

INCH-POUND

MIL-PRF-32161
w/AMENDMENT 1
25 June 2009

SUPERSEDING
MIL-PRF-32161
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PERFORMANCE SPECIFICATION

INSULATION, HIGH TEMPERATURE FIRE PROTECTION,
THERMAL AND ACOUSTIC

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 high temperature materials for use as fire protection, and thermal insulation and acoustic insulation for fire protection areas.

1.2 Classification. High temperature insulation materials should be of the following types and classes, as specified (see 3.4, 6.1.1, and 6.2), and have a fire resistance designation of N-30.

1.2.1 Types.

Type I - High temperature insulation panel, fire-protective

Type II - High temperature insulation panel, ambient thermal

Type III - High temperature insulation panel, acoustical

Class 1 - Alternate acoustic absorptive treatment for ventilation ducts, bulkheads, and overheads

Class 2 - Alternate acoustic absorptive treatment for machinery Spaces

Class 3 - Alternate high transmission loss treatment for use in other than machinery spaces

Class 4 - Alternate high transmission loss treatment for use in machinery spaces

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: SEA05M2, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard, DC 20376-5160 or emailed to CommandStandards@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 <http://assist.daps.dla.mil>.

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DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-A-3316 - Adhesives, Fire-Resistant, Thermal Insulation
- MIL-A-23054 - Acoustic Absorptive Board, Fibrous Glass Perforated Fibrous Glass Cloth Faced
- MIL-PRF-24596 - Coating Compounds, Nonflaming, Fire-Protective (Metric)
- MIL-DTL-24607 - Enamel, Interior, Nonflaming (Dry), Chlorinated Alkyd Resin, Semigloss

DEPARTMENT OF DEFENSE STANDARD

- MIL-STD-3020 - Department of Defense Standard Practice for Fire Resistance of U.S. Naval Surface Ships

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> 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 from the Bureau of Medicine and Surgery, Department of the Navy, 2300 E Street, NW, Washington, DC 20372-5300 or online at <http://navymedicine.med.navy.mil>.)

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

- S9510-AB-ATM-010 - Nuclear Powered Submarine Atmosphere Control Manual

(Copies of this document are available from the Commander, Naval Sea Systems Command, ATTN: SEA 05Z42, 1333 Isaac Hull Ave. SE Stop 5122, Washington Navy Yard, DC 20376-5122 or online at <https://smcl.dt.navy.mil>.)

CODE OF FEDERAL REGULATIONS

- 40 CFR 261 - Protection of Environment: Identification and Listing of Hazardous Waste

(Copies of this document are available from the Superintendent of Documents, U.S. Government Printing Office, Washington DC 20401 or online at www.gpoaccess.gov/index.html.)

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

- ASTM C167 - Thickness and Density of Blanket or Batt Thermal Insulations, Standard Test Methods for (DoD adopted)
- ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus, Standard Test Method for (DoD adopted)
- ASTM C423 - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method, Standard Test Method for (DoD adopted)

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ASTM C518	-	Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus, Standard Test Method for (DoD adopted)
ASTM C592	-	Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type), Standard Specification for (DoD adopted)
ASTM C665	-	Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing, Standard Specification for (DoD adopted)
ASTM C1139	-	Fibrous Glass Thermal Insulation and Sound Absorbing Blanket and Board for Military Applications, Standard Specification for
ASTM D579	-	Greige Woven Glass Fabrics, Standard Specification for (DoD adopted)
ASTM D5035	-	Breaking Force and Elongation of Textile Fabrics (Strip Method), Standard Test Method for (DoD adopted)
ASTM E84	-	Surface Burning Characteristics of Building Materials, Standard Test Method for (DoD adopted)
ASTM E90	-	Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions and Elements, Standard Test Method for (DoD adopted)
ASTM E795	-	Mounting Test Specimens During Sound Absorption Tests, Standard Practices for (DoD adopted)
ASTM E1123	-	Mounting Test Specimens for Sound Transmission Loss Testing of Naval and Marine Ship Bulkhead Treatment Materials, Standard Practices for

(Copies of these documents are available from ASTM International, 100 Barr Harbor Dr., PO Box C700, West Conshohocken, PA 19428-2959 or online at www.astm.org.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1182 - Reaction to Fire Tests for Building Products -- Non-Combustibility Test

(Copies of this document are available from ISO, 1, rue de Varembe, CH-1211 Geneva 20, Switzerland or online at www.iso.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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. Unless otherwise specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2 (see 6.3).

