and 3 – measure height of water plume and report. Place a scale on the backside of the part perpendicular to the surface. Provide a short video showing the test setup and height of plume.
Water and Splash Resistance	ISO 9073-17 or DIN/EN/ISO 4920 Four (4) consecutive cycles of 500 mL water spray.	Class 1 – no weight gain of blotting paper. Class 2 – weight gain of blotting paper not to exceed 2 g. Class 3 – weight gain of blotting paper not to exceed 5 g.
Abrasion Resistance	GMW3208 – 1000 cycles, H38 Wheel, 1000 g weight.	There shall be no holes. Wear through top layer (depending on construction, if multi-layer) is allowed.
Flexural Rigidity	ISO 178, 10 mm deflection, Span set at 50.8 mm, sample size of 25.4 mm x 152.4 mm, crosshead speed of 12.7 mm/minute.	Report results for various regions of part (loft, compression, direction). Shall be a minimum of: 4 N for 800 g/m², 900 g/m² and 1000 g/m² 5 N for 1100 g/m² 5 N for 1200 g/m² 6 N for 1300 g/m² 7 N for 1400 g/m² The wheelhouse liner material shall be of sufficient rigidity to be self-supporting in application and resist deflection in use. The average value of all samples shall meet requirement: - As received. - After gravelometer Exposure (GMW14700, Method B, five (5) cycles of 473 mL, approximately 700 g, gravel). - After exposure to Heat Aging (168 h at 85 °C). - After exposure to Resistance to Temperature – Humidity Cycle (Dimensional Stability).