Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3715

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Revised

CORE, HONEYCOMB, GLASS/PHENOLIC

1. SCOPE:

1.1 Form: This specification covers expanded honeycomb core made of glass fabric impregnated with phenolic 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 service up to 175°C (350°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 Society of Automotive Engineers, Inc., 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 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

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 final web impregnation and also for the node bond adhesive shall be a phenolic resin system suitable for producing core material meeting the requirements of 3.3.

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

Means: Core, glass cloth impregnated with phenolic 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 phenolic 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

3.1.6 Visual Imperfections:

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

3.1.6.2 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 in. (305 mm) in the "W" direction, as shown in Fig. 2.

3.1.6.3 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 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 (0.014 MPa) without resulting in any damage that would cause core rejection.

3.3.5 Node-Bond Breaks: No more than 2 node-bond breaks or separations per 12 in. (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 the manufacturer's recommendations.

3.4 Quality: The core shall be uniform in quality and condition, clean, sound, and free from foreign materials and from imperfections detrimental to fabrication, appearance, or performance of parts.

3.5 Tolerances: Unless otherwise specified, the following tolerances shall apply as appropriate to the dimensional system applied:

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	1.60

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 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 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. (305 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 core shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems 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 visual imperfections (3.1.6), shear strength (3.3.1), density (3.3.3), quality (3.4), and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for visual imperfections (3.1.6), shear strength (3.3.1), 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 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification tests and shall be performed on the initial shipment of core to a purchaser, when a change in material 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, qualification test material shall be submitted to the cognizant qualification agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows:

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 a single block or all slices cut from a single block and shall not exceed 250 lb (115 kg).

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) for the 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 4.6.1 shall state that such plan was used.

4.3.2 For Qualification 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. 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 any change is necessary in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material and 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 C273 at 25°C ± 3 (77°F ± 5) and at 175°C ± 5 (347°F ± 9), using plate-shear specimens 0.500 in. ± 0.010 (12.70 mm ± 0.25) thick with adhesive of not less than 0.08 lb per sq ft (0.39 kg/m^2) to bond plates to core. Specimens shall be tested after exposure for not less than 30 min. 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 C365 at 25°C ± 3 (77°F ± 5) and at 175°C ± 5 (347°F ± 9), using stabilized core specimens. Test shall be performed after exposure of test specimens for not less than 30 min. at the test temperature.

4.6 Reports:

4.6.1 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, material specification number, manufacturer's product designation, quantity, and block or lot number.

4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of core, supplier's product 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 a statement that the core conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.7 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 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 of such size as to be clearly legible and which will not be obliterated by normal handling:

CORE, HONEYCOMB, GLASS/PHENOLIC
AMS 3715
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 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 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 in all quotations and when acknowledging purchase orders.

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

8. NOTES:

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

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