3.2 Material.3.2.1 Composition.

3.2.1.1 Type I. Type I shall consist of a high temperature fire insulation panel, plus additional materials and requirements as specified in 3.4.1. Asbestos and ceramic fibers and components containing asbestos and ceramic fibers are prohibited.

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3.2.1.2 Types II and III. Types II and III shall consist of a high temperature fire insulation panel (Type I) plus additional materials and requirements as specified in 3.4.1. The Type I material contained in Type II and Type III configurations shall be the thickness that meets 3.5.3.3 and shall be the outermost layer of the configuration. Asbestos and ceramic fibers and components containing asbestos and ceramic fibers are prohibited.

3.2.2 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.

3.2.3 Toxicity. The high temperature fire insulation shall have no adverse effect on the health of personnel when used for its intended purpose. The high temperature fire insulation shall be assessed by the Navy and Marine Corps Public Health Center (NMCPHC) using the administrative Health Hazard Assessment (HHA). A flowchart for this process can be found as enclosure (1) of BUMED INST 6270.8. The HHA is a review of the high temperature fire insulation based on information submitted by the manufacturer, to assess health hazards associated with the handling, application, use and removal of the product. The high temperature fire insulation shall not cause any environmental problems during waste disposal (see 4.5 and 6.5).

3.2.4 Off-gassing. The high temperature fire insulation shall be certified for and assigned a usage category of either "Permitted" or "Limited" in accordance with the Material Control Program chapter of NAVSEA S9510-AB-ATM-010 (see 4.6 and 6.6).

3.3 High temperature insulation panel.

3.3.1 Dimensions and tolerances. Dimensions and dimensional tolerances are specified in table I (see 6.2).

TABLE I. Dimensional tolerances.

Type	Length* (in.)	Width* (in.)	Thickness* (in.)	Tolerances (in.)		
				Length	Width	Thickness
Type I, II, and Type III Classes 1 and 2	36 - 48	24	2.25	±¼	±¼	+⅛, -0
Type III, Classes 3 and 4	36 - 48	24	4	±¼	±¼	+¼, -0

*Note: A variation in length, and/or width, and/or thickness may be authorized, if approved, by NAVSEA to meet the performance requirements of this specification.

3.3.2 Areal density. The density of all types of high temperature insulation panels shall not exceed limits specified in table II.

TABLE II. Material density.

Type	Maximum areal density* (lb/ft ²)
Type I	1.4
Type II	1.6
Type III, Class 1	1.9
Type III, Class 2	1.6
Type III, Class 3	3.9
Type III, Class 4	3.6

*Note: A variation in maximum areal density may be authorized, if approved, by NAVSEA to meet the performance requirements of this specification.

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3.4 Types I, II, and III high temperature insulation panels. Types I, II, and III high temperature insulation panels shall have facing materials as described in 3.4.1.

3.4.1 Facing materials.

3.4.1.1 Type I and Type II. Type I and Type II shall have a facing material which, when separated from the insulation, shall have a breaking strength not less than the values specified in table III. The high temperature fire insulation panel shall be attached to the facing material using an adhesive that meets the fire tests as specified in MIL-A-3316, Class 1, Grade A adhesive.

TABLE III. Facing requirements.

Breaking strength, minimum, pounds for inch of width			
As received		After heating to 900 °F for 2 hours	
Warp	Fill	Warp	Fill
300	255	70	60

3.4.1.2 Type III. Type III, Classes 1 through 4, shall have a facing material conforming to the requirements of MIL-A-23054, or to the requirements of ASTM C1139, Type III. The high temperature fire insulation panel shall be attached to the facing material using an adhesive that meets the fire tests as specified in MIL-A-3316, Class 1, Grade A adhesive.

3.4.2 Facing alignment. In the event that the facing material does not cover the entire surface of the high temperature fire insulation panel, the uncovered portion of the panel shall not extend farther than $\frac{1}{8}$ inch from any edge. The facing shall not extend over the edge of the panel more than $\frac{1}{8}$ inch.

3.4.3 Facing material adhesion. The facing on Types I, II, and III shall have a peel strength of not less than 1 lb/in².

3.4.3.1 Test notes and observations. Because of the various types of insulation material and attachment methods used, variations in peel strengths may be observed. Some backing materials may not have sufficient structural strength to withstand more than 1 pound of separation force from the cemented facing material. In these instances, it may be observed that the insulation backing material has separated, and a thin layer of matt may be seen attached to the facing. This is not a failure of the adhesive used; it is structural failure of the backing material. Failure of the backing material should be noted in the test report.

