

MIL-C-81986 (AS)
19 November 1974

MILITARY SPECIFICATION

CORE MATERIAL, PLASTIC HONEYCOMB, NYLON PAPER BASE; FOR AIRCRAFT STRUCTURAL APPLICATIONS

This specification has been approved by the
Naval Air Systems Command, Department of the
Navy.

1. SCOPE

1.1 Scope - This specification covers the requirements for nonperforated nylon paper base plastic honeycomb core material for aircraft structural applications, including exterior parts such as radio and radar antenna housings.

1.2 Classification - This specification covers one grade of core material.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

PPP-B-585	Box, Wood, Wirebound
PPP-B-591	Box, Fiberboard, Wood-Cleated
PPP-B-636	Box, Fiberboard

Military

MIL-P-116	Preservation, Methods of
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FSC 5680

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STANDARDS

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-401	Sandwich Constructions and Core Materials, General Test Methods

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications - The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

National Standards Association, Inc.

ATC Report No.	Electrical Test Procedures for Radomes and Radome Materials
ARTC-4	

(Application for copies should be addressed to the National Standards Association, Inc., 1321 Fourteenth Street NW, Washington, D.C. 20005.)

3. REQUIREMENTS

3.1 Preproduction sample - When specified in the contract or order (see 4.3.2 and 6.2), preproduction samples of nylon paper core material of designated density, cell size dimension, resin bond, and core cell configuration shall be manufactured using the methods and processes proposed for the production lot. These samples are for the purpose of determining that the manufacturer's production methods and processes will produce core material that will meet the requirements of this specification. These samples shall be inspected as specified in Section 4 and shall be submitted as directed by the procuring activity for examination and approval.

3.1.1 Material and property control - Prior to production, material and property controls shall be established for the core cell size, type and quantity of the stabilizing resin, adhesive, and bonding methods. The control shall be continued until the application of resin and adhesive, assembly of the materials and curing of the adhesive practices have been established to produce core materials conforming to this specification. When processing practices have been so established, the production shall

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not be changed without demonstrating to the satisfaction of the procuring activity that the change does not adversely affect the quality of the core material.

3.1.1.1 Preproduction sampling and testing (see 3.1) shall be required whenever one or more changes are made with the processing of the core material, adhesive, bonding, design or fabrication techniques.

3.2 Materials - The materials comprising the core shall conform to the applicable specifications and shall be as specified herein. Materials, which are not covered by applicable specifications, or which are not specifically described herein, shall be subjected to the approval of the procuring activity.

3.2.1 Paper - The fiber paper shall be composed of an aromatic polyamide polymer (nylon) in the form of short fibers (floc), bonded together with small fibrous binder particles (fibrids) of the same material, and shall contain no extraneous diluents. The paper shall not be perforated.

3.2.2 Resin - The resin system used to impregnate the paper, or for node bonding, shall be resistant to mildew and shall not be corrosive to metals. Node bonding shall be accomplished with the same resin used for impregnation, or with a compatible resin adhesive.

3.3 Configuration - The core material shall consist of thin nylon paper base sheets bonded together to form cells approximately hexagonal in shape. (See Figure 1.)

