AEROSPACE MATERIAL SPECIFICATION

AMS3710™	REV. C

Issued 1961-07
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Reaffirmed 2022-12

Superseding AMS3710B

Sandwich Structures, Glass Fabric-Resin Low Pressure Molded, Heat Resistant

RATIONALE

AMS3710C has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE:

1.1 Form:

This specification covers a resin-impregnated glass fabric honeycomb core in the form of flat or contoured sandwich structures.

1.2 Application:

This product has been used typically for structural and electrical parts requiring low weight, strength, and good electrical resistance up to 300 °F (149 °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 following publications form a part of this specification to the extent specified herein. The applicable issue of referenced publications shall be the issue in effect on the date of the purchase order.

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/AMS3710C/

2.1 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 297 Tensile Strength of Flat Sandwich Constructions in Flatwise Plane
ASTM C 364 Edgewise Compressive Strength of Flat Sandwich Constructions
ASTM C 365 Flatwise Compressive Strength of Sandwich Cores
ASTM C 393 Flexural Properties of Flat Sandwich Constructions

2.2 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-2073-1 DOD Materiel, Procedures for Development and Application of Packaging Requirements

3. TECHNICAL REQUIREMENTS:

3.1 Material and Fabrication:

Shall consist of a resin-impregnated, glass-fabric honeycomb core covered with resin-impregnated, glass-fabric faces.

3.1.1 Core:

3.1.1.1 Glass Fabric Reinforcement: The glass fabric reinforcement, prior to being coated, shall be heat cleaned followed by application of a water-resistant finish compatible with the impregnating resin.

3.1.1.2 Style of Weave: Each ply of glass fabric used for the honeycomb core shall not exceed 0.004 inch (0.10 mm) in thickness and 2 ounces per square yard (68 g/m^2) in weight. Breaking strength shall be not less than 88 pounds per inch (15.4 kN/m) edgewise and 86 pounds per inch (15.1 kN/m) pickwise.

3.1.2 Impregnating Resin: Shall be a heat-resistant, thermosetting resin.

3.1.3 Core Layup: Honeycomb core material shall be a random layup but symmetrically positioned at diametrically opposite locations. Adjacent blocks of honeycomb whose joints are parallel to the ribbon direction shall be intermeshed (See 3.1.3.1) or butted. All other joints shall be intermeshed. The honeycomb shall not be gored.

3.1.3.1 Intermesh is defined as the positioning of adjacent blocks of honeycomb such that the outermost edge of one block shall fall within the outermost edge of the adjacent block. This shall be accomplished without crushing or damaging the honeycomb core material.

3.1.4 Faces: The thickness of faces and their tolerances shall be as specified by purchaser. The faces shall be premolded or laminated prior to bonding to the core. If required, a peel-ply-wet-ply bonding technique may be used. Sandwich faces shall be essentially void-free.

3.1.4.1 Glass Fabric Reinforcement: Each ply of glass fabric used for the outer faces shall not exceed 0.016 inch (0.41 mm) in thickness and 10 ounces per square yard (339 g/m^2) in weight.

3.1.4.2 Impregnation Resin: Shall be a heat-resistant, thermosetting resin.

3.1.5 Core-To-Face Bonding Resin: The resin or adhesive used for bonding the sandwich faces to the honeycomb core shall be a supported or unsupported, heat-resistant epoxy compound.

3.1.6 Edge Band Sealant and Local Reinforcements: The product shall be supplied free of edge band sealant and locally embedded reinforcements.

3.1.7 Core-to-Face Bond: The sandwich faces shall be uniformly and firmly bonded to the core material over the entire area of the sandwich structure. There shall be a substantial fillet of resin where the honeycomb contacts the face material. Excessive resin deposits, which affect electrical transmission efficiency, are not permitted. Ubonded areas between the outer face and the core are not acceptable.

3.2 Condition:

The bonded construction shall be cured to meet the requirements of 3.3 and supplied in the unpainted condition.