3.5 Performance characteristics.

3.5.1 Thermal conductivity of high temperature insulation panel. The thermal conductivity (k) of the Type I high temperature fire insulation panel shall not exceed 0.26 Btu-in/ft²-hr-°F at mean temperature of 75 °F (23 °C). The thermal conductivity (k) of the Type II high temperature thermal insulation panel shall not exceed 0.28 Btu-in/ft²-hr-°F at mean temperature of 75 °F (23 °C).

3.5.2 Paintability. Type I, II, and III high temperature fire insulation faced panels shall be compatible with specified paint.

3.5.3 Fire performance.

3.5.3.1 Flame spread (Types I, II, and III). The flame spread index shall not be greater than 25 for Type I, Type II, and Type III, Classes 1 through 4.

3.5.3.2 Smoke density (Types I, II, and III). Smoke developed index shall not be greater than 50.

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3.5.3.3 Full-scale fire resistance test (Type I). The full-scale fire resistance test shall provide a minimum of 30 minutes of protection based on:

- a. The fire-containment assembly, bulkhead assemblies with attached insulation, shall have withstood the fire endurance test without passage of flame for a time period equal to that for which the classification is desired, and
- b. Transmission of heat through the assembly during the fire endurance test period shall not have raised the average temperature on its unexposed surface more than 250 °F (139 °C) above its initial temperature, nor the temperature of any one point on the surface, more than 325 °F (181 °C) above its initial temperature (see 4.4.8.3).

3.5.3.4 Non-combustibility (Type I). The high temperature fire insulation panel's core material shall be non-combustible. Facing materials and their adhesives are not required to be non-combustible. To meet the requirements of non-combustibility, all of the following criteria shall be satisfied:

- a. The average furnace thermocouple temperature rise shall not exceed 54 °F (30 °C).
- b. The average surface thermocouple temperature rise shall not exceed 54 °F (30 °C).
- c. The mean duration of sustained flaming shall not exceed 10 seconds.
- d. The average mass loss shall not exceed 50 percent.

3.5.4 Acoustical performance.

3.5.4.1 Acoustical absorption. Acoustical absorption for Type II and Type III, Classes 1 and 2, shall be equal to or greater than the values in table IV.

TABLE IV. Acoustical absorption properties (Type II and Type III).

Type	Thickness (in.)	Octave band center frequency (Hz)					
		125	250	500	1000	2000	4000
Type II	2 maximum	0.50	0.60	0.60	0.40	0.20	0.10
Type III, Class 1	2 maximum	0.25	0.70	0.85	0.85	0.75	0.75
Type III, Class 2	2 maximum	0.40	0.90	0.85	0.70	0.50	0.20
Note: Values indicated under octave band frequency are sound absorption coefficients (Sabin/ft ²).							

3.5.4.2 Acoustical transmission loss. Acoustical transmission loss for Type II and Type III, Classes 1 through 4, shall be equal to or greater than the values in table V.

TABLE V. Acoustical transmission loss properties (Type II and Type III).

Type	Maximum thickness (in)	Octave band frequency (Hz)																	
		100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Type II, Class 1	2	-4	-4	-5	-5	-2	1	4	7	10	11	12	14	17	18	18	20	20	20
Type III, Class 1	2	1	-1	-4	-5	-2	1	3	5	8	10	12	11	15	17	13	12	11	15
Class 2	2	1	-1	-4	-5	-2	1	3	5	8	10	12	11	15	17	13	12	11	15
Classes 3 and 4	4	-3	-2	2	7	13	16	17	18	18	18	20	22	25	25	25	25	26	23

Note: Values indicated under $\frac{1}{3}$ -octave band frequency are in decibels (dB), and represent the minimum values to be achieved in order to classify Type II and Type III insulation materials as acceptable when tested in accordance with ASTM E90, using the mounting method specified in ASTM E1123. Values specified in table V represent measured transmission loss of the bulkhead structure with insulation material installed, minus measured transmission loss of the bulkhead structure without any insulation material installed (see ASTM E1123, section 5.1.1).

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3.6 Corrosiveness to steel, copper, and aluminum. There shall be no corrosion greater than observed with sterile cotton.