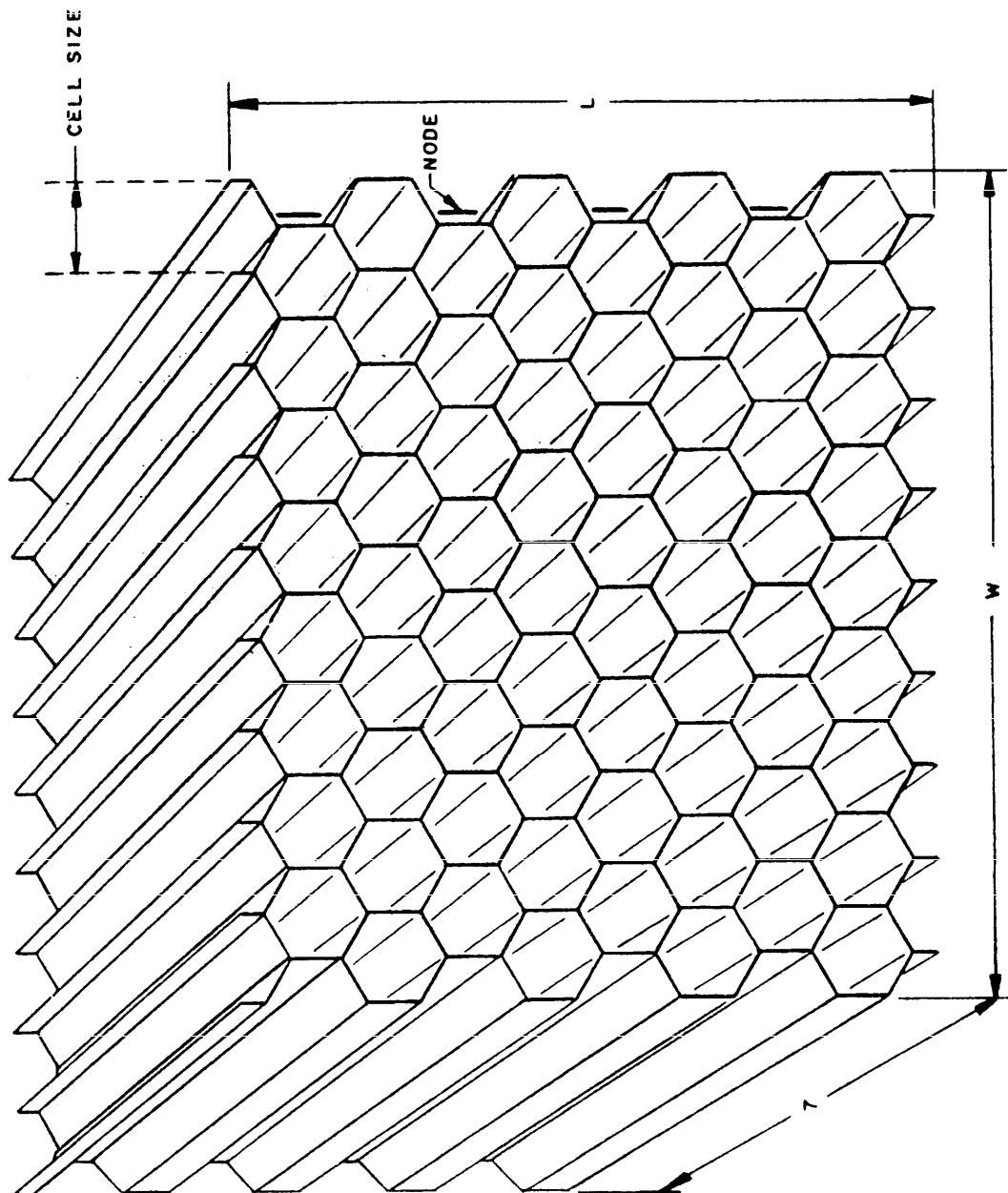
3.4 Sizes - The material shall be furnished in blocks or slices, as specified by the procuring activity. The dimensions and dimensional tolerances for the blocks or slices shall be as specified by the procuring activity.

3.5 Cure - The honeycomb core material shall be fully cured. When specified, the material may be furnished in a partially cured state to afford better conformability when used in curved sections. In this case the material shall be fully cured in accordance with the manufacturer's instructions prior to testing.

3.6 Bond or slicing test - The node bonds of the honeycomb core material shall be sufficiently strong so as to meet the requirements specified herein when machined in accordance with manufacturer's recommendations.

3.7 Cell wall edges - The honeycomb cell wall edges on the faces of the sliced core shall be in a condition as specified by the procuring activity, suitable for forming a good bond, as when wet-laminated to glass fabric base plastic laminate.

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3.8 Core properties - The nominal cell size, density, compressive properties of the core in the direction of the cells (parallel to the T direction, as illustrated in Figure 1), and the shear properties (associated with distortion in the TW and TL planes), shall conform to the requirements of Table I.

3.8.1 Mechanical properties at elevated temperature - Core material shall retain a minimum of 70 percent of the minimum values in Table I when tested at $350 \pm 10^\circ\text{F}$.

3.8.2 Wet strength - Compressive strength of the core in wet condition shall be no less than 90 percent of the minimum values in Table I.

3.9 Electrical properties - The dielectric constant of the core material shall not exceed 1.5. The material shall be conditioned at room temperature for 48 hours at 50 ± 2 percent relative humidity before testing.

3.10 Density - The density of core shall be as specified in Table I. The manufacturer shall specify the nominal density of his core and shall control this density to ± 10 percent by weight in production.

3.11 Workmanship -

3.11.1 The core materials shall be uniform, free from excess resin accumulations, starved areas, tackiness, blisters, foreign materials, and other defects, such as nested cells, split or buckled cell wall and unbonded nodes, except as specifically permitted herein.

3.11.2 Defects - No more than two flaws per square foot of slice shall be permitted per unit of core material. For the purpose of this specification flaws shall be defined as misalignments and flute bond defects. A misalignment shall be defined as the partial imposition of one corrugation into another, and a defective flute bond is a bond having less than 75 percent of available width bonded. No more than one cell wall break per square foot of slice shall be permitted.

3.12 Identification of product - Each unit of core material shall be suitably identified with the following information:

Manufacturer's Name or Trademark

Order Number and Lot Number

Specification Number

Density and Cell Size

State whether the material is fully or partially cured.

