INCH-POUND
MIL-PRF-24699A (SH)
9 November 2004
SUPERSEDING
MIL-A-24699 (SH)
24 February 1988

PERFORMANCE SPECIFICATION

ACOUSTICAL TRANSMISSION LOSS BARRIER MATERIAL

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for two types of acoustical transmission loss barrier material (see 6.1)

1.2 Classification. Material furnished under this specification is one of the types and classes in Table I as specified (see 6.2).

TABLE I. Barrier material.

Type	Description	Class	Nominal maximum surface density (lb/ft^2)
I	Faced lead free barrier material	1	0.75
		2	1.0
		3	1.5
II	Noncombustible barrier material	---	1.0

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, 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.

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.

FEDERAL STANDARDS

FED-STD-191 - Textile Test Methods.

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch or dodssp.daps.dla.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.

U.S. COAST GUARD (USCG)

Specification 164.009 - Incombustible Materials for Merchant Vessels.

(Copies of this document are available from the Commandant (MMT), U.S. Coast Guard Headquarters, 400 Seventh Street, SW, Washington, DC.)

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.)

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

S9510-AB-ATM-010 Rev 2 of 30 July 1992 - Nuclear Powered Submarine Atmosphere Control Manual.

(Copies of this document are available from the Naval Sea Systems Command, Code SEA 05Z9, 1333 Isaac Hull Avenue, SE, Stop 5133, Washington Navy Yard DC 20376-5133.)

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.

AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQC Z1.4 - Sampling Procedures and Tables for Inspection by Attributes. (DoD adopted)

(Copies of this document are available from www.asq.org or American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203.)

ASTM INTERNATIONAL

C 1139 - Standard Specification for Fibrous Glass Thermal Insulation and Sound Absorbing Blanket and Board for Military Applications.
D 638 - Standard Test Method for Tensile Properties of Plastics. (DoD adopted).
D 2261 - Standard Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine). (DoD adopted)
D 2724 - Standard Test Methods for Bonded, Fused, and Laminated Apparel Fabrics. (DoD adopted)
D 3776 - Standard Test Methods for Mass Per Unit Area (Weight) of Fabric. (DoD adopted)
D 5035 - Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method). (DoD adopted)
E 90 - Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements. (DoD adopted)
E 162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source. (DoD adopted)
E 662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials. (DoD adopted)
E 1123 - Standard Practices for Mounting Test Specimens for Sound Transmission Loss Testing of Naval and Marine Ship Bulkhead Treatment Materials.

(Copies of these documents are available from 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.

3.2 Material. Barrier materials shall be fabricated without the use of any type of asbestos.

3.2.1 Type I. Type I barrier material shall consist of a flexible layer with a woven outer facing. Type I barrier material shall be fabricated without the use of lead.

3.2.2 Type II. Type II barrier material shall consist of a flexible, noncombustible layer.

3.3 Dimensions and quantities.

3.3.1 Width of rolls (type I). Type I barrier material shall be fabricated in rolls. The width of the rolls shall be 26, 38, or 48 inches or as specified (see 6.2).

3.3.2 Quantity of pieces per roll (type I). The quantity of pieces per roll shall not exceed the values in Table II.

TABLE II. Quantity of pieces per roll (type I).

Class	Maximum quantity of pieces per roll
1	3
2	3
3	2

3.3.3 Size of panels (type II). Type II barrier material shall be fabricated in panels which shall be 3 feet by 4 feet or 3 feet by 8 feet or as specified (see 6.2).

3.3.4 Tolerance. The tolerance for dimensions of type I and type II barrier material shall not exceed plus or minus 1/4 inch.

3.4 Surface density and weight.

3.4.1 Surface density. Nominal values for surface density shall not exceed the values shown in Table III. The surface density of individual samples may vary within a tolerance of plus or minus 10 percent of the nominal density.

TABLE III. Nominal surface density.

Nominal surface density (lb/ft^2)			
Type I, class 1	Type I, class 2	Type I, class 3	Type II
0.75	1.0	1.5	1.0

3.4.2 Weight of rolls (type I). The weight per roll shall be 100 pounds plus or minus 10 percent.

3.5 Breaking force. Breaking force shall be as specified in Table IV.

TABLE IV. Minimum breaking force.

	Warp breaking force (lb/in)	Fill breaking force (lb/in)
Type I	400	300
Type II	400	300

3.6 Tearing strength (type I only). Minimum tearing strength shall be as specified in Table V.

TABLE V. Tearing strength.

	Warp tear strength (lb)	Fill tear strength (lb)
Type I	50	40

3.6.1 Rivet and grommet load bearing strength. Load bearing strength shall be not less than the values specified in Table VI.

TABLE VI. Rivet and grommet load bearing strength.

	Pounds of pull
Type I	180
Type II	180

3.7 Flexural rigidity. Flexural rigidity values shall not exceed the values in Table VII. In addition, the barrier material shall show no visible rupture or cracking on the outer or inner surfaces during and following the test.

TABLE VII. Maximum flexural rigidity.