3.3 Properties:

Sandwich constructions having nominal cell size (distance between parallel sides of a cell measured perpendicular to the ribbon direction) of the core of 3/16 inch (4.8 mm) shall conform to requirements shown in Table 1; properties of constructions having nominal core cell size other than 3/16 inch (4.8 mm) shall be as agreed upon by purchaser and vendor. Tests shall be performed in accordance with specified test methods, insofar as practicable, except that dielectric constant and dissipation factor tests shall be determined by procedures acceptable to purchaser.

3.3.1 Honeycomb Core: Shall be as shown in Table 1.

TABLE 1 - Properties, Honeycomb Core

Paragraph	Property	Requirement	Test Method
3.3.1.1	Density	8.0 to 10.0 pounds per cubic foot (128 to 160 kg/m^3)	ASTM C 271
3.3.1.2	Dielectric Constant at 9375 MHz ± 1%, maximum	1.28	
3.3.1.3	Dissipation Factor at 9375 MHz ± 1%, maximum	0.004	
3.3.1.4	Compressive Strength, 1/2 inch (12.7 mm) thick specimens, minimum	1500 psi (10.3 MPa)	ASTM C 365

3.3.2 Sandwich Panels: Flat sandwich panels, 0.500 inch ± 0.015 (12.70 mm ± 0.38) total thickness, having 0.040 inch ± 0.005 (1.00 mm ± 0.13) thick faces and 3/16 inch (4.8 mm) cells, representative of the construction supplied, shall conform to the requirements shown in Table 2, 3.3.2.7, 3.3.2.8 and 3.3.2.9; tests shall be performed in accordance with the listed ASTM Methods, insofar as practicable:

TABLE 2 - Properties, Sandwich Panels

Paragraph	Property	Requirement	Test Method
3.3.2.1	Compressive Strenght, minimum		ASTM C 364
	At 70 °F ± 2 (21 °C ± 1)	1500 psi (10.3 MPa)	
	At 300 °F ± 5 (149 °C ± 3) after 192 hours at 300 °F ± 5 (149 °C ± 3)	1500 psi (10.3 MPa)	
3.3.2.2	Shear Strength, minimum		ASTM C 273
	At 70 °F ± 2 (21 °C ± 1)	800 psi (5.52 MPa)	
	At 300 °F ± 5 (149 °C ± 3) after 30 minutes ± 5 at 300 °F ± 5 (149 °C ± 3)	600 psi (4.14 MPa)	
3.3.2.3	Shear Modulus		ASTM C 273
	At 70 °F ± 2 (21 °C ± 1)	40.0 ksi (276 MPa)	
	At 300 °F ± 5 (149 °C ± 3) after 30 minutes ± 5 at 300 °F ± 5 (149 °C ± 3)	30.0 ksi (207 MPa)	

TABLE 2 - Properties, Sandwich Panels (Continued)

Paragraph	Property	Requirement	Test Method
3.3.2.4	Flatwise Tensile Strength, minimum At 70 °F ± 2 (21 °C ± 1)	 600 psi (4.14 MPa)	ASTM C 273
3.3.2.5	Shear Strength, (sandwich structure flat only), minimum Parallel to ribbon Perpendicular to ribbon	 400 psi (2.76 MPa) 400 psi (2.76 MPa)	ASTM C 393
3.3.2.6	Flexural Strength, (sandwich structure flat only), minimum Parallel to ribbon Perpendicular to ribbon	 290 psi (2.00 MPa) 170 psi (1.17 MPa)	ASTM C 393

3.3.2.7 Power Transmission Efficiency: The power transmission efficiency of the sandwich structure at 9375 MHz ± 10 when oriented at a 20-degree angle of incidence using parallel and perpendicular polarization shall be not less than 95% when tested at 50% ± 5 relative humidity. The sandwich transmission efficiency shall be not less than 90% after exposure to 25 cycles of heating to equilibrium at +158 °F (+70 °C) and cooling to equilibrium at -35 °F (-37 °C) followed by 50 cycles of simulated altitude exposure within the range 8,000 to 50,000 feet (2,438 to 15,240 m) with condensation on the panel surfaces.

