

**INCH-POUND**  
MIL-PRF-22344E  
14 October 2004  
SUPERSEDING  
MIL-I-22344D  
15 August 1991

## PERFORMANCE SPECIFICATION

### INSULATION, PIPE, THERMAL

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

#### 1. SCOPE

1.1 Scope. This specification establishes the requirements for fibrous pipe insulation for use as thermal control on pipes, valves, and fittings for temperatures up to and including 370 degrees Fahrenheit (°F) (see 3.2 and 3.5).

#### 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

##### 2.2 Government documents.

2.2.1 Specifications, standards and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

Comments, suggestions, or questions on this document should be addressed to Commander, Naval Sea Systems Command, ATTN: SEA 05Q, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to [commandstandards@navsea.navy.mil](mailto:commandstandards@navsea.navy.mil), with the subject line "Document Comment". Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at [www.dodssp.daps.mil](http://www.dodssp.daps.mil)

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## DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-1623 - Fire Performance Requirements and Approved Specification for Interior Finish Materials and Furnishings (Naval Shipboard Use).

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch> or [www.dodssp.daps.mil](http://www.dodssp.daps.mil) or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

### BUREAU OF MEDICINE AND SURGERY (BUMED)

BUMED INST 6270.8 - Procedures for Obtaining Health Hazard Assessments Pertaining to Operational Use of a Hazardous Material.

(Copies of this document are available online at <https://bumed.med.navy.mil> or from Bureau of Medicine and Surgery, Department of the Navy, 2300 E Street, NW, Washington, DC 20372-5300.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

### ASTM INTERNATIONAL

- C 169 - Standard Test Methods for Chemical Analysis of Soda-Lime and Borosilicate Glass. (DoD adopted)
- C 302 - Standard Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation. (DoD adopted)
- C 335 - Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation. (DoD adopted)
- C 411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation. (DoD adopted)
- D 1193 - Standard Specification for Reagent Water. (DoD adopted)
- E 70 - Standard Test Method for pH of Aqueous Solutions with the Glass Electrode. (DoD adopted)

(Copies of these documents are available from [www.astm.org](http://www.astm.org) or ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

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3.2 Material. The fibrous insulation material shall be compressed or otherwise formed into pipe insulation (see 6.3). The insulation may be split or slit lengthwise.

3.2.1 Prohibited fibers. Neither asbestos nor ceramic (refractory) fibers nor materials containing any of these fibers shall be used in the insulation.

3.3 Dimensions. Pipe insulation shall be furnished in the dimensions specified in 3.3.1 through 3.3.4.

3.3.1 Length. Pipe insulation shall be furnished in lengths of 3 to 6 feet with tolerance of plus or minus 3/16 inch (see 6.2).

3.3.2 Size. Insulation shall be furnished to fit standard pipe and tube sizes (see 6.2), from 1/4 to 36 inches. The longitudinal seam shall close to within 1/8 inch along the entire length of the section. The inside diameter of the insulation shall not exceed the outside diameter of the pipe by 1/4 inch for nominal pipe sizes (nps) up to 4-1/2 inch or by 5 percent on sizes over 4-1/2 inches nps.

3.3.3 Thickness. Insulation shall be furnished either single or double layer in nominal thicknesses of 1/2 to 4 inches in increments of 1/2 inch, according to simplified standard sizes (see 6.2) with tolerance of plus or minus 3/32 inch in thickness.

3.3.4 Density. Insulation shall have a nominal density of 5.0 pounds per cubic foot (lb/ft<sup>3</sup>) with a tolerance of plus or minus 2.0 lb/ft<sup>3</sup>.

3.4 Alkalinity and pH. Alkalinity of the pipe insulation expressed as equivalent sodium oxide (Na<sub>2</sub>O) shall be not greater than 0.60 percent and the pH shall be not less than 7.5 nor more than 12.0.