°F	Inch-pounds
45	1.0
133	0.3

3.8 Peel strength (type I). Woven outer facing 180 degree peel strength shall be in accordance with Table VIII.

TABLE VIII. Minimum woven outer facing peel strength.

	Warp (lb/in)	Fill (lb/in)
Type I	4	2

3.9 Fire resistance. Fire resistance shall be as specified below.

3.9.1 Flammability (type I). Materials shall provide a flame spread index of 30 or less.

3.9.2 Smoke density (type I). Materials shall not exceed the smoke density limits specified in Table IX .

TABLE IX. Smoke density (type I).

Class	Rating
1	300
2	350
3	450

3.9.3 Noncombustibility (type II). Type II barrier material shall be noncombustible.

3.10 Sound transmission loss. Sound transmission loss shall be as specified below.

3.10.1 Type I material. Sound transmission loss values of type I barrier material in decibels (dB) shall be not less than the minimum values specified in Tables X, XI, and XII.

TABLE X. Minimum sound transmission loss values in dB for type I, class 1.

One-third octave band center frequency in Hz																		
Hz	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
dB	13	10	10	13	14	15	17	19	21	22	25	26	28	30	32	33	35	37

TABLE XI. Minimum sound transmission loss values in dB for type I, class 2.

One-third octave band center frequency in Hz																		
Hz	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
dB	12	12	12	14	16	17	19	21	23	24	26	28	30	32	34	36	38	39

TABLE XII. Minimum sound transmission loss values in dB for type I, class 3.

One-third octave band center frequency in Hz																		
Hz	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
dB	15	14	14	18	19	20	22	24	27	28	31	32	33	36	38	40	42	43

3.10.2 Type II material. Sound transmission loss values of type II barrier material in decibels shall be not less than the minimum values specified in Table XIII.

TABLE XIII. Minimum sound transmission loss values in dB for type II.

One-third octave band center frequency in Hz																		
Hz	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
dB	15	12	18	28	34	39	43	45	50	53	56	57	57	58	60	65	67	69

3.11 Toxicity. When evaluated in accordance with 4.4.9, the barrier material shall have no adverse effect on the health of personnel when used for its intended purpose and shall not cause any environmental problems during waste disposal (see 4.4.9 and 6.5).

3.12 Workmanship. The material shall be free of cracks, scratches, dents, imbedded particles, broken edges or corners, and other defects which could affect serviceability.

3.13 Off-gassing. The barrier material shall meet the requirements in the Nuclear Powered Submarine Atmosphere Control Manual, NAVSEA Technical Manual S9510-AB-ATM-010 Rev 2, for a usage category of Limited (see 4.4.10 and 6.6).

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 the test conditions specified herein

4.2 First article inspection. First article inspection shall consist of the tests specified in 4.4 as outlined in Table XIV.

TABLE XIV. First article inspection.

Inspection	Requirement paragraph	Test paragraph
Dimensions and quantities		
Width of rolls (type I)	3.3.1	4.4.1
Quantity of pieces per roll (type I)	3.3.2	4.3.2.1
Size of panels (type II)	3.3.3	4.4.1
Surface density and weight		
Surface density	3.4.1	4.4.2.1
Weight of rolls (type I)	3.4.2	4.4.2.2
Breaking force	3.5	4.4.3
Tearing strength (type I)	3.6	4.4.4
Rivet and grommet load bearing strength	3.6.1	4.4.4.1
Flexural rigidity	3.7	4.4.5
Peel strength (type I)	3.8	4.4.6
Fire resistance		
Flammability (type I)	3.9.1	4.4.7.1
Smoke density (type I)	3.9.2	4.4.7.2
Noncombustibility (type II)	3.9.3	4.4.7.3
Sound transmission loss		
Type I material	3.10.1	4.4.8.1
Type II material	3.10.2	4.4.8.2
Toxicity	3.11	4.4.9
Workmanship	3.12	4.3.2.1
Off-gassing	3.13	4.4.10

4.2.1 Lot. A lot shall consist of all finished material of one size produced in a continuous run (or at the same time and under the same conditions) and offered for delivery at one time.

4.2.2 The tests specified in 4.4.7, 4.4.8 and 4.4.9 need only be conducted for one of the following reasons:

a. If within a 3-year period preceding the date of the invitation for bids, the material has not been tested and found in conformance to 3.9, 3.10, and 3.11, respectively, or

b. If the material offered for delivery is not manufactured the same in all respects as that previously tested.

4.3 Conformance inspection. Conformance inspection shall be in accordance with Table XV and 4.3.2.

TABLE XV. Conformance inspection.

