

MIL-I-22344B  
6 August 1963  
SUPERSEDING  
MIL-I-22344A(SHIPS)  
21 March 1962

**MILITARY SPECIFICATION**  
**INSULATION, PIPE, THERMAL, FIBROUS GLASS**

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

**1. SCOPE**

1.1 This specification covers fibrous glass pipe insulation for use as thermal control on pipes, valves and fittings for temperatures up to 370° Fahrenheit (F.).

**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 the specification to the extent specified herein.

**SPECIFICATIONS**

**FEDERAL**

PPP-B-636 - Box, Fiberboard.

**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 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 Official Classification Committee, 1 Park Avenue at 33rd St., New York 16, N. Y.)

**AMERICAN SOCIETY FOR TESTING AND MATERIALS**

C302-56 - Density of Preformed Pipe Covering-Type Thermal Insulation, Tentative Method of Test for.

C335-54T - Thermal Conductivity of Pipe Insulation, Tentative Method of Test for.

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

(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.)

FSC 5640

H769

## MIL-I-22344B

## 3. REQUIREMENTS

3.1 Material.- The basic material shall be glass, processed from a molten state into fibrous form containing not more than 1.5 percent of nonfibrous material (shot) impregnated with a binder and compressed or otherwise formed into pipe, insulation (see 4.4.1).

3.1.1 Fiber diameter.- The average fiber diameter shall not exceed 0.00025 inch (see 4.4.2).

3.2 Dimensions and density.- The dimensions and density shall be as follows:

3.2.1 Length.- Insulation sections shall be furnished in lengths of 3 feet or 6 feet. Sections may be split in half lengthwise or slit lengthwise. A tolerance of plus or minus 3/16 inch in length will be permitted.

3.2.2 Sizes.- Insulation shall be furnished to fit standard pipe and tube sizes (see 6.2).

3.2.3 Thickness.- The insulation shall be furnished in nominal thicknesses of 1/2, 3/4, 1, 1-1/2 and 2 inches according to simplified standard sizes (see 6.2). A tolerance of plus or minus 3/32 inch in thickness will be permitted.

3.2.4 Density.- The insulation shall have a nominal density of 3.5 pounds per cubic foot. A tolerance of plus 1.00 or minus 0.50 pounds per cubic foot will be permitted, except in 1-1/2 inch pipe size by 1-inch in thickness and smaller, the density shall not exceed 6.50 pounds per cubic foot (see 4.4.3).

3.3 Alkalinity.- The alkalinity of the pipe insulation expressed as equivalent sodium oxide (Na<sub>2</sub>O) shall not exceed 0.60 percent and the pH shall be not less than 7.5 nor more than 12.0 (see 4.4.4).

3.4 Resistance to smoldering.- The pipe insulation shall not be smoldering at the expiration of the test specified in 4.4.5.

3.5 Fire resistance.- The insulation shall be rated as incombustible or fire retardant when tested as specified in 4.4.6.

3.6 Thermal conductivity.- The thermal conductivity (k) expressed as British thermal units (B.t.u.) per square foot per hour per °F. for a thickness of one inch shall not exceed the following values:

Mean temperature (°F.)	"k"
25	0.23
50	0.24
75	0.25
100	0.26
200	0.31

3.7 Workmanship.- The insulation shall have no visual defects that would adversely affect its serviceability.

## 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 Sampling.-

4.2.1 Lot.- For purposes of sampling, a lot shall consist of all pipe insulation of the same inner diameter and thickness produced under essentially the same conditions.

MIL-I-22344B

#### 4.2.2 Sampling for quality conformance inspection.-

4.2.2.1 Sampling for visual and dimensional examination.- A random sample of pipe insulation sections shall be selected from each lot in accordance with MIL-STD-105 at inspection level II. The acceptance quality level shall be 2.5 percent defective.

4.2.2.2 Sampling for tests.- A random sample of sections shall be selected from each lot in accordance with the table for small samples shown in MIL-STD-105 at inspection level L-4 for the tests specified in 4.3.2.

#### 4.3 Inspection.-

4.3.1 Examination.- Each of the sample sections 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 section in the sample containing one or more visual or dimensional defects shall be cause for rejection, and if the number of defective sections in any sample exceeds the acceptance number for that sample, this shall be cause for rejection of the lot represented by the sample.

4.3.2 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 4.4.7) shall be conducted only when specified (see 6.2).

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, this shall be cause for rejection of the lot which it represents.

#### 4.4 Test procedure.-

4.4.1 Nonfibrous material (shot) content.- The nonfibrous material (shot) content shall be determined for each sample by separating by hand 10 grams of fiber as fine as possible over a U. S. Standard No. 30 sieve having a U. S. Standard No. 50 sieve and a pan underneath. Breaking up the material facilitates its separation so that the fiber can be picked up readily. The material remaining after the fiber is picked out shall be screened by hand and all the fiber remaining on the No. 3 and No. 50 sieves shall be picked off. The fine splinters and dust shall be aspirated and the remainder on the No. 30 and No. 50 sieves shall be combined and weighed as the nonfibrous material (shot) content.