3.5 Hot surface performance. Pipe insulation shall be suitable for use at temperatures up to and including 370°F, and at thicknesses up to 4 inches. Pipe insulation shall show neither evidence of flaming, glowing, smoldering, nor smoking. There shall be no degradation which will seriously affect performance. Minor loss of binder or slight discoloration of the binder shall be acceptable. There shall be neither cracking nor delamination of the insulation. The insulation thickness along the top of the pipe shall decrease by not more than 10 percent.

3.6 Fire performance. Insulation shall conform to the requirements of MIL-STD-1623.

3.7 Thermal conductivity. Thermal conductivity shall be not greater than the following values:

<u>Thermal Conductivity</u>	
<u>Mean Temperature, °F</u>	<u>(Btu-in/hr-ft<sup>2</sup>-°F) (1 inch thickness)</u>
25	0.23
50	0.24
75	0.25
100	0.26
200	0.31

3.8 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.9 Toxicity. The insulation shall have no adverse effect on the health of personnel when used for its intended purpose. The insulation shall be assessed by the Navy Environmental Health Center (NAVENVIRHLHCEN) using the administrative Health Hazard Assessment (HHA). A flowchart for this process

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can be found as enclosure (1) of BUMEDINST 6270.8. The HHA is a review of the insulation based on information submitted by the manufacturer, to assess health hazards associated with the handling, application, use and removal of the product. The insulation shall not cause any environmental problems during waste disposal (see 4.6 and 6.5).

3.10 Workmanship. Insulation shall be free of defects in appearance and dimensions.

#### 4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3)

4.2 First article inspection. First article inspection shall consist of the examination of 4.4.1 and tests specified in 4.5.

4.2.1 First article unit. The first article unit shall consist of one segment of each thickness acquired at any one time.

4.3 Conformance inspection. Conformance inspection shall consist of the examination of 4.4.1 and the test of 4.5.1.

4.3.1 Lot. A lot shall consist of units representative in material and manufacturing process of all items offered under this document, except that samples for testing for conformance to 3.3 and 3.8 shall be taken from the actual lots to be shipped. Units of different size and thickness may be considered in one lot, provided there is no variation in material or process across the range. Where material and process varies across the range of size and thickness offered, additional samples shall be tested to characterize these variations. A unit is defined as a single length of pipe insulation of either the split or slit form.

4.3.2 Samples. Samples shall be selected randomly from the lot. The number of samples subjected to the examination of 4.4.1 and tests of 4.5.1 shall be in accordance with table I.

Table I. Sampling for conformance inspection.

Lot Size	Sample Size	Accept	Reject <u>1/2/3/</u>
2 - 15	2	0	1
16 - 25	3	0	1
26 - 90	5	0	1
91 - 150	6	0	1
151 - 280	7	0	1
281 - 500	9	0	1
501 - 1200	11	0	1
1201 - 3200	13	0	1
3201 - over	15	0	1

1/ All defective items shall be replaced with acceptable items prior to lot acceptance.

2/ Inspect sample size until reject criteria is reached.

3/ Rejected lots may be screened and resubmitted for inspection and retest.

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4.4 Inspection.

4.4.1 Examination of the end item for defects in appearance and dimensions. Each of the samples selected shall be examined, weighed, and measured, as applicable, to determine conformance to the requirements of 3.3 and 3.8. These tests shall be conducted on the actual lots to be shipped. Any unit containing one or more visual or dimensional defects as shown in table II shall be cause for rejection of the unit.

TABLE II. Visual and dimensional defects.

Appearance:	Binder spots or foreign inclusions larger than 1 inch in any two perpendicular dimensions. Delamination larger than 4 square inches. Sections not slit or split as ordered. Dents, depressions, or voids affecting more than 10 percent of the surface face and 20 percent of the thickness.
Dimensions:	Not within limits or tolerances specified in 3.3.

4.5 Tests.

4.5.1 Density. Density of the pipe insulation shall be determined in accordance with the method specified in ASTM C 302. On the jacketed product (see 6.3), density shall be determined by individual piece weight, using nominal facing and adhesive weight.

