



Molded Polyurethane Foam for Seating Applications

1 Scope

1.1 Material Description. Polyurethane (PUR) foam based on Methylene Diphenyl Diisocyanate (MDI), Toluene Diisocyanate (TDI), or MDI/TDI blends for seat foam applications, including seat cushions, seat backs, bolsters and molded toppers. For molded polyurethane head restraints and armrest, refer to GMW15064. For die-cut polyurethane toppers/plus-pads, refer to GMW15058, Type A1.

1.2 Symbols. Not applicable.

1.3 Applicability. The polyurethane material specified in this standard is recommended for use in automotive seat cushion and back applications. This specification segments polyurethane seating material into 6 (six) types. The 6 (six) types are based on material performance and product application, and they do not address the actual part design, particularly thickness. These standards are to be considered minimum compliance. Optimum seat conditions for maximum comfort and durability may require values different than those shown in the specification, but this will be program specific and part specific. Additional seat foam designations are provided in Component Technical Specification (CTS), Appendix C3 of the Statement of Requirements (SOR) for Seat and Head Restraint Foam.

1.4 Remarks.

1.4.1 Recycled or Alternate Materials. Recycled polyurethane materials or bio-based materials may be used for parts under this specification. Prior to incorporating recycled or bio-based materials into a finished product, the supplier shall provide data to GM Materials Engineering, showing that no decrease in performance or durability will occur due to the use of the recycled polyurethane materials or bio-based materials.

1.4.2 Annual Certification. Annual certification to this standard shall require continued conformance testing to all original physical property requirements within this standard or associated engineering drawing. Materials which are on the GM Materials Approved Source List (see Section 6), shall only be required to submit compliance testing per GMW15471 for Annual Certification for Flammability, Overall Part Weight (without components), Core Density, Molded Density, Hysteresis Loss and specific mechanical testing called out in Engineering Drawings. To be compliant and valid, the material certifications to GMW15471 shall be reported on Appendix A, Data Sheet A1, and approved by GM Seat Foam Materials Engineering/Foam Global Subsystem Leadership Team (GSSLT).

2 References

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

2.1 External Standards/Specifications.

ASTM D3574	ISO 485	ISO 1856-A	ISO 8067
ASTM D7710	ISO 845	ISO 3385	ISO/IEC 17025
ISO 105-A02	ISO 1798	ISO 3386-1	

2.2 GM Standards/Specifications.

GMW3059	GMW3235	GMW14444	GMW15635
GMW3205	GMW14270	GMW15058	
GMW3221	GMW14357	GMW15064	
GMW3232	GMW14359	GMW15634	

2.3 Additional References.

- Component Technical Specification (CTS), Appendix C3 of the Statement of Requirements (SOR) for Seat and Head Restraint Foam.
- Engineering Drawings, reference 3.2.2, 3.7 and Table 1.
- SEATS-143 Seat and Head Restraint Foam Density (D_E)

(D_E) = The supplier shall work with the GM Design Responsible Engineer, Materials Engineer, or Bill of Materials (BOM) Family Owner (BFO)-Foam to comprehend this requirement.

3 Requirements

3.1 Requirements on Test Specimens. Reference GMW3221.

3.1.1 Test specimens may be obtained from molded parts or molded foam test buns, as specified or practical. If taken from molded parts, specimens shall be taken from in and around the Indentation Load Deflection (ILD) circle, or Bolster Hardness area, and shall be free of densification layers or obvious defects such as voids. These test specimens shall be cut at a minimum of 10 mm below the molded surface of the sample and shall have their longest dimension at right angles to the direction of the foam rise. This will place that dimension parallel to the top surface. If part configuration makes it not possible to obtain suitable specimens, then test blocks from the same manufacturing process, recipe of foam, with the same Compression Force Deflection (CFD) and density can be used. The test block dimensions shall be 10 mm thick, unless other dimensions shall be agreed upon between GM engineer and the supplier. Multiple firmness foams shall have all unique firmness materials tested to applicable GMW15471 Type designation (Type E for dual firmness bolsters).

3.1.2 Conditioning. Immediately prior to test, all test pieces, except for Density, Tensile, Elongation, Tear, ILD and CFD specimens, shall be pre-dried at $70\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ and conditioned. The pre-drying period shall be $\geq 16\text{ h}$ for tests conducted after humidity aging to GMW14357 and shall be $\geq 3\text{ h}$ for other tests. Following pre-drying, all test pieces shall be conditioned to GMW3221, Code A.

3.1.2.1 Density, ILD and CFD specimens shall be conditioned at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, and in an atmosphere of $50\% \pm 5\%$ Relative Humidity (RH) for $\geq 16\text{ h}$ prior to testing.

3.1.2.2 Tests shall be conducted $\geq 96\text{ h}$ after manufacture to ensure any post reactions of the specimen are completed. Correlated ILD at lesser cure times may be used for purposes of production quality assurance.

