MIL-I-0016411B(SHIPS)
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MILITARY SPECIFICATION

INSULATION FELT, THERMAL, GLASS FIBER

(FOR TEMPERATURES UP TO 1,200°F.)

This limited coordination Military specification has been prepared by the Bureau of Ships based upon currently available technical information, but it has not been approved for promulgation as a revision of Military Specification MIL-I-16411A. It is subject to modification. However, pending its promulgation as a coordinated Military specification, it may be used in procurement.

1. SCOPE

1.1 This specification covers glass fiber insulation felt for thermal control of machinery and equipment such as steam turbines, boilers, and boiler feed pumps, at temperature up to 1,200°F.

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

SS-C-466 - Cloth, Thread, and Tape-Asbestos.
PPP-B-585 - Boxes, Wood, Wirebound.
PPP-B-601 - Boxes, Wood, Cleated-Plywood.
PPP-B-621 - Boxes, Wood, Nailed and Lock Corner.

MILITARY

MIL-P-116 - Preservation, Methods of.

STANDARDS

MILITARY

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

(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 shall apply.

AMERICAN SOCIETY FOR TESTING MATERIALS

ASTM Method C-177 - Thermal Conductivity of Materials by Means of the Guarded Hotplate, Method of Test for.

(Application for copies should be addressed to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.)

FSC 5640

OFFICIAL CLASSIFICATION COMMITTEE
Uniform Freight Classification Rules.

(Application for copies should be addressed to Official Classification Committee, 1 Park Avenue at 33rd Street, New York 16, N. Y.)

3. REQUIREMENTS

3.1 Material and construction. - The material shall consist of staple glass fibers felted into rovings and woven or bound with wire-inserted asbestos thread conforming to type III of Specification SS-C-466 to form a flexible blanket.

3.2 Dimensions. -

3.2.1 Length. - Unless otherwise specified in the contract or order, the insulation shall be furnished in rolls 25 feet in length.

3.2.2 Width. - Unless otherwise specified in the contract or order, width of roll shall be 60 inches. A tolerance in width of plus one-half inch and minus one-fourth inch will be permitted.

3.3 Thicknesses and weights. - The insulation shall be furnished in the thicknesses shown in table I as specified (see 6.1), and shall vary not more than plus or minus 10 percent from the weight specified for the ordered thickness.

Table I - Thicknesses and weights.

Thickness	Thickness tolerance ±	Weight per square foot
Inches	Inch	Ounces
3/4	1/8	9.0
1	1/8	12.0
1-1/2	1/8	18.0

3.4 Fineness of fiber. - The diameter of the individual fibers shall average between 0.00030 and 0.00040 inch. The maximum diameter of any fiber shall be not more than 0.00050 inch (see 4.4.3).

3.5 Resistance to vibration. - There shall be no sagging or settling of the insulation when subjected to the vibration test for a period of 100 hours (see 4.4.4).

3.6 Alkalinity. - The alkalinity of the finished material expressed as sodium oxide (Na_2O) shall not exceed 0.20 percent (see 4.4.5).

3.7 Fusing temperature. - The fusing temperature of the fibers shall be not less than 1300°F. (see 4.4.6).

3.8 Stability. - The insulation shall reveal no physical changes upon completion of the stability tests specified in 4.4.7.

3.9 Thermal conductivity.- Thermal conductivity (k) in B.t.u. per hour per square foot of insulation for 1°F. gradient per inch thickness shall not exceed the values at the mean temperatures shown in table II (see 4.4.8).

Table II - Thermal conductivity.

Mean temperature	Thermal conductivity (k)
Degrees F.	
100	0.32
300	.45
500	.56
700	.70

3.10 Workmanship.- The workmanship shall be first class in every respect.

4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified herein the supplier is responsible for the performance of all inspection requirements prior to submission for Government inspection and acceptance. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order.

4.2 Sampling.-

4.2.1 Lot.- For purposes of sampling a lot shall consist of not more than 25,000 square feet of glass fiber insulation felt of the same thickness offered for delivery at one time.

4.2.2 Sampling for acceptance inspection.-

4.2.2.1 Sampling for examination.- A random sample of rolls shall be selected from each lot of material for the examination specified in 4.3.1, with lot acceptance based on table III in accordance with Standard MIL-STD-105.

