The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-3716 REV B

Issued 1979-10-15
Revised 1991-01-01

Superseding AMS-3716A

Submitted for recognition as an American National Standard

CORE, HONEYCOMB, GLASS/PHENOLIC
Bias Weave Fiber Construction

1. SCOPE:

1.1 Form: This specification covers expanded honeycomb core made from glass fabric impregnated with phenolic resin and oriented so the fabric weave is on the 45-degree bias with the ribbon direction and supplied in the form of blocks, slices, and ordered shapes.

1.2 Application: Primarily for bonded sandwich structures requiring high strength and corrosion resistance for service up to 175°C (347°F).

1.3 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.

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

2.1.1 Aerospace Material Specifications:

AMS-3824 - Cloth, Type "E" Glass, Finished for Resin Laminates

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

ASTM C 271 - Density of Core Materials for Structural Sandwich Constructions
ASTM C 273 - Shear Test in Flatwise Plane of Flat Sandwich Constructions or Sandwich Cores
ASTM C 365 - Flatwise Compressive Strength of Sandwich Cores

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-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material:

3.1.1 Glass Cloth: The core material shall be made of glass cloth suitably finished as required for impregnation with the resin system specified herein. The glass cloth shall meet the requirements of AMS-3824 for the style used for each core size and density.

3.1.2 Resin: The resin used for impregnating the glass cloth in the initial and web impregnations shall be a phenolic resin system suitable for producing core meeting the requirements of 3.3.

3.1.3 Adhesive: The adhesive used to bond adjacent cells is not restricted to type but shall be sufficiently strong to produce core meeting the requirements of 3.3.

3.1.4 Construction: The resin impregnated cloth shall be oriented on the bias so that the warp and fill directions are approximately 45 degrees from the ribbon and resultant cell directions.

3.1.5 Designation: Core shall be designated according to the following numbering system:

a. Material
b. Cell Size (fraction of an inch (mm))
c. Density (pounds per cubic foot) (kg/m^3)

Example: Core, Glass/Phenolic/Bias - 3/16 - 4.0 (in Inch/Pound Units)
Core, Glass/Phenolic/Bias - 4.8 - 64 (in SI Units)

Means: Core, glass cloth, oriented on the bias, impregnated with phenolic resin, 3/16 inch (4.8 mm) cell size, with density of 4.0 pounds per cubic foot (64 kg/m^3).

3.1.6 Cell Configuration: Core shall consist of phenolic-resin-impregnated glass cloth sheets, bonded together so that cells approximately hexagonal in shape are formed when fully expanded (See Figure 1).

3.1.7 Core Dimensions: Shall be as specified in Figure 1 where,

T = Thickness, depth, or height dimension measured parallel to the core cell axis
L = Longitudinal or ribbon direction measured along the direction of a ribbon
W = Transverse direction perpendicular to the ribbon direction.

3.1.8 Visual Imperfections:

3.1.8.1 Cell Walls: There shall be no split or buckled cell walls.

3.1.8.2 Double Layer: Expanded core blocks or slices which have double layers (two ribbons bonded together which cause uneven expansion in the "L" direction) shall be acceptable if the double layers are not more frequent than one in 12 inches (305 mm) in the "W" direction, as shown in Figure 2.

3.1.8.3 Splices: There shall be no splices in sheet supplied.

3.2 Condition: Core shall be supplied in the expanded form and cured to meet the requirements of 3.3.

3.3 Properties: Core shall conform to the following requirements:

3.3.1 Shear Strength and Shear Modulus: Shall be as specified in Table I, determined in accordance with 4.5.1.

3.3.2 Compressive Strength and Compressive Modulus: Shall be as specified in Table I, determined in accordance with 4.5.2.

3.3.3 Density: Shall be within ±10% of the nominal density specified, determined in accordance with ASTM C 271.

3.3.4 Flatness: Expanded core shall exhibit total facing contact with a flat surface under a uniform pressure of not more than 2 psi (13.8 kPa) without resulting in any damage that would cause core rejection.

3.3.5 Node-Bond Breaks: No more than two node-bond breaks or separations per 12-inch (305-mm) diameter circle will be permitted with no breaks being adjacent in the "L" ribbon direction.

3.3.6 Node-Bond Strength: Shall be such that no rupture of node bonds will occur during machining performed in accordance with manufacturer's recommendations.

3.4 Quality: Core, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the core.

3.5 Tolerances: Shall be as follows:

3.5.1 Core Thickness:

Core Thickness Inches	Tolerance, Inch plus and minus
0.125 - 1.500, incl	0.006
Over 1.500 - 3.000, incl	0.010
Over 3.000	0.063

Core Thickness Millimetres	Tolerance, Millimetres plus and minus
3.18 - 38.10, incl	0.15
Over 38.10 - 76.20, incl	0.25
Over 76.20	1.60

3.5.2 Length and Width: +1.0 inch (+25 mm), -0.0

3.5.3 Cell Pitch: 1.733 times the nominal cell size, +20%, -10%, measured by taking the average distance between nodes along a ribbon, determined on six different ribbons.