And manufacturer's directions for cure if the material is partially cured

Resins, both impregnating and bonding

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TABLE I
PROPERTIES OF CORE MATERIALS 1/

Core		Compressive strength psi <u>2/</u>	Plate shear			
			"L" Direction		"W" Direction	
			Strength psi	Modulus ksi	Strength psi	Modulus ksi
Cell size ± 10%	Density lbs./cu.ft. ± 10%	Minimum for single specimen	Minimum for single specimen	Minimum for single specimen	Minimum for single specimen	Minimum for single specimen
1/8	3.0	243	162	5.7	85	3.1
1/8	3.5	324	171	5.8	90	3.2
1/8	4.0	423	225	7.8	112	4.2
3/16	2.0	95	72	2.2	36	1.8
3/16	3.0	243	135	4.5	67	2.5
3/16	3.5	324	166	5.8	79	3.1
3/16	4.0	423	225	7.8	112	4.2
1/4	1.5	50	45	1.8	22	1.3
1/4	2.0	95	72	2.2	36	1.8
3/8	1.5	50	45	1.8	22	1.3
3/8	2.0	95	72	2.2	36	1.8

1/ The values in Table I are for procurement only and are not to be used for design values.

2/ Compressive strength specimens shall be stabilized before test as recommended in MIL-STD-401.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests - The inspection and testing of plastic core material for sandwich construction shall be classified as follows:

(a) Preproduction tests

(b) Quality conformance tests

4.3 Test conditions - The laboratory testing conditions shall be in accordance with MIL-STD-401 and as described herein.

4.4 Preproduction tests -

4.4.1 Sampling for preproduction inspection - Except as specified in 4.4.2, as soon as possible after the award of contract, the contractor shall submit to a testing activity designated by the procuring activity the preproduction samples of core material. Whether or not a preproduction sample is required, the contractor shall supply a certified statement of composition and prior tests which show the core material complies with the requirements of this specification. The statement shall also include the manufacturer's trade name and code number for material, the bonding material used to produce the core material and a general description of the processes for the fabrication of the submitted samples. Process and non-proprietary control data information pertinent to the adhesive bonding of the core material for its manufacture shall also be furnished.

4.4.1.1 Test samples - The preproduction samples shall consist of at least 28 square feet of the core material cut to a thickness of 0.5 inch.

4.4.1.2 Further production - Further production of the core material for sandwich construction by the contractor prior to the approval of the procuring activity or completion of inspection of the preproduction sample shall be at the contractor's risk.

4.4.2 Preproduction sample and inspection for a subsequent contract - If a contractor has previously delivered core material for sandwich construction in accordance with the requirements of this specification and

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his product has been found to be satisfactory, the requirements for a pre-production sample and its submittal in accordance with 4.4.1 for any subsequent contract or order may be waived at the discretion of the procuring activity (see 6.2).

4.4.3 Preproduction testing of the core material for sandwich construction shall consist of all examinations and tests of this specification. The responsibility for the performance of the preproduction testing shall be as specified in the contract or order (see 3.1 and 6.2).

4.5 Quality conformance tests -

4.5.1 Lot - Unless otherwise specified in the contract or order, a lot shall consist of not more than 100 cubic feet of core material for sandwich construction of the same designated cell size dimension, density and core configuration design, manufactured under essentially the same conditions and submitted for acceptance at the same time.

4.5.2 Sampling - Unless otherwise specified in the contract, purchase order or drawing information, sampling plans and procedures in the determination of the acceptability of products submitted by a supplier shall be in accordance with the provisions set forth in MIL-STD-105.

4.5.2.1 Visual and dimensional examination - A random sample of core material shall be selected from each lot in accordance with procedures of MIL-STD-105, Inspection Level II, Acceptable Quality Level 2.5 percent defective for test of 4.5.3.

4.5.2.2 Physical and mechanical properties - A random sample shall be selected from each lot sufficient to conduct the tests of 4.6.1, 4.6.2, 4.6.3 and 4.6.4. Samples used for the core density test may be used for the determination of cell size and the strength tests.

4.5.3 Examination - The sample core material selected in accordance with 4.5.2.1 shall be visually and dimensionally examined to determine compliance with the requirements of this specification for configuration (see 3.3), non-perforation (see 3.2.1), node bonds (see 3.2.2), cell wall edges (see 3.7), size (see 3.4), bond defects and workmanship (see 3.11).

4.5.4 Preservation, packaging, packing and marking - The preservation, packaging, packing and marking of items furnished under this specification shall be in accordance with the applicable requirements of Section 5.

4.5.5 Inspection of material - The materials (see 3.2) used in the manufacture of the core material furnished under this specification shall be inspected and accepted as specified herein. The contractor shall furnish certification that the above requirements have been met.