3.7 Resistance to vibration. The insulation blanket shall not, after heating/vibration, lose more than 15.0 percent in mass, nor sag an average of more than 3 inches. There shall be no detrimental effect to the overall physical characteristics of the blanket when comparing to a control specimen. For example, bolts cutting through the insulation material that cause large quantities of fiber or insulation blanket pieces to drop off the test stand holder during or after the test is unacceptable.

3.8 Compression for Type I. The unit load required to compress the board to 40 percent of its original thickness shall average not less than 1246 Newton per square meter (N/m²) (255 pounds per square foot (lb/ft²)). Upon completion of the test, the board, after a 5-minute interval, shall return to at least 70 percent of its original thickness.

3.9 Disposal. The manufacturer shall certify that the high temperature fire insulation shall not contain any hazardous material or exhibit any hazardous characteristic as defined under 40 CFR 261 (Code of Federal Regulations).

3.10 Workmanship. The finished high temperature insulation units (panels) shall conform to the quality and grade of product established by this document.

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).

4.1.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with 4.2, 4.3, and 4.4.

4.2 First article inspection. First article inspection shall consist of the examinations of and tests specified in table VI, 4.4, and 4.5. Testing shall be performed on unpainted samples.

TABLE VI. First article inspection.

Inspections	Requirements	Tests
Toxicity	3.2.3	4.5
Off-gassing	3.2.4	4.6
Dimensions and tolerances	3.3.1	4.4.1
Areal density	3.3.2	4.4.2
Facing material adhesion	3.4.3	4.4.5
Thermal conductivity	3.5.1	4.4.6
Flame spread	3.5.3.1	4.4.8.1
Smoke density	3.5.3.2	4.4.8.2
Full-scale fire resistance test	3.5.3.3	4.4.8.3
Non-combustibility (Type I)	3.5.3.4	4.4.8.4
Acoustical absorption	3.5.4.1	4.4.9.1
Acoustical transmission loss	3.5.4.2	4.4.9.2
Corrosiveness	3.6	4.7
Resistance to vibration	3.7	4.8
Compression	3.8	4.9

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4.2.1 First article sample. The first article sample shall consist of one unit (panel) from each type of high temperature insulation acquired at any one time.

4.3 Conformance inspection.

4.3.1 Inspection of end item. Inspections shall be in accordance with table VII, except where otherwise noted. Testing shall be performed on unpainted samples.

TABLE VII. Inspection of end item.

Inspections	Requirements	Tests
Dimensions and tolerances	3.3.1	4.4.1
Areal density	3.3.2	4.4.2
Facing alignment	3.4.2	4.4.4
Facing material adhesion	3.4.3	4.4.5
Paintability	3.5.2	4.4.7

4.3.1.1 Examination of end item. The lot size shall be the total number of units (panels) (see 4.3.1.1.1).

4.3.1.1.1 Examination of end item for defects in appearance. Inspections shall be in accordance with table VIII and 4.3.2.2.1, except where otherwise noted. Not more than 5 units (panels) shall be selected from a single carton.

TABLE VIII. Examination for visual defects.

Examine	Defect
Appearance (Types I, II, and III)	Material is not uniform, void areas noted, facing misaligned, or panel not square.
Classification	Type not as specified (see 1.2).

4.3.2 Testing of the end item.

4.3.2.1 Lot. A lot shall consist of all units (panels) of the same type, size, and thickness produced under similar conditions and ready for inspection or shipment at one time. Unless otherwise specified (see 6.2), the lot size shall be expressed in the number of panels.

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4.3.2.2.1 Sampling for visual examination. At a minimum, the contractor shall randomly select samples from each lot of completed high temperature insulation material as specified in table IX, and inspect them as specified in 4.3.1.1.1 (see 6.2).

TABLE IX. Sampling for visual examination of high temperature insulation material.

Lot size	Sample size
1 to 50	5*
51 to 90	7
91 to 150	11
151 to 280	13
281 to 500	16
501 to 1,200	19
1,201 to 3,200	23
3,201 to 10,000	29
10,001 to 35,000	35
*Note: For lot size of 5 or less, all panels shall be subjected to visual inspection.	

4.3.2.2.2 Sampling for tests. At a minimum, the contractor shall randomly select a sample quantity from each lot of completed high temperature insulation material as specified in table X, and test them as specified in 4.4.1 through 4.4.9.2 (see 6.2).

Table X. Sampling for tests.

