

MIL-H-2104OC  
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SUPERSEDING  
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15 April 1971

## MILITARY SPECIFICATION

### HONEYCOMB MATERIALS, WATER MIGRATION RESISTANT TYPE, STRUCTURAL, PAPER BASE

This Specification is mandatory for use by all  
Departments and Agencies of the Department of  
Defense.

#### 1. SCOPE

1.1 Scope. This specification covers fully cured, resin-treated, kraft paper, water migration resistant type honeycomb materials for structural applications.

#### 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.

#### STANDARDS

##### Military

MIL-STD-129	Marking for Shipping and Storage
MIL-STD-401	Sandwich Construction and Core Materials:
	General Test Methods
MIL-STD-810	Environmental Test Methods

(Copies of specifications and standards 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 documents form 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.

#### OFFICIAL CLASSIFICATION COMMITTEE

##### Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, 516 W. Jackson Blvd., Chicago, IL 60606.)

FSC 5680

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NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT

National Motor Freight Classification Rules

(Application for copies should be addressed to the American Trucking Association, Inc., 1616 P Street, NW, Washington, DC 20036.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS

- \* C-366 Measurement of Thickness of Sandwich Cores
- C-481 Laboratory Aging of Sandwich Materials

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY

TAPPI Test Method T435-SU-68

(Application for copies should be addressed to the Technical Association of the Pulp and Paper Industry, 360 Lexington Ave., New York, NY 10017.)

### 3. REQUIREMENTS

3.1 Preproduction testing. This specification makes provision for pre-production testing.

3.2 Material. Material shall be as specified herein. When materials that are not specifically designated are used, such materials shall be subject to the approval of the contracting officer.

3.2.1 Base paper. The base paper for the core materials shall be 100 percent virgin softwood draft fiber. It shall be the responsibility of the supplier to determine the resin formulations, impregnation process, or other techniques necessary to meet the water migration requirements of this specification.

3.3 Configuration. The honeycomb material shall consist of the base paper, impregnated, and suitably bonded together so that, in its final expanded form, a reasonably uniform cellular structure is developed.

3.4 Dimensions. The dimensions of the honeycomb material sheets shall be as specified (see 6.1). Dimensional tolerances shall be as specified in 3.8.

3.5 Bond. The adhesive bonds shall be uniformly applied over the entire thickness and fully cured. There shall not be more than 1 unbonded glue line within any 10 inch square area of the honeycomb material.

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- \* 3.6 Fungus resistance. Compressive strength of the honeycomb material after exposure to fungus conditions shall meet or exceed the requirements of figure 3 (see 4.5.4).

3.7 Honeycomb material properties. The honeycomb material properties, for procurement purposes, shall be in accordance with figures I, II, and III. Design values for the paper honeycomb cores of sandwich panel material should be obtained from specimens and test procedures closely simulating actual conditions as to loading, facing and core thickness, facing material and ambient moisture and temperature.

3.8 Chemical neutrality. The honeycomb material shall be chemically neutral (PH  $7.0 \pm 0.1$ ) as determined by TAPPI Method T435-SU-68 for pulp and paper products.

- \* 3.9 Tolerances. Unless otherwise specified (see 6.1) the following tolerances shall apply:

Dimensions	Tolerance (inches)	
	plus	minus
Width (W)	2.0	0.0
Length (L)	1.0	0.0
Thickness (T)	0.010	0.010

The cell size shall not vary more than 0.08 inches from the nominal within any one lot.

3.10 Identification of product. Each package of honeycomb material shall be identified with the following information upon an oil proof tag or stenciled on each shipping container:

