SAE The Engineering Resource For Advancing Mobility
400 COMMONWEALTH DRIVE WARRENDALE, PA 15096

# AEROSPACE MATERIAL SPECIFICATION

AMS 3712A
Superseding AMS 3712

Issued 12-15-74
Revised 7-1-83

## CORE, HONEYCOMB, GLASS/POLYIMIDE

1. SCOPE:

1.1 Form: This specification covers expanded honeycomb core made of glass cloth impregnated with polyimide resin 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 long-time service up to 230°C (450°F) and short duration up to 370°C (700°F).

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

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

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 3824 - Cloth, Type "E" Glass, Finished for Resin Laminates

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM C271 - Density of Core Materials for Structural Sandwich Constructions
ASTM C273 - Shear Test in Flatwise Plane of Flat Sandwich Constructions or Sandwich Cores
ASTM C365 - Flatwise Compressive Strength of Sandwich Cores

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.







Printed in U.S.A.

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: Shall be suitably finished as required for impregnation with the resin system specified herein and 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 final web impregnation and also for the node bond adhesive shall be a polyimide resin system suitable for producing core material meeting the requirements specified herein.

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

a. Material
b. Cell Size (fraction of an in.) (mm)
c. Density (lb per cu ft) (kg/m$^3$)

Example: Core, Glass/Polyimide - 3/16 - 4.0 (in inch/pound Units)
Core, Glass/Polyimide - 4.8 - 64 (in SI Units)

Means: Core, glass cloth impregnated with polyimide resin, 3/16 in. (4.8 mm) cell size, with density of 4.0 lb per cu ft (64 kg/m$^3$)

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

3.1.5 Core Dimensions: Shall be as specified in Fig. 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.

3.2 Condition: Core shall be supplied completely cured and in the expanded form.

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, Ø determined in accordance with ASTM C273 at 25°C ± 3 (77°F ± 5) and at 230°C ± 5 (445°F ± 9). Specimens shall be tested after exposure for not less than 30 min. at the test temperature. Determinations shall be made in two directions.

3.3.2 Compressive Strength and Compressive Modulus: Shall be as specified in Table I, determined in accordance with ASTM C365 at 25°C ± 3 (77°F ± 5) and at 230°C ± 5 (445°F ± 9) on stabilized core specimens. Test shall be performed after exposure of test specimens for not less than 30 min. at the test temperature.

3.3.3 Density: Shall be within ± 10% of the nominal density specified in Table I, determined in accordance with ASTM C271.

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 (14 kPa) without resulting in any damage that would cause core rejection.

3.3.5 Node Bond Breaks: No more than 3 node bond breaks or separations per 12 in. (300 mm) diameter circle will be permitted with no two 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 the manufacturer's recommendations.

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

3.4.1 Visual Imperfections:

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

3.4.1.2 Double Layer: Expanded core blocks or splices 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 in. (300 mm) in the "W" direction, as shown in Fig. 2.

3.5 Tolerances: Unless otherwise specified, the following tolerances shall apply:

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 |
|---|---|
| 3.00 - 40.00, incl | 0.15 |
| Over 40.00 - 75.00, incl | 0.25 |
| Over 75.00 | 1.50 |

3.5.2 Length and Width: +1.0 in. (+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 10 nodes along a ribbon. Report the average of determinations of six different ribbons selected at random.

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 Fig. 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 in. (300 mm) apart, and another line in the principal ribbon direction (See Fig. 1).

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the core shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. 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 to determine conformance to requirements for compressive strength (3.3.2), density (3.3.3), quality (3.4), and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the first-article shipment of core to a purchaser, when a change in material or processing, or both, requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.3 Sampling: Shall be in accordance with the following:

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 specimens for each test 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 each block or all slices cut from a single block. A lot shall not exceed 250 lb (115 kg).

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) for
Ø core have 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 4.5.1 shall state that such plan was used.

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

4.3.2.1 Specimens for core shear strength and shear modulus shall be plate shear specimens 0.500 in. ± 0.010 (12.50 mm ± 0.25) thick with 0.06 lb per sq ft (0.30 kg/$m^2$) adhesive to bond plates to core.