Lot size	Sample size
1 to 25	3*
26 to 50	5
51 to 90	6
91 to 150	7
251 to 280	10
281 to 500	11
501 to 1,200	15
1,201 to 3,200	18
3,201 to 10,000	22
10,001 to 35,000	29
*Note: For lot size of 3 or less, only one panel shall be tested.	

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4.3.2.3 Noncompliance. If a sample fails to pass its appropriate inspections, the Contractor shall notify the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected; which were manufactured with essentially the same materials and processes; and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, suitable to the inspection activity, has been taken. After the corrective action has been taken, appropriate inspections shall be repeated on additional sample units. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity.

4.4 Test procedures.

4.4.1 Dimensions. Thickness, length and width shall be determined in accordance with the method specified in ASTM C167 (see 3.3.1).

4.4.2 Areal density. Density tests shall be performed in accordance with ASTM C167 (see 3.3.2).

4.4.3 Breaking strength of outer facing. (see 3.4.1.1)

4.4.3.1 Method. Unless otherwise specified, breaking strength shall be in accordance with ASTM D5035. Outer facing specimens shall be cut in both warp and fill directions. Five tests shall be made upon each sample, and the results averaged to give the breaking strength of the sample.

4.4.3.2 Setup. In order to prevent the jaws of the testing machine from cutting the outer facing, the ends of each specimen shall be coated with a polymer solution in accordance with ASTM D579, or rubber, or painted with a thick shellac for a distance of $1\frac{5}{8}$ inches from each end and allowed to dry in the air before being raveled to the 1-inch width. Small pieces of manila paper or soft cotton twill fabric shall be inserted between the specimen and the face of the jaw.

4.4.3.3 Preparation. For determining the breaking strength after heating, a muffle furnace with accurate, automatic temperature control shall be used. Two specimens 6 inches long and 8 inches wide shall be cut, one with the 6-inch dimension parallel to the warp and the other with the dimension parallel to the fill. The specimens shall be supported on a wire screen or perforated metal plate at least $\frac{1}{2}$ inch above the floor of the furnace, and not more than five specimens shall be superimposed upon one another. The furnace thermocouple shall be centrally located not more than $\frac{1}{2}$ inch above the topmost specimen.

4.4.3.4 Heating. Specimens shall be placed inside the furnace with the temperature not greater than 200 °F and with the furnace door partly open. The temperature shall gradually be raised to 500 °F and maintained at this point, until all smoking ceases. The total time consumed in the operation shall not be less than 1 or more than 2 hours. Specimens shall be removed from the furnace and the temperature increased to 900 °F. The specimens shall be replaced in the furnace and shall be maintained at 900 °F for 2 hours. Then they shall be removed, allowed to cool to room temperature, and the required breaking strength strips cut and tested, as specified in 4.4.3.1.

4.4.4 Facing alignment. Facing alignment shall be determined by direct measurement using a steel rule with 1-mm graduations (see 3.4.2).

4.4.5 Facing material adhesion.

4.4.5.1 Procedure. Using the test assembly illustrated in figure 1 and a tensile test device, conduct facing material peel tests. The tensile machine shall be configured with a 100-pound load cell utilizing the 50-pound scale for the initial pull. The 10-pound scale may be used to facilitate more accurate readings once the initial separating force is determined. The jaw speed used for this test shall be 6 inches per minute (see 3.4.3).

