

# AEROSPACE MATERIAL SPECIFICATION



AMS 3715C

Issued OCT 1979  
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Superseding AMS 3715B

## 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:

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.

#### 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.

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## 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 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 inch) (mm)
- c. Density (pounds per cubic foot) ( $\text{kg/m}^3$ )

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 inch (4.8 mm) cell size, with density of 4.0 pounds per cubic foot ( $64 \text{ kg/m}^3$ ).

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 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 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  $\pm 10\%$  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.
- 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 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 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  $\pm 10\%$  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.

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 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 4.6 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  $75\text{ }^{\circ}\text{F} \pm 5$  ( $24\text{ }^{\circ}\text{C} \pm 3$ ) and at  $347\text{ }^{\circ}\text{F} \pm 9$  ( $175\text{ }^{\circ}\text{C} \pm 5$ ), 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.

4.5.2 Compressive Strength and Compressive Modulus: Shall be determined in accordance with ASTM C 365 at  $75\text{ }^{\circ}\text{F} \pm 5$  ( $24\text{ }^{\circ}\text{C} \pm 3$ ) and at  $347\text{ }^{\circ}\text{F} \pm 9$  ( $175\text{ }^{\circ}\text{C} \pm 5$ ), 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 3715C, 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 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 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 3715C

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 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.

8.4 Procurement documents should specify not less than the following:

AMS 3715C

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 Temp °F	Core Shear Strength <sup>A</sup>	Core Shear Strength <sup>A</sup>	Core Shear Modulus <sup>B</sup>	Core Shear Modulus <sup>B</sup>	Compressive Strength <sup>A</sup>	Compressive Modulus <sup>B</sup>
			psi, min L	psi, min W	ksi, min L	ksi, min W	Stabilized psi, min	Stabilized ksi, dry min
3/16	4.0	75	210	110	11.5	5.0	480	57.0
		347	125	65	6.9	3.0	335	39.9
3/16	5.5	75	370	190	19.5	8.5	750	95.0
		347	220	115	11.7	5.1	525	66.5
3/16	7.0	75	500T	290T	28.0	12.5	1,230T	136.0
		347	300T	175T	16.8	7.5	860T	95.2
3/16	8.0	75	600	370	34.0	15.0	1,280	164.0
		347	360	220	20.4	9.0	895	114.8
3/16	12.0	75	940PT	570T	55.0	25.0	2,300T	260.0
		347	565PT	340T	33.0	15.0	1,610T	182.0
1/4	3.5	75	170	100	9.0	3.5	400	46.0
		347	100	60	5.4	2.1	280	32.2
1/4	4.5	75	250	140	14.0	6.0	560	70.0
		347	150	85	8.4	3.6	390	49.0
1/4	5.0	75	340T	200T	17.0	7.5	660	84.0
		347	205T	120T	10.2	4.5	460	58.8
1/4	6.5	75	450T	260T	25.0	11.0	900	120.0
		347	270T	155T	15.0	6.6	630	84.0
3/8	2.2	75	75	45	5.0	2.0	145	13.0
		347	45	25	3.0	1.2	100	9.1
3/8	3.2	75	160	85	8.0	3.0	350	38.0
		347	95	50	4.8	1.8	245	26.6
3/8	4.5	75	260	150	14.0	6.0	550	65.0
		347	155	90	8.4	3.6	385	45.5
3/8	6.0	75	340	210	22.5	10.0	750	100.0
		347	205	125	13.5	6.0	525	70.0

TABLE 1A - Properties, Inch/Pound Units (Continued)

Nominal Cell Size Inch	Nominal Core Density lb per cu ft	Test Temp °F	Core Shear	Core Shear	Core Shear	Core Shear	Compressive	Compressive
			Strength <sup>A</sup> psi, min L	Strength <sup>A</sup> psi, min W	Modulus <sup>B</sup> ksi, min L	Modulus <sup>B</sup> ksi, min W	Strength <sup>A</sup> Stabilized psi, min	Modulus <sup>B</sup> Stabilized ksi, dry min
3/8	8.0	75	520T	320T	31.0	13.0	1,200T	150.0
		347	310T	190T	18.6	7.8	840T	105.0

<sup>A</sup>Strengths are minimum individual values

<sup>B</sup>Moduli are minimum average values

T = Typical value

P = Preliminary value

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