Table III - Sampling for examination.

Number of rolls in inspection lot	Number of rolls in sample	Acceptance number (defectives)	Rejection number (defectives)
15 and under	5	0	1
16 to 40	7	0	1
41 to 65	10	0	1
66 to 110	15	1	2
Over 110	25	2	3

4.2.2.2 Sampling for tests.- From each lot the inspector shall select seven samples 12 by 60 inches at random for the tests specified in 4.3.2. Each specimen shall be taken from a different roll.

4.3 Inspection.-

4.3.1 Examination.- Each of the sample rolls selected in accordance with 4.2.2.1 shall be surface examined, weighed, and measured to determine conformance with the requirements of this specification which do not require tests. Any roll in the sample containing one or more visual or dimensional defects shall be rejected, and if the number of defective rolls in any sample exceeds the acceptance number for that sample, the lot represented by the sample shall be rejected. Rejected lots may be offered again for examination provided the contractor has removed all nonconforming rolls. The inspector shall again select and examine samples from such rejected lots to verify compliance with this specification.

4.3.2 Acceptance tests.- The samples selected in accordance with 4.2.2.2 shall be subjected to the tests specified in 4.4 to determine conformance with this specification except that the thermal conductivity test (see 4.4.8) shall be conducted only when specified (see 6.1).

4.3.2.1 Action in case of failure.- If any of the samples tested is found to be not in conformance with this specification, the lot which it represents shall be rejected. A rejected lot may be resubmitted for test after the manufacturer, having been informed of the reasons for rejection, has so reworked the entire lot as to remove or correct all nonconforming material.

4.4 Test procedures.-

4.4.1 Thickness.- The test specimen shall be ruled off into 10 approximately square and equal areas, and the thickness measurement taken at the center of each area. In determining the thicknesses, the test specimen shall be placed on a hard flat surface, and the penetrating pin of the depth gage shall be forced downward through the specimen, perpendicular to the flat surface as shown on figure 1. If necessary to prevent compression of the specimen by the depth-gage pin, the specimen shall first be pierced. When the point of the pin touches the flat surface, the sliding disk shall be lowered to the point of contact with the top surface of the specimen. The gage shall be withdrawn, and the distance from the point of the pin to the sliding disk shall be measured to the nearest 1/32-inch. The average of the 10 thickness measurements shall be taken as the thickness of the test specimen.

4.4.2 Weight.- Each sample shall be weighed on suitable scale to verify compliance with 3.3.

4.4.3 Fineness of fibers.- Diameter of fibers shall be determined microscopically on the basis of at least 7 checks on each of the samples. The average diameter for purposes of determining conformance with 3.4 shall be the average of all measurements on all samples; the maximum shall be the maximum diameter of any fiber thus measured.

4.4.4 Resistance to vibration.- The test for determining ability of the material to withstand vibration while subjected to a temperature of 1,200°F. shall be conducted on two 2-foot square, 2-inch thick sheets which shall be mounted on the faces of an electrical heater plate. The ends of the heater plate shall be insulated with cut sections of the material and the entire assembly shall be fitted and mounted within a 1/16-inch thick sheet-iron casing 30 by 30 by 6 inches. The casing shall be mounted in a vertical position on a vibration test apparatus. Five iron constantan thermocouples, equally spaced and secured in each face of the heater plate and the outer surfaces of the metal casing, shall afford a means of ascertaining the inner and the exposed temperature of the assembly. During the test the material shall be subjected to 720 vibrations per minute through an arc of 15 minutes for a period of 100 hours of operation. At the end of the 100-hour period of operation the outer metal casing of the assembly shall be removed and the condition of the sheets noted.

