

MIL-C-83400A  
19 August 1980  
SUPERSEDING  
MIL-C-83400 (USAF)  
29 November 1972

## MILITARY SPECIFICATION

### CORE MATERIAL FOR METAL SANDWICH PANELS FOR SHELTER CONSTRUCTION (POLYURETHANE FOAM)

This specification is approved for use by all  
Department and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers rigid, cellular urethane, thermal insulation core material for metal sandwich panels to be used in shelter construction.

1.2 Classification. Cellular urethane insulation shall be of the following types:

Type I - Nominal density of 2.0 pounds per cubic foot  
(32 kilograms per cubic meter ( $\text{Kg/m}^3$ )).

Type II - Nominal density of 4.0 pounds per cubic foot  
(64  $\text{Kg/m}^3$ ).

#### 2. APPLICABLE DOCUMENTS

2.1 Issues of documents. 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-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to the Aeronautical Standards Division, ENSS, WPAFB, Ohio 45433 by using the self-addressed Standardization Document (DD Form 1426) appearing at the end of this document or by letter.

FSC 5410

**MIL-C-83400A**

(Copies of specifications, standards, drawings and publications required by contractors 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.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

- ASTM C177** - Method of Test for Thermal Conductivity of Materials by Means of the Guarded Hot Plate
- ASTM C203** - Method of Test for Breaking Load and Calculated Thermal Strength of Preformed Block-Type Thermal Insulation
- ASTM C273** - Method of Shear Test in Flatwise Plane of Flat Sandwich Constructions or Sandwich Cores
- ASTM C366** - Method of Measurement of Thickness of Sandwich Cores
- ASTM D1621** - Method of Test for Compressive Strength of Rigid Cellular Plastics
- ASTM D1622** - Method of Test for Apparent Density of Rigid Cellular Plastics
- ASTM D1623** - Method of Test for Tensile Properties of Rigid Cellular Plastics
- ASTM D2126** - Method of Test for Resistance of Rigid Cellular Plastics to Simulated Service Conditions
- ASTM D2842** - Method of Test for Water Absorption of Rigid Cellular Plastics

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

**FEDERAL AIR REGULATION (FAR)**

**FAR 25.853**      **Compartment Interior**

(Application for copies should be addressed to the Flight Standards Service, Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591.)

MIL-C-83400A

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

### 3. REQUIREMENTS

**3.1 Material.** The rigid, cellular urethane, thermal insulation covered by this specification shall be composed of poly-isocyanates reacted with polyhydroxy compounds (polyether only), expanded with a suitable blowing agent.

**3.2 Construction.** The construction of the insulation shall consist of a multitude of individual cells of uniform size and dimensions, a large majority of which are closed off from the other, homogeneous throughout, free of large voids, accumulations of unexpanded material, foreign inclusions, contaminants or seams, and shall be free of any material that accelerates aging and deterioration or contributes to the formation of toxic gases or objectionable odors.

**3.3 Dimensions and tolerances.** Dimensions shall be specified by the procuring activity. Dimensional tolerances shall conform to the following. (See 4.4.)

Length:	$\pm 1/16$ inch per foot (in/ft) (5.2 millimeters/meter (mm/m) and total of $\pm \frac{1}{4}$ inch (6.35 mm).
Width:	$\pm 1/16$ in/ft (5.2mm/meter) and total of $\pm 1/8$ inch (3.18mm)
Thickness:	$\pm 1/32$ inch (0.79mm) up to 2 inches (51mm) $\pm 1/16$ inch (1.59mm) greater than 2 inches (51mm)

**3.4 Edges.** Edges shall be square (90  $\pm 2.0$  degrees).

**3.4 Physical properties.** The insulation shall conform to the mechanical and thermal properties prescribed in Table 1.

**3.6 Hydrolytic stability.** After aging, the change in ultimate compressive strength shall not exceed 20 percent.

MIL-C-83400A

TABLE 1. Mechanical and thermal properties.