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
Ø in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in materials or processing, or both, and, when requested, sample core. Production core made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Reports:

4.5.1 The vendor of core shall furnish with each shipment three copies of 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 of this specification. This report shall include the purchase order number, AMS 3712A, core designation, quantity, and block or lot number.

4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, AMS 3712A, contractor or other direct supplier of core, supplier's material designation, part number, and quantity. When core for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of core to determine conformance to the requirements of this specification and shall include in the report either a statement that the core conforms or copies of laboratory reports showing the results of tests to determine conformance.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to 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 and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

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

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

CORE, HONEYCOMB, GLASS/POLYIMIDE
AMS 3712A
CORE CLASSIFICATION
T x L x W _____
MANUFACTURER'S NAME OR TRADEMARK _____
BLOCK OR LOT NUMBER _____
PURCHASE ORDER NUMBER _____
DATE OF MANUFACTURE _____

5.1.3 Ø Packages 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. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.1.4 Ø For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-794, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.1.1 and 5.1.3 will be acceptable if it meets the requirements of Level C.

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, HT 424, Bloomingdale Division, American Cyanamid Co., Havre de Grace, Maryland, 21078, has been found satisfactory for bonding plate shear and stabilized compressive strength specimens.

8.3 Aluminum alloy sheet, 0.020 in. (0.50 mm) in nominal thickness has been used on the stabilized compressive strength specimens.

8.4 Dimensions and properties, other than temperatures, in inch/pound units are standard; dimensions and properties in SI units are shown as the approximate equivalents of the inch/pound units and are presented only for informational purposes.

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

Title, number, and date of this specification
Nominal cell size and density required
Length, width, and thickness of blocks or slices required
Quantity of core desired
Applicable level of packaging (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 "C" (NOMETCOM).

TABLE I

| Nominal Core Dimensions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cell Size Inch | Density lb per cu ft | Test Temp °F | Core Shear Strength psi, min | | Core Shear Modulus psi, min | | Compressive Strength Stabilized psi, min | Compressive Modulus Stabilized psi, min, dry |
| | | | L | W | L | W | | |
| 3/16 | 4.0 | RT | 140 | 70 | 13,000 | 5,000 | 300 | 25,000 |
| | | 445 | 90 | 45 | 8,500 | 3,500 | 195 | 16,000 |
| 3/16 | 4.5 | RT | 220 | 110 | 22,000 | 8,400 | 400 | 31,000 |
| | | 445 | 145 | 70 | 14,000 | 5,500 | 260 | 20,000 |
| 3/16 | 5.0 | RT | 250 | 125 | 26,000 | 10,000 | 480 | 42,000 |
| | | 445 | 160 | 80 | 17,000 | 6,500 | 310 | 27,500 |
| 3/16 | 6.0 | RT | 345 | 170 | 35,000 | 11,500 | 625 | 64,000 |
| | | 445 | 225 | 110 | 22,500 | 7,500 | 405 | 41,500 |
| 3/16 | 8.0 | RT | 500 | 330 | 48,000 | 17,500 | 1,000 | 85,000 |
| | | 445 | 325 | 215 | 31,000 | 11,500 | 650 | 55,000 |
| 1/4 | 4.0 | RT | 140 | 80 | 13,000 | 7,000 | 325 | 25,000 |
| | | 445 | 90 | 50 | 8,500 | 4,500 | 215 | 16,000 |
| 1/4 | 5.0 | RT | 250 | 125 | 26,000 | 10,000 | 450 | 35,000 |
| | | 445 | 160 | 80 | 17,000 | 6,500 | 300 | 22,500 |
| 3/8 | 4.0 | RT | 195 | 100 | 23,000 | 8,000 | 325 | 35,000 |
| | | 445 | 125 | 65 | 15,000 | 5,000 | 215 | 22,500 |
| 3/8 | 5.5 | RT | 300 | 160 | 30,000 | 10,000 | 540 | 45,000 |
| | | 445 | 195 | 105 | 19,500 | 6,500 | 350 | 29,000 |
| 3/8 | 7.0 | RT | 480 | 280 | 37,000 | 14,000 | 875 | 75,000 |
| | | 445 | 310 | 180 | 24,000 | 8,000 | 565 | 50,000 |