AEROSPACE MATERIAL SPECIFICATION

AMS3716™	REV. C

Issued 1979-10
Revised 1998-08
Reaffirmed 2022-08

Superseding AMS3716B

Core, Honeycomb, Glass/Phenolic Bias Weave Fiber Construction

RATIONALE

AMS3716C has been reaffirmed to comply with the SAE Five-Year Review policy.

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:

These products have been typically used for bonded sandwich structures requiring high strength and corrosion resistance for service up to 177 °C (350 °F), but usage is not limited to such applications. Each application should be considered individually.

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.

AMS 3698 Adhesive Film, Hot Melt, Addition - Type Polyimide, For Foam Sandwich
AMS 3824 Cloth, Glass, Finished for Resin Laminates

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS3716C/

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

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

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/m3)

Example: Core, Glass/Phenolic/Bias - 3/16 to 4.0 (in Inch/Pound Units)
Core, Glass/Phenolic/Bias - 4.8 to 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 1, determined in accordance with 4.5.1.

3.3.2 Compressive Strength and Compressive Modulus: Shall be as specified in Table 1, 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.

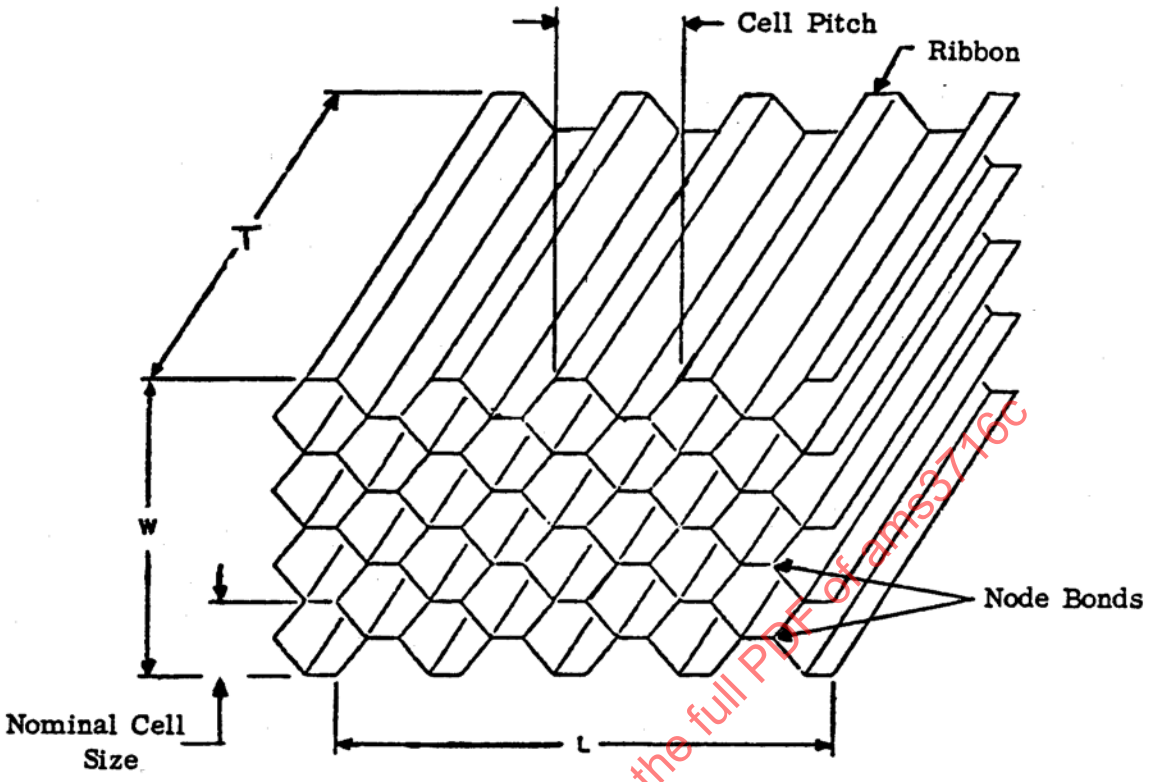

FIGURE 1 - Honeycomb Core

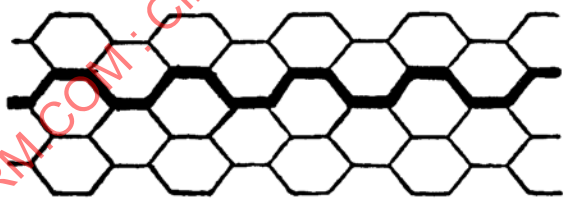

FIGURE 2 - Double Ribbons

TABLE 1

Nominal Core Dimensions Cell Size Inch	Nominal Core Dimensions Density lb per cu ft	Test Temp °F	Core Shear Strength psi, min Ind. L	Core Shear Strength psi, min Ind. W	Core Shear Modulus psi, min Avg. L	Core Shear Modulus psi, min Avg. W	Compressive Strength Stabilized psi, min Ind.	Compressive Modulus Stabilized psi, Dry Typical
1/8	3.0	77	150	75	13,000	6,000	260	22,000
		350	90	45	7,800	3,600	180	15,400
1/8	4.0	77	240	120	25,000	10,000	420	45,000
		350	145	70	15,000	6,000	275	31,500
1/8	5.5	77	340	180	30,000	12,000	720	76,000
		350	205	110	18,000	7,200	505	53,200
1/8	8.0	77	460	270	35,000	20,000	1215	100,000
		350	275	160	21,000	12,000	850	70,000
3/16	1.8	77	85	40	6,000	TBR	90	14,000
		350	50	25	3,600	TBR	65	9,800
3/16	2.0	77	90	50	8,000	TBR	125	17,000
		350	55	30	4,800	TBR	90	11,900