3.3.2.8 Weather Resistance: When specified, the product shall have weather resistance acceptable to purchaser, determined by a procedure agreed upon by purchaser and vendor.

3.3.2.9 Corrosion: The product shall not have a corrosive effect on other materials when exposed to conditions normally encountered in service, determined by a procedure agreed upon by purchaser and vendor. Discoloration of metals shall not be considered objectionable.

3.4 Quality:

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

3.4.1 Surface Condition: The surfaces of the sandwich structure shall be free of adhesion-inhibiting materials.

3.4.2 Imperfections: Molded sandwich structures shall have no imperfections which exceed the maximum allowable limits of 3.4.2.1 through 3.4.2.4.

3.4.2.1 Gaps: Not more than 20% of the total amount of honeycomb jointed lengths may have gaps up to one-half cell diameter in dimension for a maximum total gap length of 8 inches (203 mm) including all adjacent pieces. Not more than 5% of the total amount of honeycomb jointed lengths may have gaps up to one cell diameter in dimension for a maximum total gap length of 5 inches (127 mm) between adjacent pieces.

3.4.2.2 Unbonded Areas: Unbonded areas not larger than 1 square inch (6.5 cm^2) shall be allowed between the inner skin of the sandwich and the core if the total area of these unbonded areas is less than 0.5% of the total face-to-core area. Unbonded areas shall also be limited to not more than one per each 3 foot (914 mm) square and they shall be no closer than 6 inches (152 mm) from each other.

3.4.2.3 Resin Pools: A resin pool not larger than 1 square inch (6.5 cm^2) in area is permitted on the inner skin of the sandwich if the total area of such a resin pool is less than 1% of the total face-to-core area. Resin pools also shall be limited to not more than one per each 3 foot (914 mm) square and they shall be not closer than 6 inches (152 mm) from each other.

3.4.2.4 Other small surface imperfections, such as reduction of void-freeness (excluding contaminants) on the inner skin of the sandwich, not exceeding 1 square inch (6.5 cm^2) in area, are allowed. The total area of these imperfections shall be less than 5% of the total face-to-core area. Such imperfections shall be limited to not more than one per each 3 foot (914 mm) square and they shall be not closer than 6 inches (152 mm) from each other.

3.5 Tolerances:

Thickness tolerances of sandwich panels shall be as specified by purchaser.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of sandwich panels shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the panels conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for material and fabrication (3.1), flatwise tensile strength (3.3.2.4), flexural strength (3.3.2.6), quality (3.4), and tolerances (3.5) are acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests for all technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of panels to a 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.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: In accordance with Single Sampling for Normal Inspection, General Inspection Level II, specified in MIL-STD-105. Sufficient product shall be taken from inspection units selected at random from each production lot to perform all required tests and to allow for invalid 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 all sandwich panels produced from the same batches of ingredients, using the same processing conditions on the same machine, and presented for vendor's inspection at one time.

4.3.1.2 When a statistical sampling plan has 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 4.5 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample panels shall be approved by purchaser before panels for production use are supplied, unless such approval be waived by purchaser. Results of tests on production panels 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 panels which are essentially the same as those used on the approved sample. If necessary to make any change in ingredients, in type of processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in ingredients and/or processing and, when requested, sample panels. Production panels made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Reports:

The vendor of panels shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the panels conform to the other technical requirements. This report shall include the purchase order number, lot number, AMS 3710C, vendor's product identification, size or part number, and quantity.

4.6 Resampling and Retesting:

If any specimen used in the above tests fails to meet the specified requirements, disposition of the panels may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the panels represented. Results of all tests shall be reported.