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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3568A

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Superseding AMS 3568

Sheet, Polyether Urethane (EU) Elastomer Foam Shock Absorbing

1. SCOPE:

1.1 Form:

This specification and its supplementary detail specifications cover a chemically or mechanically expanded polyether urethane (EU) elastomeric foam material in the form of ready-to-use sheet.

1.2 Application:

Primarily for use in applications where shock absorbing characteristics and cushioning are required and where flammability does not preclude its use.

1.3 Classification:

The requirements specified herein and in the applicable detail specification define each foam material on the basis of density which is referenced in the title of each detail specification.

1.4 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

2.1.1 Aerospace Material Specifications:

AMS 2825 Material Safety Data Sheets
AMS 3599 Plastic Sheet, Copper Faced, Glass Fabric Reinforced Epoxy Resin, Flammability Controlled

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM D 412 Rubber Properties in Tension
ASTM D 1056 Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1667 Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Vinyl)
ASTM D 3574 Testing Flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foams

2.3 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.3.1 Military Standards:

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-794 Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Detail Specifications:

The requirements for a specific foam material shall consist of all requirements specified herein in addition to requirements specified in the applicable detail specification. In case of conflict between requirements of this basic specification and an applicable detail specification, requirements of the detail specification shall govern.

3.2 Material:

Shall be a polyether urethane (EU) elastomeric foam sheet composed of open or closed cells.

3.2.1 Finish: All surfaces of sheet shall have a cut finish.

3.3 Properties:

The foam sheet shall conform to the requirements specified in the applicable detail specification. Tests shall be performed on the product supplied and in accordance with test methods specified in 4.5, insofar as practicable.

3.4 Quality:

Foam, as received by purchaser, shall be uniform in quality, condition, and free from foreign materials, imperfections, and contaminants detrimental to usage of the foam.

3.4.1 Voids:

3.4.1.1 The foam shall contain no voids larger than 0.5 x 0.30 inch (13 x 7.6 mm) and 0.30 inch (7.6 mm) in depth. No more than one void may be present in any 3-inch (76-mm) square of surface area and no more than three voids in any 1.0 square foot (0.093 m^2) of surface area.

3.4.1.2 Voids 0.2 x 0.2 x 0.2 inch (5 x 5 x 5 mm) or smaller are permissible provided not more than two are present in any 2-inch (51-mm) square of surface area nor more than four in any 6-inch (152-mm) square of surface area.

3.4.1.3 Any void extending through thickness of the foam is not acceptable.

3.5 Sizes and Tolerances:

The dimensions of the foam sheet shall be as specified in applicable drawings, or as ordered, and the tolerances shall be as specified in Tables 1 and 2, determined in accordance with ASTM D 1056.

TABLE 1

Nominal Thickness Inches	Tolerance, Inch plus and minus
Up to 0.250, incl	0.031
Over 0.250 to 0.500, incl	0.062
Over 0.500 to 1.000, incl	0.094
Over 1.000	0.125

TABLE 1 (SI)

Nominal Thickness Millimetres	Tolerance, Millimetres plus and minus
Up to 6.35, incl	0.79
Over 6.35 to 12.70, incl	1.57
Over 12.70 to 25.40, incl	2.39
Over 25.40	3.18

TABLE 2

Nominal Length and Width Inches	Tolerance, Inch plus and minus
Up to 6, incl	0.125
Over 6 to 18, incl	0.250
Over 18	0.375

TABLE 2 (SI)

Nominal Length and Width Millimetres	Tolerance, Millimetres plus and minus
Up to 152, incl	3.18
Over 152 to 457, incl	6.35
Over 457	9.52

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of sheet shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the sheet conforms to the requirements of this specification and the applicable detail specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for density, compression deflection at 20% compression and at 40% compression, compression set, and water absorption are acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests for all technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of sheet to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient sheet shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1.1 A lot shall be all foam sheet of the same thickness and density produced in a single production run from the same batch of raw materials and presented for vendor's inspection at one time. An inspection lot shall be al sheets cut from a single block of foam formed in an individual mold cavity and shall not exceed 200 pounds (91 kg) or 2000 board feet (4.7 m^3) of foam and may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.

4.3.1.2 When a statistical sampling plan has been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6 shall state that such plan was used.