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4.6 Test methods -

4.6.1 Core density - The density of the core shall be determined in accordance with MIL-STD-401.

4.6.2 Cell size -

4.6.2.1 Specimens - The test specimens may be any convenient size or shape of the core material that can be accurately measured from blocks or slices.

4.6.2.2 Procedure - The distance between flats for ten cells in a row in the transverse direction shall be measured to the nearest 0.01 inch. The nominal cell size shall be taken as a tenth of the measured distance.

4.6.3 Core flatwise compressive strength - Compressive strength of core shall be determined in accordance with MIL-STD-401 using stabilized specimens. Five specimens, 3 by 3 by 1/2 inches, with the 1/2 inch dimension in the "T" direction, shall be prepared and tested (see Figure 1).

4.6.3.1 Core flatwise compressive strength in wet condition - Five specimens prepared as in 4.6.3 shall be immersed in water at room temperature, $73.5 \pm 2^\circ\text{F}$, for 24 hours. Remove the specimens and test immediately as in 4.6.3.

4.6.3.2 Core flatwise compressive strength at elevated temperature - Five stabilized specimens, prepared in accordance with MIL-STD-401, shall be heated at $350 \pm 10^\circ\text{F}$ for 1/2 hour and tested as in 4.6.3 at this temperature.

4.6.4 Core shear strength and core shear modulus - Plate shear strength and modulus of rigidity shall be determined in accordance with MIL-STD-401. Five honeycomb specimens in both TL and TW directions shall be prepared and tested at room temperature ($73.5 \pm 2^\circ\text{F}$) and the results averaged for each direction. The modulus of rigidity shall be obtained by computing the slope of the initial straight line portion of the stress-strain curve.

4.6.4.1 Core shear at elevated temperature - Five specimens in each direction, prepared in accordance with MIL-STD-401, shall be heated at $350 \pm 10^\circ\text{F}$ for 1/2 hour and tested as in 4.6.4 at this temperature.

4.6.5 Electrical test - Dielectric constant of the core shall be determined in accordance with paragraph 3.2.3 of ATC Report No. ARTC-4 and panels shall be as specified therein. The "W" dimension shall be parallel with the ground plane for one determination and a second determination shall be made with the "L" dimension parallel with the ground plane. The dielectric constant, recorded to the nearest one hundredth, shall be the average of the two readings.

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4.7 Rejection - When any specimen fails to meet the minimum mechanical value for single specimens (Table I), the lot shall be rejected. When core material fails to meet other requirements specified herein, the lot shall be rejected.

5. PREPARATION FOR DELIVERY

5.1 Levels of packaging and packing -

5.1.1 Level A - The core material shall be packaged in accordance with Method III of MIL-P-116 in unit quantities as specified by the procuring activity. For more than one core piece per container, the layers of core material shall be interleaved with 200-pound test double-faced corrugated fiberboard conforming to PPP-B-636. The material shall be packed in overseas exterior-type shipping containers conforming to PPP-B-585, PPP-B-591, or PPP-B-636. As far as practical, exterior containers shall be of uniform shape and size, be of minimum volume and tare consistent with the protection required, and shall contain identical quantities. Containers shall be closed and strapped in accordance with the applicable container specification.

5.1.2 Level B - The core material shall be packaged and packed as indicated in 5.1.1 except that containers shall be domestic-type exterior shipping containers indicated in the applicable container specification and need not be strapped.

5.1.3 Level C - Core material shall be packed in containers of the type, size, and kind commonly used for the purpose, in a manner that will insure acceptance by common carrier for safe delivery to destination. Shipping containers shall comply with the established rules or regulations of common carriers which are applicable to the mode of transportation employed.

5.2 Marking - In addition to any special marking required by the contract, or order (see 6.2), interior and exterior containers shall be marked in accordance with requirements of MIL-STD-129.

5.2.1 Container markings shall include the resins used for both impregnating and bonding.

6. NOTES

6.1 Intended use - The core material may be used for aircraft radar antenna housings as well as for general aircraft structural parts and other applications. The material may be used for applications where temperature will not exceed 350°F.

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6.2 Ordering data - Government procurement documents should always specify the following information:

- (a) The title, number, and date of this specification.
- (b) Whether blocks or slices are desired.
- (c) Cell size and density.
- (d) The three dimensions of the core material and tolerances.
- (e) The quantity of core material.
- (f) Fully cured.
- (g) Level of packaging and packing (see 5.1).
- (h) Special markings (see 5.2).
- (i) Preproduction sampling (see 3.1 and 4.4).

Preparing activity:
Navy - AS
(Project No. 5680-N017)

☆U.S. GOVERNMENT PRINTING OFFICE: 1975-403-114/3670

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL		CMB Approval No. 22-R255
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