REQUIREMENT	TYPE I	TYPE II	PROCEDURE
Density lb/ft <sup>3</sup> (Kg/m <sup>3</sup> )	2 (3.2) $\pm 1\%$	4 (6.4) $\pm 1\%$	4.5.1
Thermal conductivity BTU in/hr sq ft F	0.2 max $\frac{1}{2}$	0.2 max	4.5.2
Compressive strength at 10% deformation or at yield point in thickness direction psi (Kg/cm <sup>2</sup> )	25 min (1.73) 35 min (2.42) 25 min (1.73) 15 min (1.04) 0.08 max (0.38)	65 min (4.48) 75 min (5.19) 40 min (2.76) 20 min (1.38) 0.08 max (0.38)	4.5.3 4.5.4 4.5.5 4.5.6 4.5.7
Tensile strength psi (Kg/cm <sup>2</sup> )			
Shear strength psi (Kg/cm <sup>2</sup> )			
Flexural strength psi (Kg/cm <sup>2</sup> )			
Water absorption lb/ft (Kg/cm <sup>2</sup> )			
Dimensional stability			
Linear & change	$\pm 2.5, -0$ max	$\pm 2.0$ max	4.5.8
Volumetric & change	$\pm 5.5, -0$ max	$\pm 4.0$ max	4.5.9
Flame resistance	$\frac{2}{2}$	$\frac{2}{2}$	4.5.10
Hydrolytic stability	$\pm 10\%$	$\pm 10\%$	

1/ Parallel to rise direction.

2/ No sample shall burn past the gauge mark 5 inches (127mm) from the point of ignition.

MIL-C-83400A

4.2 First article inspection. A first article sample consisting of 5 square feet of the insulation material shall be submitted for first article inspection (see 4.6). The sample shall be representative of the material proposed to be furnished under the contract. First article inspection shall be conducted by the Government, at a place designated by the procuring activity, and shall consist of examination for the defects specified in Table I, and all tests specified herein.

4.2.1 Failure. Failure of a first article to pass any examination or test specified herein may be cause, at the option of the Government for refusal to conduct additional testing until the faults revealed by the test have been corrected.

4.3 Sampling. The sample size and levels of inspection shall be in accordance with MIL-STD-105.

4.3.1 Lot. Unless otherwise specified (6.2), a lot shall consist of all the insulation boards of the same type and size submitted for inspection at the same time.

4.3.2 Sampling for examination. Samples for quality conformance examination shall be selected in accordance with inspection level II of MIL-STD-105.

4.3.3 Sampling for testing. Samples for quality conformance testing shall be selected in accordance with inspection level S-3 of MIL-STD-105.

4.3.3.1 Reduced sampling. Reduced sampling may be instituted provided the conditions for reduced inspection specified in MIL-STD-105 have been met. Sampling for reduced inspection shall be in accordance with inspection level S-2 of MIL-STD-105.

4.4 Quality conformance examination. Samples selected in accordance with 4.3.2 shall be examined for the defects listed in Table II. The acceptable quality levels for major defects shall be 1.0 percent and for minor defects shall be 2.5 percent.

4.4.1 Thickness of boards. The thickness of insulation boards shall be determined according to ASTM C366.

4.4.2 Length and width. The length and width of boards shall be measured with a steel tape or rule graduated in 1/16 inch (1.59mm) increments.

## MIL-C-83400A

4.4.3 Square edges. Squareness of edges and corners shall be determined with a vernier adjusting square with minimum graduations of 1.0 degrees of arc.

4.4.4 Visual examination. Visual examination shall include scanning for surface defects and breaking at least 10 percent of the samples for examination for internal defects.

4.5 Quality conformance testing. Each sample selected in accordance with 4.3.3 shall be subjected to the tests specified below, using an AQL of 6.5 on the basis of percent defective.