4.3.1.2.1 For U.S. Military procurement, sampling shall be in accordance with MIL-STD-105.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample sheet shall be approved by purchaser before sheet for production use is supplied, unless such approval be waived by purchaser. Results of tests on production sheet shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production sheet which are essentially the same as those used on the approved sample sheet. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in ingredients and/or processing and, when requested, sample sheet. Production foam sheet made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

Tests to determine conformance to this basic specification and applicable detail specifications shall be performed in accordance with the following test methods:

Density	ASTM D 1667
Compression Deflection for 20% Compression	ASTM D 1056
Compression Deflection for 40% Compression	ASTM D 1056
Tensile Strength	ASTM D 412
Ultimate Elongation	ASTM D 412
Shock Absorption-Resiliency	4.5.2
Compression Set	ASTM D 3574
Dimensional Change	4.5.3
Low-Temperature Flexibility	4.5.4
Water Content	4.5.5
Water Absorption	4.5.6
Corrosion	4.5.7
Hydrolytic Stability	4.5.8
Dry Heat Aging	4.5.9

4.5.1 Specimen Conditioning: Unless otherwise specified in the applicable test method, all tests shall be conducted at 20 °C ± 3 (68 °F ± 5) on specimens conditioned for not less than 5 hours at the test temperature.

4.5.2 Shock Absorption Resiliency:

4.5.2.1 Test specimen shall be 3.00 inches ± 0.12 (76.2 mm ± 3.0) square with parallel top and bottom surfaces and shall be not less than 0.250 inch (6.35 mm) or greater than 0.625 inch (15.88 mm) thick.

4.5.2.2 Procedure:

4.5.2.2.1 The rebound tester shall consist of a 2-inch (51-mm) ID vertically mounted, clear plastic tube, such as acrylic, into which a 16 mm diameter, 16.3 gram ± 0.1 steel ball is released so that it falls free and without rotation. The height of drop shall be 18 inches (457 mm). Since it is most convenient to note the position of the top of the ball on rebound, the top of the ball shall be 18.6 inches (472 mm) above the surface of the foam. If this condition is met before the drop, the “zero” rebound point will be 16 mm (diameter of the ball) above the specimen surface. The scale generated on the back surface of the tube shall be calibrated directly, in percent, as follows: For every 5% of rebound, a complete circle shall be circumferentially scribed and for every 1%, a 120-degree arc shall be scribed. The complete circles representing each 5% rebound are an essential part of the apparatus, since they aid in eliminating parallax reading errors.

4.5.2.2.2 In setting up the actual test, center the specimen at the base of the tube and adjust the height of the tube so that zero rebound is 16 mm above the surface of the foam specimen.

4.5.2.2.3 Calculate the median resiliency percentage for each specimen based on three rebound values. If any test value for a given specimen deviates more than 20% from the median, make two additional drops and calculate the median for all five drops.

4.5.2.2.4 Report the median of the three individual specimen medians as the Ball Rebound Resilience Value in percent.

4.5.3 Dimensional Change:

4.5.3.1 Specimens: Shall be 12 x 3 inches (305 x 76 mm) and the thickness shall be as-supplied.

4.5.3.2 Procedure:

4.5.3.2.1 Bench marks 10.00 inches ± 0.10 (254.0 mm ± 2.5) apart shall be placed along the centerline approximately 1 inch (25 mm) from each end.

4.5.3.2.2 The marked specimens, lying on a suitable flat surface, shall be placed in a circulating-air oven and allowed to remain for 168 hours ± 2 at 95 °C ± 2 (203 °F ± 3).

4.5.3.2.3 The specimens shall be removed from the oven and allowed to stabilize for 2 hours ± 0.1 at 20 °C ± 2 (68 °F ± 3). The distance between the bench marks shall be measured and the dimensional change shall be expressed as a percent of the original measured length.

4.5.4 Flexibility at Low Temperature:

4.5.4.1 Specimens: Shall be 1 x 8 inches (25 x 203 mm) by 0.250 inch (6.35 mm) thick and the surface shall be as-supplied.

4.5.4.2 Procedure:

4.5.4.2.1 Specimens and equipment shall be conditioned for not less than 4 hours at -18 °C ± 1 (0 °F ± 2). After conditioning, the specimen shall be bent, within 5 seconds, 180 degrees around a 0.500-inch (12.7-mm) diameter steel mandrel. When performing the test, care must be taken to ensure that both the test mandrel and foam specimens are not exposed to warming.

4.5.4.2.2 After bending, the specimens shall be visually inspected for cracking or splitting. Cracking or splitting is not acceptable.