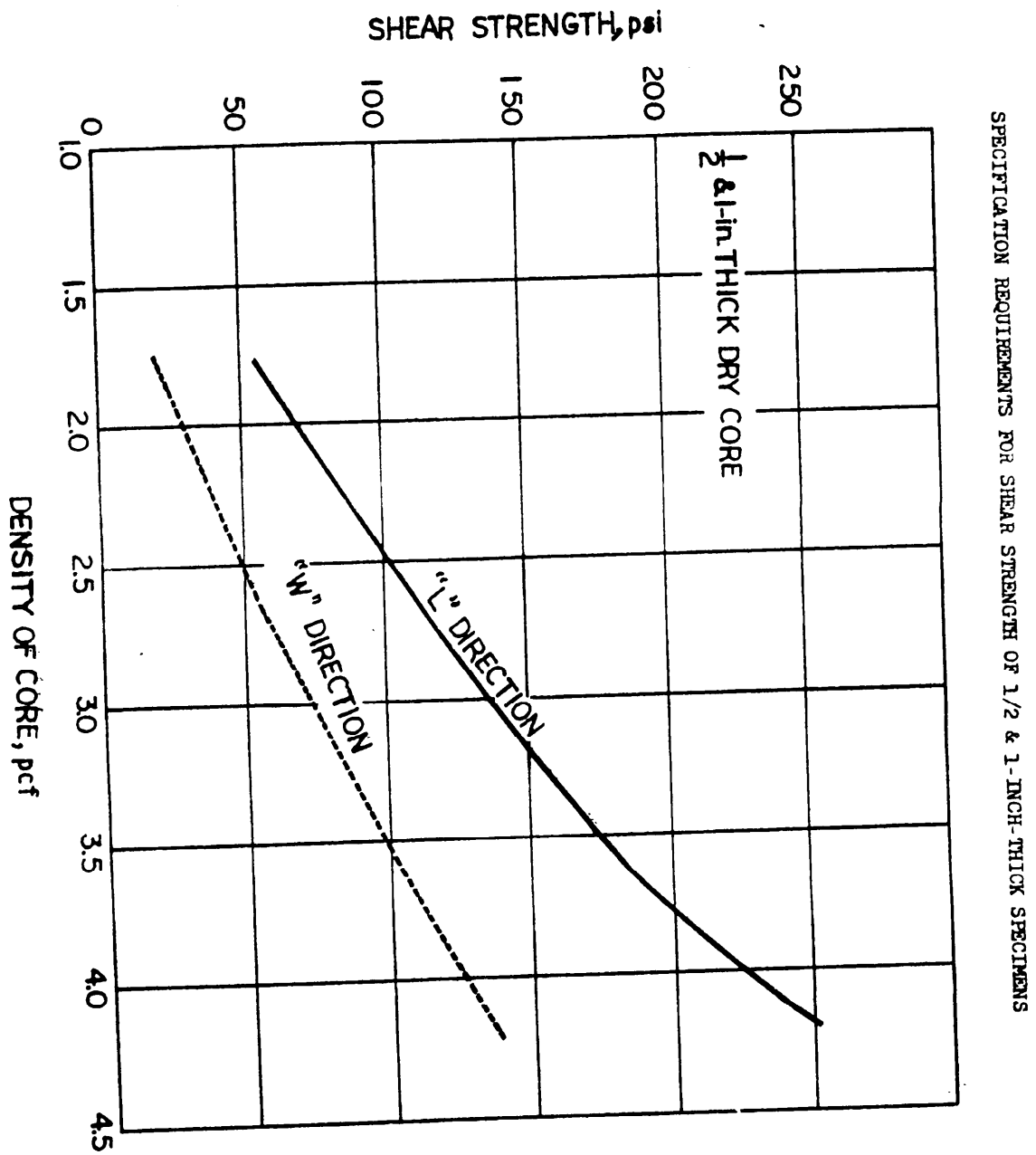
Manufacturer's name and trademark  
This Specification Number  
Type  
Density  
Size  
Date of production

3.11 Workmanship. The honeycomb material shall be uniform within the specified tolerances (see 3.8) and free from excess resin accumulations, starved areas and foreign materials. The cell wall edges of the core shall be clean cut with no high or low spots, no broken edges, etc., so as to be suitable for bonding to the sandwich facings.