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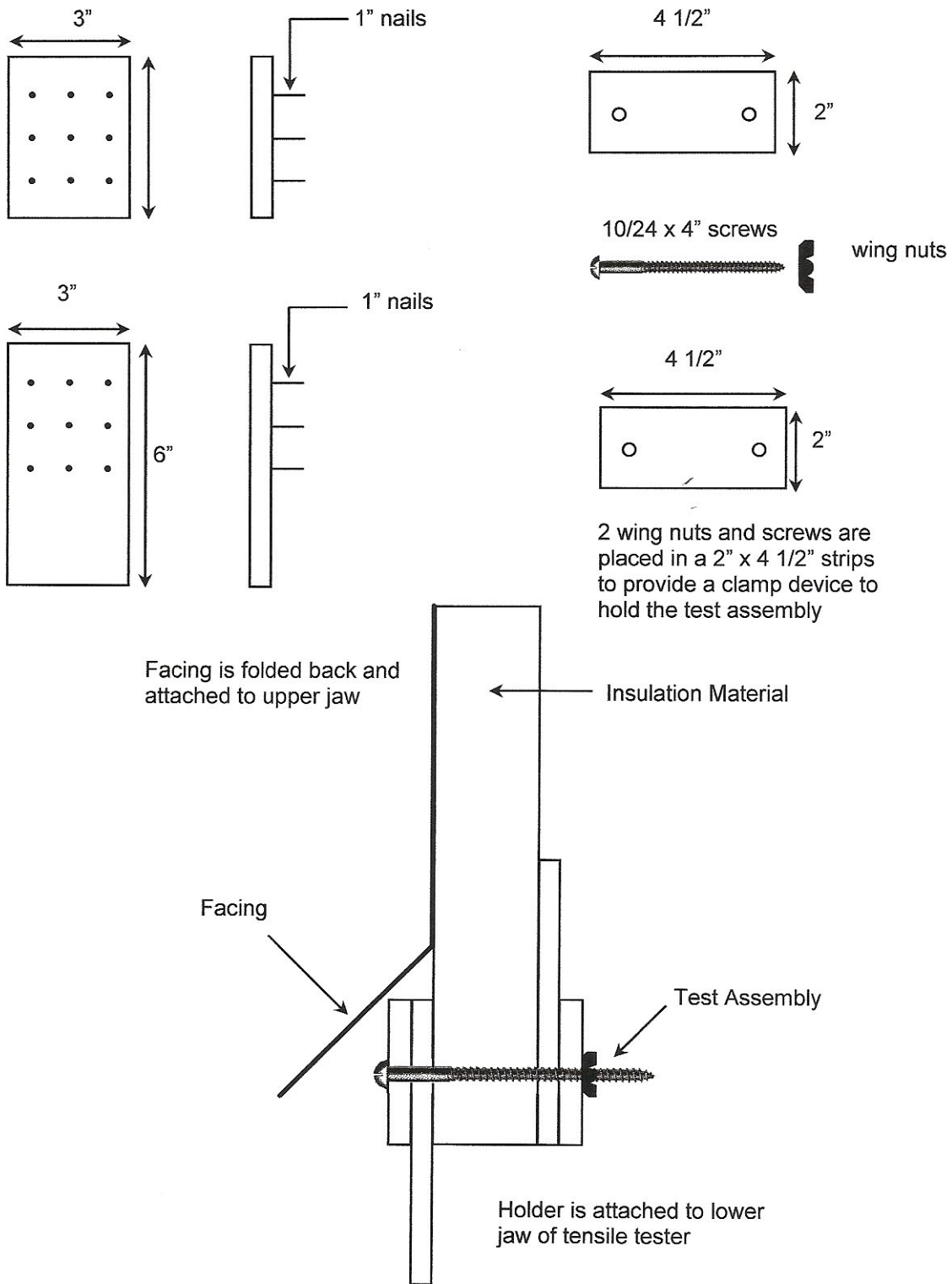


FIGURE 1. Test assembly.

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4.4.5.2 Specimen preparation. Test specimens shall be cut 3 inches wide and 14 inches long. It is preferred that manufacturers provide test specimens with only 6 inches of facing material cemented to the backing material. If this is not possible, cut specimens to size and use a sharp knife to carefully skin the facing material from the backing material for a length of 8 inches. Cut 2 inches off the backing material so that the facing extends 2 inches beyond the backing matt. This will allow space for the facing material to be placed in the tensile tester jaw, without distorting the test specimen.

4.4.5.3 Specimen set-up. Fold the separated facing material back over the cemented piece (a loose-fitting rubber band may be used to keep the facing out of the way during assembly). Place the specimen backing matt on one side of the 4-inch by 3-inch board with nails (the facing should be up). Align the matt until it is even with both sides and has a length of 4 inches on the board. Press the backing matt on the nails. Carefully align the longer board with nails over the backing matt (also a length of 4 inches on the board) and press firmly in place. The facing material should be on the smooth side of the longer board. Place clamping device over the two boards and tighten with nuts until a slight amount of compression of the backing matt is noted.

4.4.5.4 Set-up of test apparatus in tensile tester. Place the long board of the test assembly in the lower jaw of the tensile tester, with the smooth side of the board and facing material towards the front of the machine. Remove the rubber band (if used) from the facing material and place the 2-inch overlap of facing material in the upper jaw. The material should be aligned as nearly as possible to a 180-degree pull.

4.4.5.5 Test procedure. Set the jaw drive speed to 6 inches per minute. Start tensile tester and observe force required to peel facing material from the backing matt. Separation forces may vary from 1 pound to 35 pounds.