4.5.5 Water Content:

4.5.5.1 Specimens: Test specimens shall be 4 inches (102 mm) square by as-supplied thickness.

4.5.5.2 Procedure: Weigh each specimen to the nearest 0.001 gram and record the data (W_I). Place the specimens in a circulating-air oven and hold at 65 °C ± 5 (149 °F ± 9) for 4 hours ± 0.5. Remove the specimens from the oven and place in a desiccator to cool. Reweigh the specimen to the nearest 0.001 gram (W_F). Calculate percent water content as follows:

$$\% \text{ Water Content} = \frac{W_I - W_F}{W_I} \times 100$$

W_I = Initial Specimen Weight

W_F = Specimen Weight After Heating

4.5.6 Water Absorption:

4.5.6.1 Specimens: Shall be 4 inches (102 mm) square by as-supplied thickness.

4.5.6.2 Procedure:

4.5.6.2.1 Place the specimens in a circulating-air oven and hold at 65 °C ± 5 (149 °F ± 9) for 4 hours ± 0.5. Remove the specimens from the oven and place in a desiccator to cool. After the specimens have cooled, weigh to the nearest 0.001 gram and record the values (W_I), or use dried water content specimens (4.5.5).

4.5.6.2.2 Place the specimens in a container where relative humidity is maintained at 95% ± 4 and the temperature is 23 °C ± 2 (73 °F ± 4). Maintain the conditions for 28 hours ± 0.5. Remove the specimens and weigh each to the nearest 0.001 gram (W_F). Calculate the percent water absorption as follows:

$$\% \text{ Water Absorption} = \frac{W_F - W_I}{W_I} \times 100$$

W_I = Initial Specimen Weight

W_F = Specimen Weight After Exposure to Humidity

4.5.7 Corrosion:

4.5.7.1 Specimens: Shall be approximately 3.5-inch (89-mm) diameter foam disks by as-supplied thickness.

4.5.7.2 Procedure: The foam specimens shall be placed between a 4 x 4-inch (102 x 102-mm) copper clad on one side, epoxy glass laminate conforming to AMS 3599.

4.5.7.2.1 The copper surfaces shall be cleaned as follows prior to assembly with the test specimens:

4.5.7.2.1.1 Immerse the copper-clad panels for 10 - 15 seconds in a 20% solution, by weight, of sulfuric acid at 55 °C ± 5 (131 °F ± 9) and rinse in flowing water.

4.5.7.2.1.2 Immerse in 50% solution, by weight, of hydrochloric acid at room temperature for 10 - 15 seconds and rinse in flowing water.

4.5.7.2.1.3 Immerse in 10% solution, by weight, of sodium hydroxide at room temperature for 10 - 15 seconds and rinse in flowing water.

4.5.7.2.1.4 Rinse in deionized water for not less than 15 seconds followed by immersion in clean isopropyl alcohol for not less than 5 seconds and, immediately on removal from the last rinse, dry with filtered compressed air.

4.5.7.2.1.5 After cleaning, the copper surfaces shall have a uniformly bright surface, free from spots, streaks, and discoloration. Panels not meeting these requirements shall not be used. Panels may be recleaned twice.

4.5.7.2.1.6 After the panels have been cleaned, the copper surface shall not be touched and the panels shall be handled by the edges only.

4.5.7.2.1.7 Panels, which have been cleaned, shall be assembled with the foam specimens within 2 hours after cleaning is complete.

4.5.7.2.2 Each foam specimen shall be placed between the copper-clad laminate with the copper surfaces in contact with the foam. The assembled specimens shall be placed in a fixture which provides light pressure, ensuring good surface contact between the specimens and the copper surfaces. Two separate groups of specimens are required for the test.

4.5.7.2.3 Maintain one set of specimens at room temperature for 120 hours ± 2. The second set shall be concurrently held at 80 °C ± 5 (176 °F ± 9) in a circulating-air oven for 120 hours ± 2.

4.5.7.2.4 After completion of the test, disassemble the foam specimens and copper-clad panels. Examine visually with the unaided eye, corrected to 20/20 acuity, the copper surfaces for corrosion, pitting, and discoloration, noting the condition of the copper surfaces.

4.5.8 Hydrolytic Stability:

4.5.8.1 Specimens: Shall be 2 inch (51 mm) square strips of foam by as-supplied thickness.

4.5.8.2 Procedure:

4.5.8.2.1 Place the specimens in a chamber maintained at 95 °C ± 3 (203 °F ± 5) and at a relative humidity of 95% ± 5 and hold for 28 days ± 0.1.

4.5.8.2.2 Remove the specimens from the humidity chamber, transfer them to a circulating-air oven, and hold specimens for 24 hours ± 0.1 at 50 °C ± 3 (122 °F ± 5). Allow the specimens to cool to room temperature.

4.5.8.3 Test in accordance with ASTM D 3574, Test D, using a deflection value of 50% ± 1.