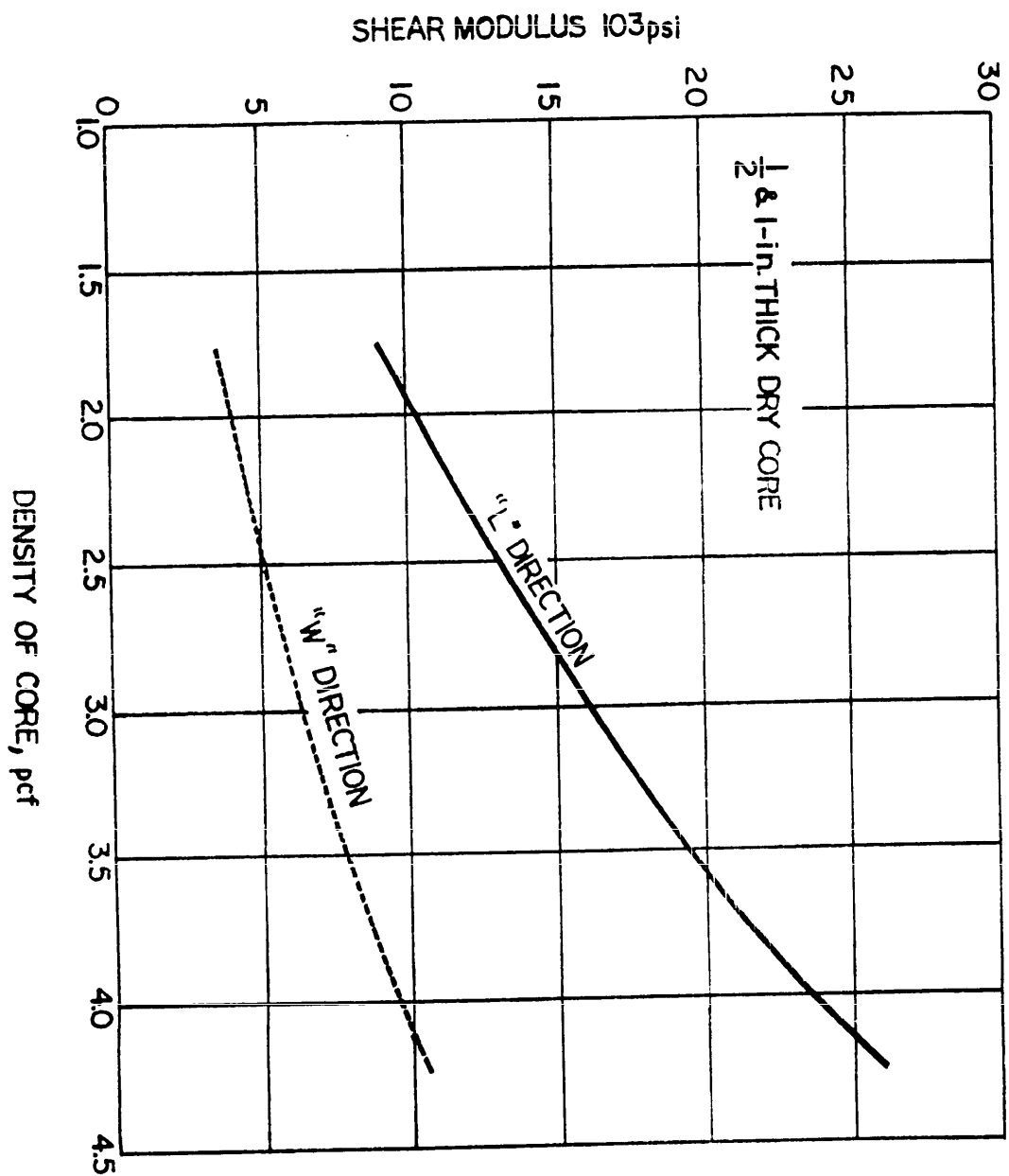
- \* 3.12 Density. The density of the honeycomb material shall be within 10% plus or minus of that specified in the contract or purchase order (see 6.1).

