AEROSPACE MATERIAL SPECIFICATION

AMS3712™	REV. C

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Reaffirmed 2022-08

Superseding AMS3712B

Core, Honeycomb, Glass/Polyimide

RATIONALE

AMS3712C has been reaffirmed to comply with the SAE Five-Year Review policy.

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:

This core has been used typically for bonded sandwich structures requiring high strength and corrosion resistance for long-time service up to 450 °F (232 °C) and short duration up to 700 °F (371 °C), but usage is not limited to such applications.

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 issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

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/AMS3712C/

2.1 SAE Publications:

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

AMS 3824 Cloth, Glass, Finished for Resin Laminates

2.2 ASTM Publications:

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

ASTM C 271 Density of Sandwich Core Materials
ASTM C 273 Shear Properties of Sandwich Core Materials
ASTM C 365 Flatwise Compressive Properties of Sandwich Cores

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 impregnations, and also for the node bond adhesive, shall be a polyimide 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 inch) (mm)
c. Density (pounds per cubic foot) (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 inch (4.8 mm) cell size, with density of 4.0 pounds per cubic foot (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 Figure 1).

3.1.5 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

3.2 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 ASTM C 273 at 75 °F ± 5 (24 °C ± 3) and at 446 °F ± 9 (230 °C ± 5). Specimens shall be plate shear specimens 0.500 inch ± 0.010 (12.70 mm ± 0.25) thick. Two or more plies of adhesive may be used in preparing test specimens if necessary to induce core failure. Specimens shall be tested after exposure for not less than 30 minutes 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 1, determined in accordance with ASTM C 365 at 75 °F ± 5 (24 °C ± 3) and at 446 °F ± 9 (230 °C ± 5) on stabilized core specimens (See 8.2). Test shall be performed after exposure of test specimens for not less than 30 minutes at the test temperature.

3.3.3 Density: Shall be within ±10% of the nominal density specified in Table 1, determined in accordance with ASTM C 271.

3.3.4 Flatness: Expanded core shall make 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 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, as free from foreign materials as commercially practicable, and free 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.

TABLE 1A - Properties, Inch/Pound Units

Nominal Cell Size Inch	Nominal Core Density lb per cu ft	Test Temp °F	Core Shear Strength[A] psi, min L	Core Shear Strength[A] psi, min W	Core Shear Modulus[B] ksi, min L	Core Shear Modulus[B] ksi, min W	Compressive Strength[A] Stabilized psi, min	Compressive Modulus[B] Stabilized ksi, dry min
3/16	4.0	75	140	70	13.0	5.0	300	25.0
		446	90	45	8.5	3.5	195	16.0
3/16	4.5	75	220	110	22.0	8.4	400	31.0
		446	145	70	14.0	5.5	260	20.0
3/16	5.0	75	250	125	26.0	10.0	480	42.0
		446	160	80	17.0	6.5	310	27.5
3/16	6.0	75	345	170	35.0	11.5	625	64.0
		446	225	110	22.5	7.5	405	41.5
3/16	8.0	75	500	330	48.0	17.5	1000	85.0
		446	325	215	31.0	11.5	650	55.0
1/4	4.0	75	140	80	13.0	7.0	325	25.0
		446	90	50	8.5	4.5	215	16.0
1/4	5.0	75	250	125	26.0	10.0	450	35.0
		446	160	80	17.0	6.5	300	22.5
3/8	4.0	75	195	100	23.0	8.0	325	35.0
		446	125	65	15.0	5.0	215	22.5
3/8	5.5	75	300	160	30.0	10.0	540	45.0
		446	195	105	19.5	6.5	350	29.0
3/8	7.0	75	480	280	37.0	14.0	875	75.0
		446	310	180	24.0	8.0	565	50.0

[A]Strengths are minimum individual values
[B]Moduli are minimum average values

TABLE 1B - Properties, SI Units

Nominal Cell Size mm	Nominal Core Density kg/m^3	Test Temp °C	Core Shear Strength[A] MPa, min L	Core Shear Strength[A] MPa, min W	Core Shear Modulus[B] MPa, min L	Core Shear Modulus[B] MPa, min W	Compressive Strength[A] Stabilized MPa min	Compressive Modulus[B] Stabilized MPa, dry min
4.8	64	24	0.97	0.48	89.6	34.5	2.07	172.4
		230	0.62	0.31	58.6	24.1	1.34	110.3
4.8	72	24	1.52	0.76	151.7	57.9	2.76	213.7
		230	1.00	0.48	96.5	37.9	1.79	137.9
4.8	80	24	1.72	0.86	179.3	68.0	3.31	289.6
		230	1.10	0.55	117.2	44.8	2.14	189.6
4.8	96	24	2.38	1.17	241.3	79.3	4.31	441.3
		230	1.55	0.76	155.1	51.7	2.79	286.1
4.8	128	24	3.45	2.28	331.0	120.7	6.90	586.1
		230	2.24	1.48	213.7	79.3	4.48	379.2
6.4	64	24	0.97	0.55	89.6	48.3	2.24	172.4
		230	0.62	0.34	58.6	31.0	1.48	110.3
6.4	80	24	1.72	0.86	179.3	69.0	3.10	241.3
		230	1.10	0.55	117.2	44.8	2.07	155.1
9.5	64	24	1.34	0.69	158.6	55.2	2.24	241.3
		230	0.86	0.45	103.4	34.5	1.48	155.1
9.5	88	24	2.07	1.10	206.8	69.0	3.72	310.3
		230	1.34	0.72	134.5	44.8	2.41	200.0
9.5	112	24	3.31	1.93	255.1	96.5	6.03	517.1
		230	2.14	1.24	165.5	55.2	3.90	344.7

[A]Strengths are minimum individual values
[B]Moduli are minimum average values

3.4.1.2 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.

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

3.5 Tolerances:

Shall be as follows:

3.5.1 Core Thickness: Shall be as shown in Table 2.

TABLE 2A - Thickness Tolerances, Inch/Pound Units

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 - Thickness Tolerances, SI Units

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 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 Figure 1).

3.5.5 Ribbon Direction: All ribbons shall be parallel to each other within 10 degrees. This 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 a corresponding line through two nodes of another ribbon in the principal ribbon direction (See Figure 1).

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The manufacturer of core shall supply all samples for required tests 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 specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Compressive strength (3.3.2), 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 first-article shipment of core by the manufacturer, when a change in ingredients and/or processing requires reapproval as in 4.4.1, 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.

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 4.5 shall state that such plan was used.

4.3.2 For Preproduction Tests: Acceptable to purchaser.

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. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, manufacturer 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 procedure shall not be shipped prior to receipt of reapproval.

4.4.2 Manufacturer 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.

4.5 Reports:

The supplier of core shall furnish with each shipment a report from the manufacturer 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, block or lot number, AMS 3712C, manufacturer's identification, size, and quantity.

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. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 A core lot may be packaged in small quantities and delivered under the basic lot approval provided lot identification is maintained.

5.1.2 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.

5.1.3 Each piece of core and each interior and exterior package shall be legibly marked 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/POLYIMIDE
AMS 3712C
CORE DESIGNATION
T x L x W _____
MANUFACTURER'S IDENTIFICATION _____
BLOCK OR LOT NUMBER _____
PURCHASE ORDER NUMBER _____
DATE OF MANUFACTURE _____

5.1.4 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.