4.4.2 Diameter of fiber.- Diameter of fibers shall be determined microscopically on the basis of measuring 100 fibers on each of the samples selected in accordance with 4.2.2.2. The average diameter for purposes of determining conformance with 3.1.1 shall be the average of all measurements on all samples.

4.4.3 Density.- The density of the pipe insulation shall be determined in accordance with the method specified in ASTM C 302-56.

#### 4.4.4 Alkalinity and pH.-

4.4.4.1 Alkalinity.- The alkalinity test shall be performed as follows: Weigh a 5-gram ( $\pm 0.01$  gram) representative sample<sup>1/</sup> of the pipe insulation and introduce into a 500-milliliter (ml.), pyrex Erlenmeyer flask. Wet with 5 ml. of 95 percent ethyl alcohol, and add 400 ml. of distilled water. Reflux for 4 hours plus or minus 5 minutes. At the end of this period, disconnect the condenser and filter at once through No. 41 Whatman paper supported in a Buechners funnel. Wash the flask and material three times with 25-ml. portions of hot distilled water using suction. Titrate immediately with 0.02N H<sub>2</sub>SO<sub>4</sub>, using six to eight 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<sub>2</sub>O shall be calculated from the following formula:

$$\text{Percent Na}_2\text{O} = 0.0124 (\text{mls. H}_2\text{SO}_4 \text{ used by sample minus mls. H}_2\text{SO}_4 \text{ used by blank})$$

<sup>1/</sup>A representative sample is conveniently prepared by taking borings with a large cork borer through the cross section of the pipe insulation.

**MIL-I-22344B**

4.4.4.2 pH.- The pH test shall be performed as follows: A 25 gram sample shall be taken by means of a cork borer<sup>2/</sup>. A representative 1-gram specimen weighed to the nearest 0.001 grams shall be placed in a 500 ml pyrex Erlenmeyer flask and 100 ml of distilled water added. This water shall be made by the Rohm & Haas Amberlite Ion Exchange Resin HB-1. Macerate the glass insulation with the flattened end of a polyethylene stirring rod until the specimen is thoroughly wetted. Affix a 9 millimeter by 200 centimeter pyrex glass air condenser and set the flask on a hot plate. The hot plate shall be adjusted so that it will maintain the contents of the flask at 95° to 100°C. without boiling the water. The flask and contents shall be heated for one hour after which time the flask is cooled to 20° to 30°C. Transfer 50 ml of the extract to a 100 ml pyrex glass beaker and measure the pH with glass electrode and a saturated KC1-calomel electrode half cell capable of precision to within 0.1 pH.

4.4.5 Smolder test.- The specimen shall be mounted in a horizontal position. The flame from a Bunsen burner shall be directed against the lower surface of the specimen at one end for 3 minutes. Then the flame shall be removed. The specimen shall be examined.

4.4.6 Fire resistance.-

4.4.6.1 Test specimen.- A section of pipe insulation 36 inches in length, shall be secured to a 36-inch length of steel pipe with wire or metal bands.

4.4.6.2 Procedure.- The specimen shall be placed in a horizontal position with the surface to be exposed to the fire facing downward, and shall be supported on the flat surface of a 2 by 2 by 1/8-inch steel angle frame. (Standard laboratory equipment has a 30 by 30-inch clear opening.) The flame from a 3/4 to 7/8-inch gas-air burner, Universal Blast Burner, Fisher Scientific No. 4-191, or equivalent, shall be directed against the center of the lower surface of the specimen. The top of the burner tube shall be 28-3/4 inches below the specimen. Temperature indications shall be obtained with a chromel-alumel thermo element made of 0.12849-inch wire placed in a 3-inch horizontal coil 1 inch below the center of the specimen. The wires shall be bare for a distance of 2 inches from the junction. Temperature readings shall be taken at intervals not exceeding 2 minutes. The test duration shall be 40 minutes and the flame shall be regulated to give temperature indications according to the time temperature curve shown on figure 1. The flame shall touch the specimen during the entire test period. Exceptions can be made for the first 5 minutes, if required, for proper temperature regulation. The area under the time temperature curve obtained from the thermo element readings shall be within 5 percent of that of the reference curve being followed. The test shall be conducted in a room which is free from appreciable air currents and which has a temperature between 60° and 85° F.

4.4.6.3 Rating.- For incombustible and fire retardant materials, the specimen as a whole and the different units or portions thereof shall remain in place until the end of the flame exposure period specified in 4.4.6.2. No glow shall progress to the ends of the specimen at any point during or after the test.