#### 4. QUALITY ASSURANCE PROVISIONS

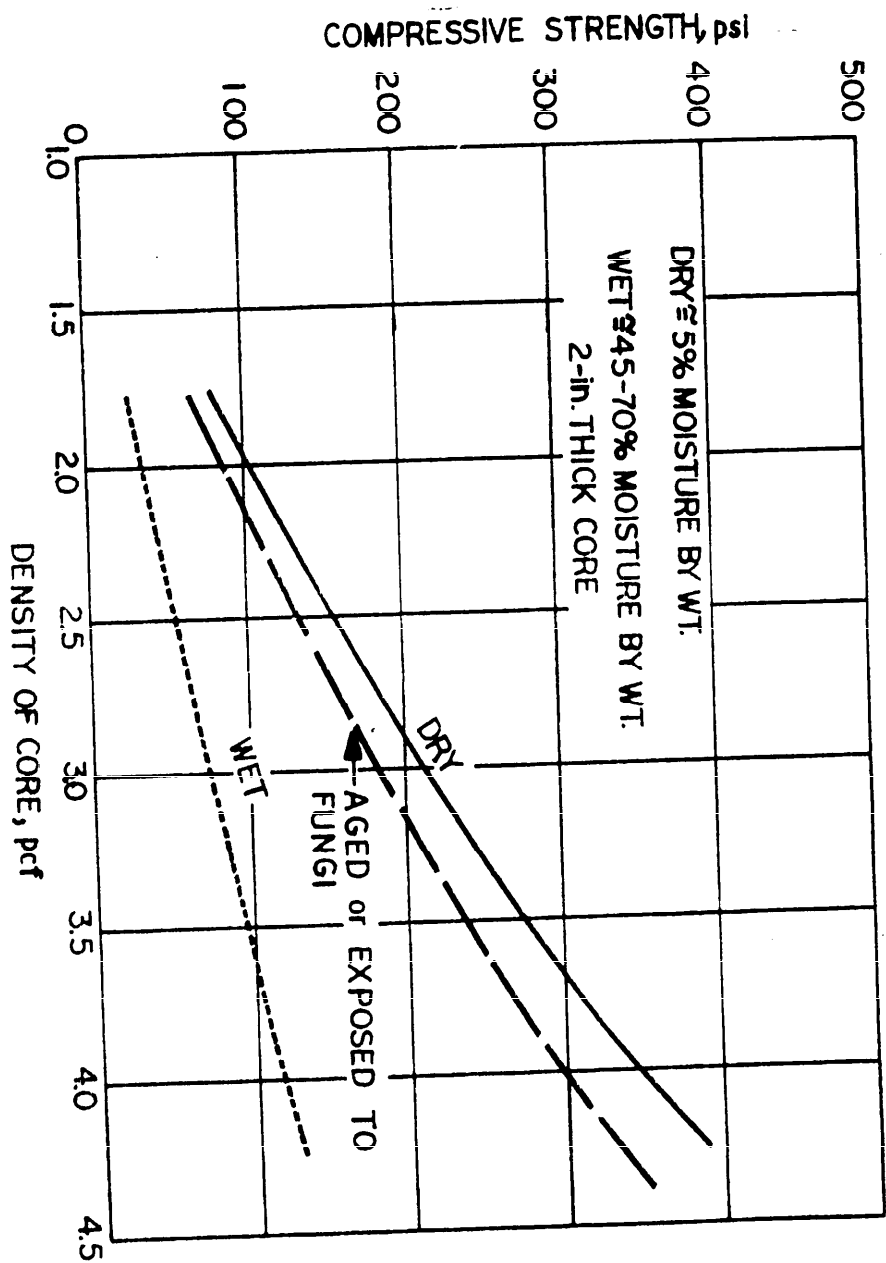
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DENSITY VS COMPRESSION STRENGTH  
FIGURE 3  
SPECIFICATION REQUIREMENTS COMPRESSION STRENGTH OF 2-INCH THICK SPECIMENS

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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 specified herein. Except as otherwise specified in the contract or purchase order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein unless disapproved by 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. Tests shall be classified as preproduction see (4.4) and (4.5) and quality conformance see (4.6).

4.3 Test conditions. Unless otherwise specified, all tests required by this specification shall be made at ambient temperature and humidity conditions.

4.4 Preproduction tests.

4.4.1 Sampling for preproduction tests.

4.4.1.1 Inspection lot. All honeycomb material of the same density produced on consecutive days shall be considered a lot for inspection purposes.

4.4.1.2 Test samples. Sample sheets for preproduction tests shall be taken from the first ten blocks of the first lot manufactured. A block is defined as a production item before slicing.

4.4.2 Visual and dimensional examinations.

4.4.2.1 Visual examination. Each of the honeycomb sheets selected in accordance with 4.4.1.2 shall be given a visual examination to determine conformance with this specification.

4.4.2.2 Dimensional examination. Length and width dimensions of each sheet of honeycomb material selected for examination shall be measured with a suitable scale to the nearest 0.10 inch. Thickness shall be measured in accordance with ASTM C-366 Method B.

4.4.3 Tests. Specimens cut from each of the samples selected in accordance with 4.2.3 shall be subjected to each of the applicable tests specified in 4.5. Failure to meet the requirements of any test shall be cause for rejection of the lot represented by the samples.