4.4.5 Alkalinity.- Weigh a 5 ± 0.01 gram representative sample of the felt, and introduce into a 500-milliliter pyrex Erlenmeyer flask. Wet with 5 milliliters of 95 percent ethyl alcohol, and add 400 milliliters of distilled water. Reflux for 4 hours ±5 minutes. At the end of this period, disconnect the condenser and filter at once through No. 41 Whatman paper supported in a Buechner funnel. Wash the flask and material three times with 25 milliliters portions of hot distilled water using suction. Titrate immediately with 0.02 NH_2SO_4, using 6 to 8 drops of 1 percent solution of phenol-red indicator, to the disappearance of the pink color. Run a blank determination on the same amount of distilled water and alcohol and correct for any alkalinity shown. The percentage alkalinity as Na_2O is calculated from the following formula: percent Na_2O = 0.0124 (mℓ. H_2SO_4 used by sample minus mℓ. H_2SO_4 used by blank).

4.4.6 Fusing temperature.- Weigh 1 gram of glass fiber into a crucible and place in a muffle furnace at room temperature. Turn all heating elements on at start of test and adjust so that the specified temperature of 1,300°F. is reached in 45 minutes. When this temperature is reached, remove crucible from furnace immediately, allow to cool, and examine visually for fusion. Fusion shall be said to have taken place if any part of the sample has melted and formed a homogeneous mass.

4.4.7 Stability.- Samples of felt 4 inches square shall be encased in a metal wire screen and placed on a rack above the water level in a steam digester. The samples shall be subjected to saturated steam at 225 pounds per square inch gage for 16 hours. Samples shall then be removed, examined, and conditions noted.

4.4.8 Thermal conductivity.- Thermal conductivity shall be determined in accordance with ASTM Method C-177.

4.5 Inspection of preparation for delivery.- Sample bales and shipping containers shall be selected and inspected in accordance with Specification MIL-P-116 to verify conformance to the requirements of section 5 herein.

5. PREPARATION FOR DELIVERY

5.1 Packaging.-

5.1.1 Level A.- Rolls shall be individually covered with standard 7-1/2 ounce (weight) burlap tubing with tubing drawn together at each end with wire ties.

5.1.2 Level C.- Rolls shall be individually packaged in accordance with the suppliers commercial practice.

5.2 Packing.-

5.2.1 Level A.- Rolls shall be packed in wood-cleated plywood, nailed wood or wirebound boxes conforming to Specification PPP-B-601 (overseas type), PPP-B-621 (class 2) or PPP-B-585 (class 3), respectively, at the option of the contractor. Boxes shall be closed and strapped in accordance with the applicable box specification or appendix thereto. The gross weight of containers shall not exceed 200 pounds.

5.2.2 Level B.- Rolls packaged as specified in 5.1.1 need not be overpacked for shipment. Alternatively, rolls may be packed in containers specified for level A (see 5.2.1) except containers shall be of the domestic type or class as applicable. Closure of boxes, when used as shipping containers, shall be as specified in the applicable box specification or appendix thereto.

5.2.3 Level C.- Rolls shall be prepared for shipment in a manner which will insure acceptance by common carrier and safe delivery at destination. Containers or method of shipment shall comply with the Uniform Freight Classification Rules or other carrier regulations as applicable to the mode of transportation.

5.3 Marking.- In addition to any special marking required by the contract or order, packages and shipping containers shall be marked in accordance with Standard MIL-STD-129.

6. NOTES

6.1 Ordering data.- Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Thickness of insulation required (see 3.3).
(c) When thermal conductivity tests should be conducted (see 4.3).
(d) Levels of packaging and packing required (see 5.1 and 5.2).

Notice.- When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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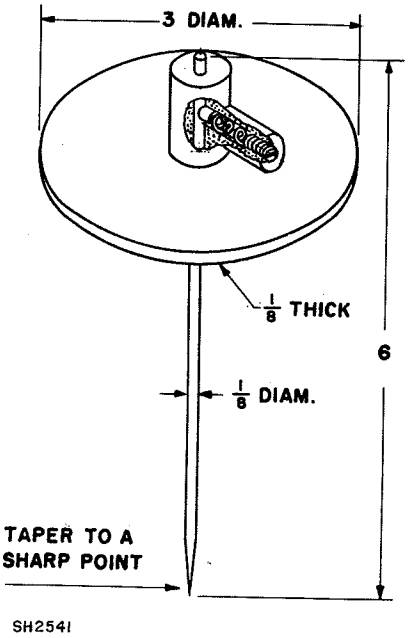

Figure 1 - Depth gage for thickness measurements.