4.5.1 Density. The density of the insulation board shall be determined in accordance with ASTM D1622.

TABLE 11. Classification of defects.

DEFECT	MAJOR	MINOR	METHOD OF INSPECTION
Length, width and thickness not within tolerances (3.3)	X		4.4.1, 4.4.2
Edges not square (3.4)	X		4.4.3
Holes through board exceeding 1/4 sq in for each sq ft of area	X		4.4.4
Crushing of not more than 10% of original thickness or not more than 25% of actual size of individual piece		X	4.4.4
Voids (3.2)		X	4.4.4
Unexpanded material (3.2)		X	4.4.4
Foreign inclusion (3.2)		X	4.4.4
Contaminants (3.2)		X	4.4.4
Seams (3.2)		X	4.4.4

## MIL-C-83400A

4.5.2 Thermal conductivity. The thermal conductivity (K factor) shall be determined in accordance with ASTM C177 at mean temperature of 0°F, 50°F, 100°F, and 150°F (-18°C, 10°C, 38°C, and 66°C) after conditioning for 12 days at 90°F (32°C) and 90 percent relative humidity. Thermal conductivity shall be determined and reported along each major area. The heat flow is to be measured parallel to the rise of the foam.

4.5.3 Compressive strength. The compressive strength shall be determined in accordance with ASTM D1621, Procedure A.

4.5.4 Tensile strength. The tensile strength shall be determined in accordance with ASTM D1623.

4.5.5 Shear strength. Shear strength shall be determined in accordance with ASTM C273.

4.5.6 Flexural strength. Flexural strength shall be determined in accordance with ASTM C203.

4.5.7 Water absorption. Water absorption shall be determined in accordance with ASTM D2842.

4.5.8 Dimensional stability. Dimensional stability shall be determined in accordance with ASTM D2126, Procedure F.

4.5.9 Flame resistance. Flame resistance shall be determined in accordance with FAR 25.853.

4.5.10 Hydrolytic stability. The test specimens shall be exposed for 28 days at 158°F + 1.8°F (70°C + 1°C), and 95 percent +5 percent relative humidity. After this exposure, the specimens (49°C + 1°C) shall be subjected to thirty minutes exposure at 120°F + 2°F, in a mechanically convected dry air oven and then to thirty minutes at ambient room conditions. The compressive strength shall be determined for conformance to 3.6.

4.6 Inspection of preparation for delivery. The preservation, packaging, packing and marking of the insulation material shall be examined to determine compliance with the requirements of Section 5 of this specification.

## 5. PACKAGING

5.1 Preservation-packaging and packing. Cleaning, preservation, packaging, and packing shall be in accordance with the applicable packaging standard or packaging data sheet for the level of protection specified (6.2).

## MIL-C-83400A

5.2 Marking. Except for special requirements (6.2), packages shall be marked in accordance with MIL-STD-129.

## 6. NOTES

6.1 Intended use. The material covered by this specification is intended for application as the insulating core material in metal faced sandwich construction panels at ambient temperatures from  $-25^{\circ}\text{F}$  to  $160^{\circ}\text{F}$  ( $-32^{\circ}\text{C}$  to  $71^{\circ}\text{C}$ ).

6.2 Design for thermal expansion. Painted surfaces of shelters in actual field use reach temperatures of  $200^{\circ}\text{F}$  ( $93^{\circ}\text{C}$ ). Fabricators of shelters using foam core sandwich shall design for the linear and volumetric expansion that will take place.

6.3 Ordering data. Procurement documents should specify the following:

- a. Title, number, and date of this specification.
- b. Dimensions and tolerances (3.3).
- c. Location for examination of first article (4.2).
- d. Lot size (4.3.1).
- e. Applicable packaging standard or packaging data sheet (5.1).
- f. Applicable level of material protection (5.1).
- g. Any special marking requirements (5.2).

Custodians:  
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Navy - YD

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(Project Number: 5410-0232)



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