3.5.4 Average Cell Size: Shall not vary more than ±10% from nominal dimensions, determined by taking the average distance between node bonds along the "W" dimension for at least 60 cells selected at random in groups containing 10 adjacent cells (See Figure 1).

3.5.5 Ribbon Direction: All ribbons shall be parallel to each other within 10 degrees. The ribbon direction shall be determined by measuring the angle between one line through two nodes of the same ribbon ("L" direction) 12 inches (305 mm) apart, and another line in the principal ribbon direction (See Figure 1).

3.5.6 Impregnated Cloth Bias Direction: The warp and fill direction of the impregnated glass cloth shall be essentially 45 degrees to the ribbon and the cell directions. Slight misorientation of the bias shall be acceptable provided the flexibility of the core slice is uniform and the mechanical properties are met.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of core shall supply all samples Ø 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 core conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for visual imperfections (3.1.8), shear strength (3.3.1), density (3.3.3), quality (3.4), and tolerances (3.5) 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 core 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:
Ø

4.3.1 For Acceptance Tests: Each block or 2% of the slices from each lot shall be sampled at random to provide sufficient core 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 a single block or all slices cut from a single block and shall not exceed 250 pounds (□3 kg).

4.3.1.2 When a statistical sampling plan has been agreed upon by purchaser and Ø 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.

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

4.4 Approval:

4.4.1 Sample core shall be approved by purchaser before core for production use is supplied, unless such approval be waived by purchaser. Results of tests on production core 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 core which are essentially the same as those used on the approved sample core. 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 core. Production core made by the revised procedures shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Shear Strength and Shear Modulus: Shall be determined in accordance with ASTM C 273 at 25°C ± 3 (77°F ± 5) and at 175°C ± 5 (347°F ± 9), using plate shear specimens 0.500 inch ± 0.010 (12.70 mm ± 0.25) thick with adhesive of not less than 0.08 pounds per square foot (0.39 kg/m^2) to bond plates to core. Specimens shall be tested after exposure for not less than 30 minutes at the test temperature. Determinations shall be made in two directions.

4.5.2 Compressive Strength and Compressive Modulus: Shall be determined in accordance with ASTM C 365 at 25°C ± 3 (77°F ± 5) and at 175°C ± 5 (347°F ± 9), using stablized core specimens. Tests shall be performed after exposure of test specimens for not less than 30 minutes at the test temperature.

4.6 Reports: The vendor of core shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the core conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS-3716B, manufacturer's product designation, and quantity.

4.7 Resampling and Retesting: If any specimen used in the above tests fails to Ø meet the specified requirements, disposition of the core may be based on the results of testing three additional specimens cut from the same block for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the core represented. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 The core shall be packaged to prevent physical damage during shipment and handling and shall be shipped flat unless contoured or formed shapes require special support.

5.1.2 Each piece of core and each interior and exterior package shall be identified with not less than the following information applied to a durable tag, using characters which will not be obliterated by normal handling:

CORE, HONEYCOMB, GLASS/PHENOLIC/BIAS
AMS-3716B
CORE CLASSIFICATION _____
T x L x W _____
MANUFACTURER'S IDENTIFICATION _____
LOT NUMBER _____
PURCHASE ORDER NUMBER _____
DATE OF MANUFACTURE _____

5.1.3 Ø Packages of core shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the core to ensure carrier acceptance and safe delivery.

5.1.4 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-794, Commercial Level, unless Level A is specified in the request for procurement.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Core not conforming to this specification, or to modifications authorized by purchaser, will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (Ø) symbol is used to indicate technical changes from the previous issue of this specification.

8.2 Film adhesive complying with AMS-3698 has been found satisfactory for bonding plate-shear and stabilized compressive strength specimens.

8.3 Aluminum alloy sheet, 0.020 inch (0.51 mm) in nominal thickness has been used on the stabilized compressive strength specimen.

8.4 Dimensions and properties in inch/pound units and Celsius temperatures are primary; dimensions and properties in SI units and the Fahrenheit temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

8.5 For direct U.S. Military procurement, purchase documents should specify not less than the following:

Title, number, and date of this specification
Designation of core desired (See 3.1.5)
Size of block or slices desired
Quantity or number of slices desired
Level A packaging, if required (See 5.1.4).

8.6 Core meeting the requirements of this specification has been classified under Federal Supply Classification (FSC) 5680.

This specification is under the jurisdiction of AMS Committee "CC".