4.4.6 Thermal conductivity. Thermal conductivity shall be determined in accordance with ASTM C177 or ASTM C518 (see 3.5.1). In the case of a dispute, ASTM C177 shall be the referee test method.

4.4.7 Paintability. Apply one coat of latex flat primer, conforming to MIL-PRF-24596, and one coat of fire-retardant paint, conforming to DoD-E-24607 or MIL-PRF-24596 to the cloth surface of the high temperature insulation facing. The paint shall dry to a uniform smooth coat, which shall have a semi-gloss appearance when viewed under ordinary conditions of illumination. There shall be no shiners or flashers. Tinted colors shall dry to a uniform color (see 3.5.2).

4.4.8 Fire tests. Fire tests shall be performed on unpainted samples.

4.4.8.1 Flame spread. Flame spread tests shall be performed in accordance with ASTM E84 (see 3.5.3.1).

4.4.8.2 Smoke density. Smoke-developed tests shall be performed in accordance with ASTM E84 (see 3.5.3.2).

4.4.8.3 Full-scale fire resistance test. The full-scale fire resistance test shall be performed in accordance with MIL-STD-3020 (see 3.5.3.3).

4.4.8.4 Non-combustibility. Non-combustibility tests shall be performed in accordance with ISO 1182 (see 3.5.3.4).

4.4.9 Acoustical tests. Acoustical tests shall be performed on unpainted samples.

4.4.9.1 Acoustical absorption. Acoustical absorption tests shall be performed in accordance with ASTM C423, using mounting Method A of ASTM E795 (see 3.5.4.1).

4.4.9.2 Acoustical transmission loss. Acoustical transmission loss tests shall be performed in accordance with ASTM E90, using the mounting method specified in ASTM E1123 (see 3.5.4.2).

4.5 Toxicity. To determine conformance with the requirements of 3.2.3, high temperature fire insulation shall be evaluated using the HHA process. Sufficient data to permit an HHA of the product shall be provided by the manufacturer/distributor to the NMCPHC. To obtain current technical information requirements specified by the NMCPHC, see 6.5.

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4.6 Off-gassing. The high temperature fire insulation shall be tested in accordance with the Material Control Program chapter of NAVSEA S9510-AB-ATM-010 by a Government approved testing facility. The results shall be submitted to the Government for evaluation and approval for use (see 3.2.4 and 6.6).

4.7 Corrosiveness to steel, copper, and aluminum. The insulation shall be tested in accordance with the corrosiveness method of ASTM C665 (see 3.6).

4.8 Resistance to vibration. Vibration resistance shall be conducted in accordance with the test method in the Supplementary Requirements Section of ASTM C592 (see 3.7 and 6.10).

4.9 Compression. The compression test shall be performed in accordance with ASTM C167 to determine conformance with the requirements of 3.8.

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. Material covered by this document is intended for use as high temperature fire, thermal and acoustic insulation for ship hulls, bulkheads, overheads, decks, structural panels, stiffeners, and stanchions. It will be used to retard fire spread between compartments.

6.1.1 High temperature fire insulation equivalency rating. Type II and Type III materials may be substituted for thermal and acoustic insulation materials (see 6.1.1.1 and 6.1.1.2).

6.1.1.1 Thermal insulation. High temperature thermal insulation may be substituted for thermal insulation in accordance with table XI. Substitutions of thermal insulation (specifically, MIL-I-742, Type I) for the equivalent high temperature thermal insulation (Type II), as detailed in this specification, are categorically disallowed.

6.1.1.2 Acoustic insulation. High temperature acoustic insulation may be substituted for acoustic insulation in accordance with table XI. Substitutions of acoustic insulation (specifically, MIL-A-23054; MIL-I-22023, Type III; any high transmission loss treatment) for the equivalent high temperature acoustic insulation (Type III, Classes 1 through 4), as listed in this specification, are categorically disallowed.

TABLE XI. High temperature thermal and acoustic insulation substitutions.

Specified thermal/acoustic insulation	Equivalent high temperature insulation from this specification	
	Type and Class	Thickness (in.)
Thermal insulation MIL-I-742, Type I, 2"	Type II	2.25 maximum
Acoustic insulation MIL-A-23054, 2" MIL-I-22023, Type III, 2" For high transmission loss applications for use in other than machinery spaces, 1.0- pound or 1.5-pound septum, 4" For high transmission loss applications for use in machinery spaces, 1.0-pound or 1.5- pound septum, 4"	Type III, Class 1 Type III, Class 2 Type III, Class 3 Type III, Class 4	2.25 maximum 2.25 maximum 4 maximum 4 maximum

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6.1.2 Painting instructions. The faced material should be primed with one coat of latex emulsion flat primer, conforming to MIL-PRF-24596, in accordance with manufacturer instructions. The finish coat should be one coat of fire-retardant paint conforming to DoD-E-24607 or MIL-PRF-24596.

