



**Flexible Polyurethane Foam for
Head Restraint, Armrest, Consoles and Molded Applications**

1 Scope

1.1 Material Description. Polyurethane (PUR) foam based on Methylene Diphenyl Diisocyanate (MDI), Toluene Diisocyanate (TDI), or Methylene Diphenyl Diisocyanate/Toluene Diisocyanate blend (MDI/TDI) for head restraint armrest, console, and other molded applications. For polyurethane molded seat foam, refer to GMW15471. For polyurethane back-foaming of instrument panels, door panels, consoles, et.al, refer to GMW15065. For polyurethane foam for acoustic, gasket, seal, dampener applications, etc., refer to GMW14196, and GMW16750.

1.2 Symbols. Not applicable.

1.3 Applicability. The polyurethane material specified in this standard is recommended for use in automotive head restraint, armrest, console, and non-seating molded flexible polyurethane foam applications. This standard is to be considered minimum compliance. Optimum product conditions for maximum comfort, safety, and durability may require values different than those shown in the specification, but this will be program and part specific. For additional foam requirements, reference SOR Appendix C.

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 Materials. Materials which have secured MATSPC approval shall only be required to submit compliance testing for density, flammability, and Constant Force Deflection (CFD) for Production Part Approval Process (PPAP) annual certification.

2 References

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

2.1 External Standards/Specifications.

ASTM F1957	ISO 845	ISO 1856	ISO 3386-1
ISO 105-A02	ISO 1798	ISO 1923	ISO 8067

2.2 GM Standards/Specifications.

GMW3059	GMW4659	GMW14363	GMW15635
GMW3205	GMW6992	GMW14444	GMW16750
GMW3221	GMW14196	GMW15065	GMW16853
GMW3232	GMW14357	GMW15471	
GMW3235	GMW14359	GMW15634	

2.3 Additional References.

- CG4150, Foam Certification Data Form (available with GMW15064 from the engineering standards supplier). See Appendix A, Figure A1 for example.
- SOR Appendix C.
- Test Fabrics, Incorporated, 415 Delaware Avenue, West Pittston, Pennsylvania, United States, Telephone: 570-603-0432, email: testfabric@aol.com.

3 Requirements

3.1 General. General requirements are as follows.

- a. The material shall be a flexible, open cell polyurethane foam which can have hardness and density requirements as specified on part drawing, and which are suited to its application and purpose.
- b. Molded parts manufactured from this foam shall be equal in foam structure, cell size and mechanical properties.
- c. The foam shall not cause any skin irritation, or have an unpleasant odor.
- d. The surface of the molded parts shall be open and porous to ensure sufficient breathability. The foam part shall have no unfoamed areas (shrinkage spots, voids, missing foam), no cracks, and no densification areas (streaks, mismix, knit lines) which could have adverse effects on appearance, performance or serviceability.
- e. 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.
- f. The foam molded part must be physiologically unobjectionable. It must be free from constituents which could cause health damages or skin irritations.
- g. The foam part may have no extractable and/or volatile constituents which could result in migration or contact effects with soft trim covering fabrics.

3.1.1 After part release, no change to the formulation can take place without the approval of GM Materials Engineering.

3.1.2 If the foam density varies $\pm 20\%$, or the CFD varies $\pm 25\%$, from the values listed in the CG4150 Data Form, then a new MATSPC approval would be required to encompass new variance.

In addition, a new MATSPC approval may be required, if after review by GM Materials Engineering:

- Additional ingredients are added to the formula which have not been included in the original MATSPC approved recipe, or;
- There are changes to the major ingredients (polyols or isocyanates) of the foam recipe.

3.1.2.1 Annual certification densities shall meet Engineering Drawing requirements with tolerances. To be applicable, MATSPC approved materials must meet Engineering Drawing requirements with tolerances.

3.2 Emissions Testing of Interior Materials and Parts.

3.2.1 For all Code E designated parts per GMW14444, reference GMW16853 for emissions testing of interior materials and parts.

3.2.2. Foam with flame retardant chemistries, Cresyl Diphenyl Phosphate (CDPP), Dicesyl Phenyl Phosphate (DCPP), Tricesyl Phosphate (TCP), or Triphenyl Phosphate (TPP) is prohibited in order to improve vehicle interior air quality (VIAQ). Alternative flame retardant chemistries in foam formulations must be used.