4.5.2 Alkalinity. The alkalinity test shall be performed by the method 31 of ASTM C 169. A representative sample may be prepared by taking borings using a large cork borer through the cross-section of the pipe insulation.

4.5.3. Hydrogen-ion concentration (pH). The pH test shall be performed as follows: A 25-gram sample shall be taken (a representative sample may be conveniently prepared by taking borings with a large cork borer through the cross-section of the pipe insulation). A representative 1 gram specimen weighed to the nearest 0.001 gram shall be placed in a 500 mL Pyrex Erlenmeyer flask or equal, and 100 mL of distilled water added. The distilled water shall be ASTM D 1193, Type I. Macerate the fibrous insulation with the flattened end of a polyethylene stirring rod until the specimen is thoroughly wetted. Affix a 9 millimeter (mm) by 200-centimeter (cm) Pyrex glass air condenser or equal, 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 194°F to 212°F, without boiling the water. The flask and contents shall be heated for 1 hour after which time the flask shall be cooled to 68°F to 86°F. Transfer 50 mL of the extract to a 100 mL Pyrex glass beaker or equal, and measure the pH by ASTM E 70.

4.5.4. Hot surface performance. Hot surface performance of one sample of pipe insulation shall be determined in accordance with ASTM C 411. Insulation for 1-inch pipe shall be tested at a temperature of 370°F, and a thickness of 1 inch.

4.5.5. Fire performance. Three flat samples of pipe insulation shall be tested in accordance with MIL-STD-1623.

4.5.6. Thermal conductivity. One sample of pipe insulation shall be tested in accordance with ASTM C 335. Determinations shall be made at three mean temperatures, 100°F, 150°F, and 200°F. Results of these tests shall be extended, through reasonable curve fit or numerical techniques, to establish the thermal conductivity at the levels specified in 3.7.

4.6 Toxicity. To determine conformance with the requirements of 3.9, the insulation shall be evaluated using the HHA process. Sufficient data to permit a HHA of the product shall be provided by the

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manufacturer/distributor to the NAVENVIRHLTHCEN. To obtain current technical information requirements specified by the NAVENVIRHLTHCEN, see 6.5.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This specification covers material intended for use on pipes as thermal insulation for surface temperatures of 100°F to 370°F (see 3.2 and 3.5). The material supplied under this specification in the past has been manufactured from fibrous glass with an average fiber diameter no greater than 0.0004 inch.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. When a first article inspection is required (see 3.1).
- c. Length of insulation required (see 3.3.1).
- d. Nominal pipe and tube sizes required (see 3.3.2).
- e. Thickness of insulation required (see 3.3.3).
- f. Packaging requirements (see 5.1).
- g. Is Material Safety Data Sheet required? (see 6.4).
- h. Toxicity conformance (see 3.9 and 6.5).

6.3 Jackets and layers. Pipe insulation is also furnished with factory-applied jackets. The jacketed insulation must meet all of the requirements of this specification. Preformed fittings are also available. If multi-layer combinations of single standard layers are required, the layers should be specified as "factory-tested".

6.4 Material safety data sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. In order to obtain the MSDS, FAR clause 52.223-3 must be in the contract.

6.5 Toxicity evaluation. The NAVENVIRHLTHCEN requires sufficient information to permit a HHA of the product. Any questions concerning toxicity, information required to conduct a HHA, and requests for a HHA should be addressed to the Commanding Officer, Navy Environmental Health Center, ATTN: Hazardous Materials Department, Industrial Hygiene Directorate, 620 John Paul Jones Circle, Suite 1100, Portsmouth, VA 20378-2103. Upon receipt of the HHA, a copy should be provided to Commander, Naval Sea Systems Command, ATTN: SEA 05M3, 1333 Isaac Hull Ave., SE, Stop 5133, Washington Navy Yard, DC 20376-5133.

6.6 Subject term (key word) listing.

Conductivity  
Control

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6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:  
Navy - SH  
Air Force - 99

Preparing activity:  
Navy - SH  
(Project 5640-0012)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at [www.dodssp.daps.mil](http://www.dodssp.daps.mil).