



AEROSPACE MATERIAL SPECIFICATION	AMS3715™	REV. D
	Issued 1979-10 Revised 2004-05 Reaffirmed 2022-08	
Superseding AMS3715C		
Core, Honeycomb, Glass/Phenolic		

RATIONALE

AMS3715D has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE:

1.1 Form:

This specification covers honeycomb core made of glass fabric impregnated with phenolic resin and supplied in the form of blocks, slices, and ordered shapes.

1.2 Application:

This honeycomb core has been used typically for bonded sandwich structures requiring high strength and corrosion resistance for service up to 350 °F (177 °C), but usage is not limited to such applications. A common use is outboard control surfaces subject to water migration.

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.

2.1 SAE Publications:

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

AMS 3824 Cloth, Glass, Finished for Resin Laminates

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SAE WEB ADDRESS:

For more information on this standard, visit
<https://www.sae.org/standards/content/AMS3715D/>

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
ASTM C 393	Flexural Properties of Sandwich Constructions

3. TECHNICAL REQUIREMENTS:

3.1 Material:

- 3.1.1 Glass Cloth: Shall be suitably finished as required for impregnation with the resin system specified. The fabric shall meet suitable industry standards for the fabric type and be controlled by vendor PCD. Requirements in AMS-3824 shall apply whenever possible.
- 3.1.2 Resin: The resin used for impregnating the glass cloth in the initial web impregnation and final core densification dips shall be a phenolic resin system suitable for producing core material meeting the requirements of 3.3. Node bond adhesive will be as controlled by vendor PCD.
- 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/m³)

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 inch (4.8 mm) cell size, with density of 4.0 pounds per cubic foot (64 kg/m³).

3.1.4 Cell Configuration:

- 3.1.4.1 Expanded 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).
- 3.1.4.2 Corrugated Core shall consist of phenolic resin impregnated glass cloth sheets, bonded together so that a flat sheet bisects each cell (See Figure 2).

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 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 or Table 2, determined in accordance with 4.5.1. Shear Strength for 16# core shall be Flexural Shear Strength in accordance with 4.5.2.
- 3.3.2 Compressive Strength and Compressive Modulus: Shall be as specified in Table 1 or Table 2, determined in accordance with 4.5.3.
- 3.3.3 Density: Shall be within $\pm 10\%$ of the nominal density specified in Table 1 or Table 2, determined in accordance with ASTM C 271.
- 3.3.4 Flatness: All 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.
- 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 3.
- 3.4.1.3 Splices: There shall be no splices in sheet supplied.
- 3.4.1.4 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.

3.5 Tolerances:

Shall be as follows as appropriate to the dimensional system applied:

3.5.1 Core Thickness: Shall be as shown in Table 3.

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

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 L 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 $\pm 10\%$ 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 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: Shear strength (3.3.1), density (3.3.3), visual imperfections (3.4.1), and tolerances (3.5) are acceptance tests and shall be performed on each lot. The average of the lot tests shall meet the min average requirement in Table 1 or 2 and that all of the individual lot test values shall meet the min individual requirement in Table 1 or 2. For properties where only Typical values are listed in the Tables, the Typical values shall not be used as specification requirements.
- 4.2.2 Preproduction Tests: All technical requirements are preproduction tests and shall be performed prior to or on the initial 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 shall have a representative sample cut 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 4.6 shall state that such plan was used.
- 4.3.2 For Preproduction Tests: As agreed upon by purchaser and supplier.
- #### 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 procedures 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 Test Methods:

- 4.5.1 Shear Strength and Shear Modulus: Shall be determined in the "L" and "W" directions in accordance with ASTM C 273 at $75^{\circ}\text{F} \pm 5$ ($24^{\circ}\text{C} \pm 3$) and at $347^{\circ}\text{F} \pm 10$ ($175^{\circ}\text{C} \pm 5$), using plate-shear specimens $0.500 \text{ inch} \pm 0.010$ ($12.70 \text{ mm} \pm 0.25$) in thickness. Specimens shall be tested after exposure for not less than 30 minutes at the test temperature. Shear Modulus for 16# core shall be measured to a load of 11,500 lbs for L and 6,500 lbs for W. Shear Strength is not measurable for 16# core by this method.
- 4.5.2 Flexural Shear Strength: Shall be determined in the "L" and "W" directions in accordance with ASTM C 393 at $75^{\circ}\text{F} \pm 5$ ($24^{\circ}\text{C} \pm 3$). Test specimens shall be 0.500 ± 0.006 inches T, 3.00 ± 0.02 inches wide, and 14 ± 0.07 inches long. Ribbon direction shall be within 5 degrees of parallel to the long dimension of the test specimen for the L, and within 5 degrees of perpendicular for the W. Both facings shall be 2024-T81 0.0071 inches thick. The core shall be bonded to the aluminum facings in a manner that assures a shear failure between the adjacent load and support blocks. Other failure modes are not acceptable. Test arrangement is a simple four-point bend.
- 4.5.3 Compressive Strength and Compressive Modulus: Shall be determined in accordance with ASTM C 365 at $75^{\circ}\text{F} \pm 5$ ($24^{\circ}\text{C} \pm 3$) and at $347^{\circ}\text{F} \pm 9$ ($175^{\circ}\text{C} \pm 5$), using 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.