4.4.6.3.1 Incombustible.- No flame shall issue from the specimen during or after flame application.

4.4.6.3.2 Fire retardant.- During or after flame application no sustained flaming shall issue from the specimen. Any flame which occurs shall be limited to intermittent short flames from the area directly exposed to the test flame. No flame from the specimen shall reach the angle frame at any point. No flaming shall occur more than 2 minutes after the test flame is discontinued.

4.4.7 Thermal conductivity.- The sample shall be a 3-foot sectional cover for a 3-inch pipe. The thermal conductivity shall be determined in accordance with the method specified in ASTM C 335-54T.

4.5 Inspection of the preparation for delivery.- The preservation, packaging, packing and marking shall be examined for conformance with the requirements of Section 5.

5. PREPARATION FOR DELIVERY

5.1 Packing.- Packing shall be level A, B, or C, as specified (see 6.2).

<sup>2/</sup>A representative sample is conveniently prepared by taking borings with a large cork borer through the cross section of the pipe insulation.

MIL-I-22344B

5.1.1 Level A.- Pipe insulation shall be packed in a container conforming to PPP-B-636, class 2, except that limitations on inside dimensions of box shall not apply. All corners and edge seams, and manufacturer's joint shall be waterproofed in accordance with Appendix to PPP-B-636.

5.1.2 Level B.- Pipe insulation shall be packed in fiberboard boxes conforming to class 1 of PPP-B-636.

5.1.3 Level C.- Pipe insulation shall be packed in containers, at the lowest rates, in a manner which will insure acceptance by common carrier and will afford protection against physical damage during direct shipment from the supply source to the first receiving activity for immediate use. This level in general shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation and may be the supplier's commercial practice when such meets the requirements of this level.

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

## 6. NOTES

6.1 Intended use.- This specification covers material intended for use on pipes as an antisweat insulation for temperatures of 32° to 100°F., and as a heat insulation for surface temperatures of 100° to 370°F.

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

- (a) Title, number, and date of this specification.
- (b) Nominal pipe and tube sizes, and thickness required (see 3.2.2 and 3.2.3).
- (c) When thermal conductivity tests should be conducted (see 4.3.2).
- (d) Levels of packing required (see 5.1).

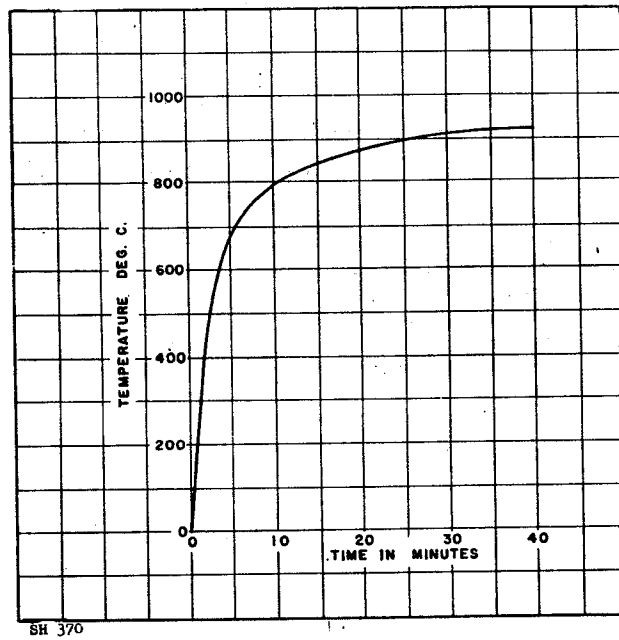
6.3 Pipe insulation in accordance with this specification is also furnished with factory applied jackets. Preformed fibrous glass fittings are also available.

Custodians:  
Army - MO  
Navy - Ships  
Air Force - MOAMA

Preparing activity:  
Navy - Ships  
(Project 5640-0067)

\*U.S. GOVERNMENT PRINTING OFFICE: 1974-713-152/3937

MIL-I-22344B



SH 370

Figure 1 - Time temperature curve.

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R004
<b>INSTRUCTIONS</b>		
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.		
SPECIFICATION		
ORGANIZATION		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?		
A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE?		
<input type="checkbox"/> YES <input type="checkbox"/> NO      IF "YES" IN WHAT WAY?		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity)		DATE

DD FORM 1426  
1 APR 63

REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE

N772

**FOLD**

---

**DEPARTMENT OF THE NAVY  
BUREAU OF SHIPS  
WASHINGTON 25, D. C.**

**POSTAGE AND FEES PAID  
NAVY DEPARTMENT**

**OFFICIAL BUSINESS**

**CHIEF, BUREAU OF SHIPS  
SPECIFICATIONS AND STANDARDIZATION BRANCH  
DEPARTMENT OF THE NAVY  
WASHINGTON 25, D. C.**

**FOLD**

---