4.5 Test procedures.

4.5.1 Honeycomb material density. The honeycomb material density shall be determined in accordance with the core density and specific gravity method of MIL-STD-401 from two randomly selected specimens from each sample sheet. These specimens shall be conditioned for at least 48 hours in an atmosphere of  $50 \pm 2$  percent humidity at  $73^\circ \pm 2^\circ$  F. The individual values and average value of density shall be reported for each lot of honeycomb material. Specimens shall be at least two square feet in area and shall not contain splices or splice material.

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**4.5.2 Water migration test.** At least two specimens from each sample sheet shall be conditioned in accordance with 4.5.1. The water migration properties of this honeycomb material shall then be determined in accordance with the "Core Water Migration" Method of MIL-STD-401. The individual values and the average values shall be recorded and shall not exceed one cell filled in 24 hours.

**4.5.3 Honeycomb shear test.** At least four specimens 12" X 4" X 1" thick from each sample sheet shall be conditioned in accordance with 4.5.1. The honeycomb shear strength and shear modulus of these specimens shall then be determined in accordance with the "Core Shear" Method of MIL-STD-401. At least two specimens shall be tested in the T L plane and at least two specimens shall be tested in the T W plane. The individual values and the average values of shear modulus and shear strength for each plane shall be reported. Not more than one specimen or 10 percent of all specimens (whichever is greater) tested for each plane shall have strengths below the values shown by the curves of figure I.

**4.5.4 Fungus resistance test.** Specimens of bare core material 4 inches by 4 inches by 2 inches thick (T dimension) shall be aged in accordance with the Fungus Resistance Test of MIL-STD-810, Method 508, for 28 days at 30° C using a mixture of 5 of the organisms. After aging, the specimens shall be conditioned at test conditions (73° ±2° F and 50 ±5 percent relative humidity) for 16 hours prior to testing in accordance with 4.5.5 below (see 3.5).

**4.5.5 Core compression tests.** At least six specimens 4 inches by 4 inches by 2 inches thick shall be conditioned in accordance with 4.4.1. The flatwise compressive strength of these specimens shall be determined in accordance with the Core Compression Method of MIL-STD-401. At least two specimens shall be tested in the dry condition (73° ±2° F), at least two specimens shall be tested after soaking in water at 73° ±2° F for 48 hours, and at least two specimens of each sample shall be tested after being aged in accordance with ASTM C-481, cycle A. The individual values and the average values for "dry" and wet compressive strengths shall be reported for each lot of honeycomb material. No more than one specimen or 10% of all specimens (whichever is greater) shall be below the values shown by the applicable curve of figure 3.

#### **4.6 Quality conformance inspection.**

**4.6.1 Visual and dimensional tests.** The visual and dimensional tests of (4.4.2.1) and (4.4.2.2) shall be performed on each honeycomb production blocks to determine compliance with this specification.

**4.6.2 Mechanical tests.** A 0.500 thick sample from each tenth production block shall be tested in accordance with (4.5.1) density, (4.5.2) water migration and (4.5.5) wet and dry compression to determine compliance with this specification.

### **5. PREPARATION FOR DELIVERY**

#### **5.1 Preservation and packaging.**

**5.1.1 Level C.** Honeycomb material shall be preserved and packaged in accordance with the manufacturer's commercial practice.



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## 5.2 Packing.

5.2.1 Level C. Honeycomb material packaged in accordance with 5.1.1 shall be packed in containers in a manner to insure safe delivery and acceptance at destination. Containers shall comply with Uniform Freight Classification Rules or National Motor Freight Classification Rules whichever is applicable.

5.3 Marking. In addition to any special marking specified in the contract, each unit and intermediate package and shipping container shall be marked in accordance with para 3.7 and MIL-STD-129.

## 6. NOTES

6.1 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Density required (see 3.11).
- c. Dimensions (see 3.3).

6.2 The margins of this specification are marked with an asterisk (\*) to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

### Custodians:

Navy - EC  
Air Force - 84

### Preparing Activity:

Air Force - 84

### Review Activity:

Air Force - 17

### Project Number:

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### Other interests:

Department of Agriculture - Forest Products Laboratory  
Department of Commerce - National Bureau of Standards



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