3.2.3 The foam material recipe shall be free of Chlorofluorocarbons (CFC) and Hydrofluorocarbons (HFC).

3.3 Type Descriptions.

3.3.1 Type 1. This type is a PUR flexible foam for forming molded part by pouring directly into a mold without soft trim cover (may contain head restraint rods, armatures, energy-management components, etc.), e.g., cut-and-sew headrest, foam-on-a-stick headrest, general-application foam buns.

3.3.2 Type 2. This type is a PUR flexible foam for the back-foaming of foam headrests or seat-attached armrest with minimum density of 30 kg/m³, e.g., pour-in-place (PIP) head restraint.

3.3.3 Type 3. This type is a PUR flexible foam based on MDI for the back-foaming of foam headrests or seat-attached armrest, e.g., with density < 30 kg/m³, such as a pour-in-place (PIP) 2nd and 3rd row center head restraints.

3.3.4 Type 4. This type is a PUR flexible foam for forming molded part by pouring directly into a mold sans soft trim cover (may contain armatures, energy-management components, etc.), e.g., seat-attached armrest.

3.3.5 Type 5. This type is a PUR flexible foam for forming a thin, low-firmness molded part, by pouring directly into mold sans appearance cover or trim (may contain armatures, structural inserts, etc.), e.g., cut-and-sew armrest foamed over armature, foam-only console/armrest topper pad, door armrest.

3.3.6 Type 6. This type is a PUR flexible foam for forming thin, medium-firmness armrests, by pouring directly into mold sans appearance cover or trim (may contain armatures, structural inserts, etc.), e.g., cut-and-sew armrest foamed over armature, foam-only console/armrest topper pad, door armrest.

3.3.7 Type 7. This type is a PUR flexible foam for forming thin, hard-firmness armrests, by pouring directly into mold sans appearance cover or trim (may contain armatures, structural inserts, etc.), e.g., cut-and-sew armrest foamed over armature, foam-only console/armrest topper pad, door armrest.

3.3.8 Type Z. PUR flexible foam for this type will also be used for armrest or headrest seals, but will have unique properties which will distinguish them from the other foam types. Compression Force Deflection, density, and any other unique properties pertinent to the performance of the foam, for its specific application shall be called out on the print or the math file.

3.4 Requirements for Test and Specimens.

3.4.1 Test specimens for Type 1 through Type 4 may be obtained from molded parts or molded foam test buns, 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.

3.4.2 Conditioning. Immediately prior to test, all test pieces 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-E and shall be $\geq 3\text{ h}$ for other tests. Following pre-drying, all test pieces shall be conditioned to GMW3221, Code A. Conditioning for emission tests shall be performed in accordance with GMW16853 (paragraphs 3.15 and 3.2).

3.4.2.1 Density and hardness specimens for regular production quality verifications may 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: $\geq 2\text{ h}$ prior to testing of MDI-based foam, and; $\geq 24\text{ h}$ prior to testing of TDI-based, or MDI/TDI-blended foams.

3.4.2.2 Tests shall be conducted $\geq 96\text{ h}$ after manufacture to ensure any post reactions of the specimen are completed.

3.4.3 Samples to be tested for hardness and CFD will be supported by a rigid block 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. A minimum size for the supportive test block shall be 380 mm x 380 mm. The support block shall not be perforated. Hardness test location shall be specified on the part drawing.

3.5 Basic Foam Physical Properties. All requirements listed in Table 1 shall be tested and fulfilled by the foam manufacturer, and results submitted to GM Materials Engineering by using the CG4150 Foam Certification Data Form (see Appendix A, Figure A1 for example). Values indicated with "N/R" are not required. Values indicated with "Report" shall be included with submission using the CG4150 Foam Certification Data Form. Documentation of additional properties may be required by the approving region.

Table 1: Material Property Requirements

Property	Test Method	Units	Type							
			1	2	3	4	5	6	7	Z
Density	ISO 845 ^{Note 1}	kg/m ³	Per Engineering Drawing with Tolerance							
Hardness Number	GMW14363-A1 ^{Note 2, Note 3}	-	Per Engineering Drawing with Tolerance				N/R			
	GMW14359 Code 2 ^{Note 4, Note 5}	-	N/R				< 248	≥ 248 and ≤ 354	> 354 and ≤ 500	
Compression Set at 50%	As received condition ISO 1856-A ^{Note 6}	%	≤ 10	≤ 10	≤ 18	≤ 12.5	≤ 12.5	≤ 12.5	≤ 12.5	
	After Steam Autoclave ISO 1856-A and GMW14357-E ^{Note 6}	%	≤ 15	≤ 15	≤ 20	≤ 15	≤ 20	≤ 15	≤ 15	

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