6.1.3 Installation details. Installation details for this material are contained in MIL-STD-3020. Details for studs and caps are contained in NAVSEA Standard Drawing 803-5184182. For Naval shipboard installation, the assembly with fire insulation and associated attachment method is intended to be shock tested (medium weight, Grade A, in accordance with MIL-S-901) prior to fire resistance testing. This shock test may be incorporated into the fire resistance test method of this specification.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of the specification.
- b. Type (see 1.2).
- c. When a first article sample is required (see 3.1, 4.2, and 6.3).
- d. Dimensions, as required (see 3.3.1).
- e. Inspection conditions (see 4.1.1).
- f. Lot size, if other than specified (see 4.3.2.1).
- g. Sampling for visual examination (see 4.3.2.2.1).
- h. Sampling for tests (see 4.3.2.2.2).
- i. Packaging requirements (see 5.1).
- j. Material Safety Data Sheet (MSDS) requirements (see 6.4).
- k. Toxicity conformance (see 3.2.3 and 6.5).
- l. Off-gassing conformance (see 3.2.4 and 6.6).

6.3 First article. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Material safety data sheets. Contracting officers will identify those activities requiring companies 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 Navy and Marine Corps Public Health Center (NMCPHC) requires sufficient information to permit an HHA of the product. Any questions concerning toxicity and requests for HHA should be addressed to the Commanding Officer, Navy and Marine Corps Public Health Center (NMCPHC), ATTN: Industrial Hygiene Department, 620 John Paul Jones Circle, Suite 1100, Portsmouth, VA 23708-2103. Upon receipt of the HHA, a copy should be provided to the Naval Sea Systems Command, ATTN: SEA 05M2, 1333 Isaac Hull Ave., SE, Stop 5160, Washington Navy Yard, DC 20376-5160 or emailed to commandstandards@navy.mil.

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6.6 Material certification. Materials to be installed in submarines are to be controlled to prevent off-gassing, which contaminates the atmosphere and can result in health hazards to personnel or deleterious effects on machinery. These controls are accomplished through the Submarine Material Control Program, which is described in the Nuclear Powered Submarine Atmosphere Control Manual, NAVSEA S9510-AB-ATM-010 chapter titled "Material Control Program". Under the Submarine Material Control Program, all materials considered for use on submarines require certification and assignment of a usage category. Under the certification process, candidate materials are selected by Navy activities or contractors, and a request for certification is submitted to the Naval Sea Systems Command, SEA 05M2, 1333 Isaac Hull Ave., SE, Stop 5160, Washington Navy Yard, DC 20376-5160 or emailed to commandstandards@navy.mil. The certification request is accompanied by detailed information, including descriptions of the material, method of application, usage, and storage. A chemical analysis is conducted, which is normally accomplished through off-gas testing. The off-gas test is required to be conducted in a Government approved laboratory designated by the preparing activity. Information pertaining to this test requirement may be obtained from the Naval Sea Systems Command, SEA 05M2, 1333 Isaac Hull Ave., SE, Stop 5160, Washington Navy Yard, DC 20376-5160 or emailed to commandstandards@navy.mil. Based on the chemical analysis results, a usage category is assigned to the material defining whether, and to what extent, the material may be used on submarines.

6.7 Subject term (key word) listing.

Acoustical fire insulation

Fire insulation

Thermal fire insulation

6.8 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. 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.

6.9 Additional information. If thermal conductivity, acoustic absorption and/or acoustic transmission loss are voluntarily tested and reported for material types and classes which do not have a requirement for these properties, this additional information may be used by the procuring activity in material selection and application.

6.10 Resistance to vibration. The latest edition of ASTM C592 does not contain the information for supplementary requirements. However, the supplementary requirements section is included in ASTM C592-04.

Custodians:

Army – AV
Navy – SH
Air Force – 99

Preparing Activity:

Navy – SH
(Project 2090-2007-004)

Review Activity:

DLA – CC

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 <http://assist.daps.dla.mil>.