3/16	3.0	77	150	75	15,000	7,000	275	32,000
		350	90	45	9,000	4,200	190	22,400
3/16	4.0	77	220	110	20,000	10,000	410	45,000
		350	130	65	12,000	6,000	285	31,500

TBR = To be reported on preproduction test report.

TABLE 1 (SI)

Nominal Core Dimensions Cell Size mm	Nominal Core Dimensions Density kg/m^3	Test Temp °C	Core Shear Strength MPa, min Ind. L	Core Shear Strength MPa, min Ind. W	Core Shear Modulus MPa, min Avg. L	Core Shear Modulus MPa, min Avg. W	Compressive Strength Stabilized MPa, min Ind.	Compressive Modulus Stabilized MPa, Dry Typical
3.2	48	25	1.03	0.52	89.6	41.4	1.79	152
		177	0.62	0.31	53.8	24.8	1.24	106
3.2	64	25	1.65	0.83	172	68.9	2.90	310
		177	1.00	0.48	103	41.4	2.03	217
3.2	88	25	2.34	1.24	207	82.7	4.96	524
		177	1.41	0.76	124	49.6	3.48	367
3.2	128	25	3.17	1.86	241	138	8.38	689
		177	1.90	1.10	145	82.7	5.86	483
4.8	29	25	0.59	0.28	41.4	TBR	0.62	96.5
		177	0.34	0.17	24.8	TBR	0.45	67.6
4.8	32	25	0.62	0.34	55.2	TBR	0.86	117
		177	0.38	0.21	33.1	TBR	0.62	82.0
4.8	48	25	1.03	0.52	103	48.3	1.90	221
		177	0.62	0.31	62.0	29.0	1.31	154
4.8	64	25	1.52	0.76	138	68.9	2.83	310
		177	0.90	0.47	82.7	41.4	1.96	217

TBR = To be reported on preproduction test report.

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:

The 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:

TABLE 2A

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

TABLE 2B

Core Thickness Millimeters	Tolerance, Millimeters plus and minus
3.18 to 38.10, incl	0.15
Over 38.10 to 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.

3.6 Quality:

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

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The manufacturer of core shall supply all samples and shall be responsible for the performance of 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: 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: All technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of core to 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.

4.3 Sampling and Testing:

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 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 (113 kg).

4.3.1.2 A statistical sampling plan acceptable to purchaser may be used 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: Acceptable to purchaser.