3.1.3 Samples to be tested for ILD and Bolster Hardness will be supported by a rigid block fixture which will fill any significant cavity on the underside of the pad (B-surface), and which will support the area to be deflected in a horizontal plane parallel to the base of the indenter machine. Bolsters shall be supported by essentially-vertical walls on support block fixture to prevent significant splay of bolster during indentation. A minimum size for the supportive test block fixture shall be $380\text{ mm} \times 380\text{ mm}$. The support block shall not be perforated with ventilation holes. ILD test location shall be specified on the part drawing. ILD flat-plate indenter diameter shall be $152\text{ mm} \pm 1\text{ mm}$, per GMW14359, Code 3. Bolster Hardness hemisphere indenter diameter shall be $20\text{ mm} \pm 1\text{ mm}$, per GMW14359, Code 8.

3.1.4 Test Laboratory. Test shall be performed at an ISO/IEC 17025 accredited laboratory, or a facility approved by GM Materials Engineering.

3.2 Emissions Testing of Interior Materials and Parts. For all Code E designated parts per GMW14444, reference GMW15471 for emissions testing of interior materials and parts.

3.3 This material shall be a flexible, open-cell polyurethane foam which can have multiple hardness and/or density areas as specified on part drawing, and which is suited to its application and purpose. Molded parts manufactured from this foam shall be equal in foam structure, cell size and mechanical properties. The foam shall not cause any skin irritation, or have an unpleasant odor. The surface of the molded parts shall be open and porous to ensure sufficient breathability. The foam part shall have no un-foamed areas (shrinkage spots, voids, missing foam), no cracks and no densification areas (streaks, striations, inadequate mix, knit lines) which could have adverse effects on appearance, performance or serviceability. Foamed inserts must be securely bound to the foam or fixed by constructional means (finning, corrugation, etc.) and may have no shrinkage spots or cracks around them. The foamed inserts shall be securely bound to the foam to avoid a crack at misuse. The foam molded part must be physiologically unobjectionable. It must be free from constituents which could cause health damages or skin irritations. The foam part may have no extractable and/or volatile constituents which

could result in migration or contact effects with soft trim covering fabrics. After the foam is removed from the mold, it shall be compressed to break the initial cell structure by rolling, pressing, or vacuum-crushing.

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.

3.3.1 In the case of multiple firmness pads, the hard and soft molded areas shall be specified on the part drawing. Mixtures of the phases are permissible, but shall not result in properties which could adversely impact the performance of the foam. The adhesive strength at the interface of the zones must be equal to or greater than the tear strength of the individual foam. Each of the multiple firmness foams are subject to GMW15471, Type-designation approval by GM Materials Engineering.

3.3.2 GM Engineering may, at their discretion, establish additional, or more specific, mechanical property requirements listed in Table 1 on the Engineering Drawings, such as, or for; Density, Elongation, or (ILD).

3.4 Type Descriptions.

3.4.1 Front Seat Cushions (FSC) with nominal Densities $\geq 55 \text{ kg/m}^3$ shall be tested to Type A or Type Z.

3.4.1.1 FSC, including Passenger FSC with nominal Densities $< 55 \text{ kg/m}^3$ and $\geq 50 \text{ kg/m}^3$ shall be tested to Type B.

3.4.2 Rear Seat Cushions (RSC) with nominal Densities $\geq 48 \text{ kg/m}^3$ shall be tested to Type B or Type Z.

3.4.2.1 RSC with nominal Densities $< 48 \text{ kg/m}^3$ and $\geq 42 \text{ kg/m}^3$ shall be tested to Type C.

3.4.3 Front Seat Backs (FSB) and Rear Seat Backs (RSB) with nominal Densities $\geq 45 \text{ kg/m}^3$ shall be tested to Type C or Type Z.

3.4.3.1 FSB with nominal Densities $< 45 \text{ kg/m}^3$ and $\geq 40 \text{ kg/m}^3$ shall be tested to Type D.

3.4.4 RSB with nominal Densities $< 45 \text{ kg/m}^3$ $\geq 38 \text{ kg/m}^3$ shall be tested to Type D or Type Z.

3.4.5 Bolsters, including dual firmness bolsters, shall be tested to Type E or Type Z.

3.4.6 Molded Topper Pads, and Cushion Length Adjustment (CLA) foam, shall be tested to Type F.

3.4.7 Type Z. PUR foam which does not fit in the other Types. Specific requirements to be established by GM Design Release Engineer and documented on Appendix A, Data Sheet A1.

3.5 Test Results. Include a copy of the data sheet with the test log.

3.5.1 All requirements listed in Table 1 shall be tested and fulfilled by the foam manufacturer, and results submitted to GM Materials Engineering by using Appendix A, Data Sheet A1. Values indicated with N/R are not required. Values indicated with "Report", shall be included with submission of foam certification data. Documentation of additional properties may be required by the approving region.

3.5.2 Data for the Certification Form. Complete Appendix A, Data Sheet A1 to include the following:

- Signed approval from General Motors Interior Materials Engineering, or Foam GSSLT.
- Complete identification of the seat subsystem (part number, lot number, etc.) if applicable.
- Conditioning of test sample, if any.
- Test conditions (temperature, humidity, force applied, etc.)

3.6 Quality. All requirements listed in Table 1 shall be fulfilled by the delivered foam and shall be documented by the supplier in Appendix A, Data Sheet A1. Values designated as "Per Engineering Drawing with Tolerance" shall be documented and noted on the drawing/in the math data for production quality check purposes. Values indicated with not applicable (N/A) are not required. Documentation of additional properties may be required by the approving region.