4.6 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 3715D, manufacturer's identification, size, and quantity.

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 twice the original number of specimens, cut from the same block. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the core represented.

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 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

AMS 3715D

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.

6. ACKNOWLEDGMENT:

The supplier 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 A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this specification. An (R) symbol to the left of the document title indicates a complete revision of the specification, including technical revisions. Change bars and (R) are not used in original publications, nor in specifications that contain editorial changes only.

- 8.2 Aluminum alloy sheet, 0.020 to 0.040 inch (0.51 to 1.02 mm) in nominal thickness, has been used on the stabilized compressive strength specimens.

8.3 Terms used in AMS are clarified in ARP1917.

- ~~8.3.4~~ Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

9.48.5 Procurement documents should specify not less than the following:

AMS 3715D

Nominal cell size and core density required

Length, width, and thickness of blocks or slices required

Quantity of core desired

Special packaging, if required.

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PREPARED UNDER THE JURISDICTION OF AMS COMMITTEE "P"

Table 1A - Properties, Inch/Pound Units

Nominal Cell Size Inch	Nominal Core Density lb per cu ft	Test Temperature, °F ± 5 °F ± 10 °F	L Shear	W Shear	L Shear Modulus, ksi			W Shear Modulus, ksi			Compressive Strength, psi	Stabilized Compressive Modulus, ksi
			Strength, psi	Strength, psi	Minimum Individual	Minimum Individual	TYP	MA	MI	TYP	MA	MI
3/16	4	75	210	110	11.5	10.5	9.5	5.5	5.0	4.5	480	45.6
		347	125	65	6.9	6.3	5.7	3.3	3.0	2.7	335	31.9
3/16	5.5	75	370	190	19.5	16.8	15.5	8.5	7.8	6.8	750	76.0
		347	220	115	11.7	10.1	9.3	5.1	4.7	4.1	525	53.2
3/16	7	75	525	290	28.0	23.0	21.0	12.5	10.5	9.0	1100	135.0
		347	315	174	16.8	13.8	12.6	7.5	6.3	5.4	770	94.5
3/16	8	75	600	370	34.0	27.3	26.0	15.0	12.5	11.0	1280	131.2
		347	360	220	20.4	16.4	15.6	9.0	7.5	6.6	895	91.8
3/16	12	75	850	570	55.0	44.0	37.2	25.0	20.0	17.5	2200	208.0
		347	510	342	33.0	26.4	22.3	15.0	12.0	10.5	1540	145.6
1/4	3.5	75	170	100	9.0	8.0	7.0	4.3	3.5	3.0	400	36.8
		347	100	60	5.4	4.8	4.2	2.6	2.1	1.8	280	25.8
1/4	4.5	75	250	140	14.0	13.0	12.0	7.4	6.0	5.0	560	56.0
		347	150	85	8.4	7.8	7.2	4.4	3.6	3.0	390	39.2
1/4	5	75	450T	200T	17.0	16.0	15.0	9.0	7.5	6.0	660	67.2
		347	205T	120T	10.2	9.6	9.0	5.4	4.5	3.6	460	47.0
1/4	6.5	75	450T	260T	26.0	24.0	18.0	16.0	12.0	9.5	900	96.0
		347	270T	155T	15.6	14.4	10.8	9.6	6.6	5.7	630	67.2
3/8	2.2	75	75	45	5.0	4.5	3.9	2.0	1.8	1.4	145	10.4
		347	45	25	3.0	2.7	2.3	1.2	1.1	0.8	100	7.3
3/8	3.2	75	160	85	11.0	7.5	6.5	5.0	3.5	2.8	350	30.4
		347	95	50	6.6	4.5	3.9	3.0	2.1	1.7	245	21.3
3/8	4.5	75	260	150	14.0	12.3	11.5	7.6	5.8	5.0	550	52.0
		347	155	90	8.4	7.4	6.9	4.6	3.5	3.0	385	36.4
3/8	6	75	340	210	22.5	17.5	16.0	10.0	8.5	7.5	750	80.0
		347	205	125	13.5	10.5	9.6	6.0	5.1	4.5	525	56.0
3/8	8	75	520T	320T	31.0	24.8	22.0	13.0	12.0	10.0	1200T	120.0
		347	310T	190T	18.6	14.9	13.2	7.8	7.2	6.0	840T	84.0

TYP is the Typical value for modulus, for informational purposes only.

MA is the minimum average

MI is the minimum individual

T = Typical value for informational purposes only; these values are not specification requirements.