Inspections	Requirement paragraph	Test paragraph
Group A		
Dimensions and quantities		
Width of rolls (type I)	3.3.1	4.4.1
Quantity of pieces per roll (type I)	3.3.2	4.3.2.1
Size of panels (type II)		
Surface density and weight	3.3.3	4.4.2
Surface density	3.4.1	4.4.2.1
Weight of rolls (type I)	3.4.2	4.4.2.2
Workmanship	3.12	4.3.2.1
Group B		
Breaking force	3.5	4.4.3
Tearing strength (type I)	3.6	4.4.4
Rivet and grommet load bearing strength	3.6.1	4.4.4.1
Flexural rigidity	3.7	4.4.5
Peel strength (type I)	3.8	4.4.6

4.3.1 Lot. A lot shall consist of all finished material of one size produced in a continuous run (or at the same time and under the same conditions) and offered for delivery at one time. The sampling unit shall be one roll or panel.

4.3.2 Sampling.

4.3.2.1 Sampling for visual and dimensional examination. For visual and dimensional examination (group A of Table XV), a random sample shall be selected from each lot in accordance with ASQC Z1.4 at inspection level I. Each of the samples taken shall be subjected to surface examination for quantity of pieces per roll and workmanship (see Table XVI). Any defects detected during the inspection shall be cause for rejection.

Table XVI. Classification of defects.

Examine	Defect	Major	Minor
End item	Length and width not as specified.		X
	Cracks, scratches, dents, imbedded particles.	X	
	Broken edges or corners (type II)	X	
	Damage or defects affecting function or serviceability.	X	
	Excessive quantity of pieces per roll.	X	

4.3.2.2 Sampling for conformance tests. For quality conformance inspection requiring tests (group B of Table XV), a random sample shall be selected from each lot in accordance with ASQC Z1.4, level S-2. Any defects detected during the inspection shall be cause for rejection.

4.3.2.3 Nonconformance. If a sample fails to pass group B inspection, the contractor shall notify the qualifying activity and 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 and which were manufactured under 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 acceptable to the contracting activity has been taken. After the corrective action has been taken, group B inspection shall be repeated on additional sample units (all tests and examinations, or the test which the original sample failed at the option of the qualifying activity). Group A inspections may be reinstituted; however, final acceptance and

shipment will be withheld until group B inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the contracting activity.

4.4 Tests.

4.4.1 Dimensions. Width of rolls and size of panels shall be determined by using a steel rule calibrated in 1/16-inch graduations (see 3.3.1 and 3.3.3).

4.4.2 Surface density and weight.

4.4.2.1 Surface density. Surface density shall be determined in accordance with ASTM D 3776 (see 3.4.1).

4.4.2.2. Weight of rolls. Weight shall be determined by using a scale with a capacity and sensitivity sufficient to weigh the entire item. The accuracy of the scale shall be certified by a recognized authority (see 3.4.2).

4.4.3 Breaking force. Breaking force shall be determined in accordance with ASTM D 5035 (see 3.5).

4.4.4 Tearing strength. Tearing strength shall be determined in accordance with ASTM D 2261 (see 3.6).

4.4.4.1 Rivet and grommet load bearing strength. Strength shall be determined using test procedures described in ASTM D 638. Test specimens shall be prepared as follows: test specimens shall be 3 inches wide and 7 inches long. Brass grommets (1/2 inch inside diameter by 1 inch outside diameter) shall be placed on the width center, 1-1/2 inches from material ends. The two grommeted ends are attached to steel hooks mounted in the tension tester jaws so that the steel hooks pass through the grommet eyelets. The tension tester is driven at a rate of 20 inches per minute and the tear-out force of the grommets in pounds of pull is recorded (see 3.6.1).

4.4.5 Flexural rigidity. Flexural rigidity shall be determined in accordance with FED-STD-191, test method 5206 at 45 degrees Fahrenheit ($^{\circ}$F) and 133°F (see 3.7).

4.4.6 Peel strength. Peel strength shall be determined in accordance with ASTM D 2724 (see 3.8).

4.4.7 Fire resistance.

4.4.7.1 Flammability. Flammability shall be determined in accordance with ASTM E 162 (see 3.9.1), with the barrier material sample positioned so the woven facing faces the heat source.

4.4.7.2 Smoke density. Smoke density shall be determined in accordance with ASTM E 662 (see 3.9.2).

4.4.7.3 Noncombustibility. Type II materials shall be tested for noncombustibility in accordance with USCG 164.009 (see 3.9.3).

4.4.8 Sound transmission loss.

4.4.8.1 Type I material. Transmission loss for type I barrier material shall be tested in accordance with ASTM E 90 (see 3.10.1).

4.4.8.2 Type II material. Type II barrier material shall be tested in accordance with ASTM E 90, except as follows: the type II barrier material shall be mounted to a base layer of 2-inch thick, fibrous glass panel in accordance with ASTM C 1139 type II grade 6 and installed on a bulkhead as specified in ASTM E 1123 (see 3.10.2). Installation of the type II barrier material shall be in accordance with ASTM E 1123, except for the stud

installation pattern. The studs shall be installed such that they are aligned in rows and columns in a rectangular pattern, 12 inches apart and 6 inches from the seams in the barrier material.

4.4.9 Toxicity. The barrier material shall be evaluated by the Navy Environmental Health Center (NAVENVIRHLTHCEN) using the administrative Health Hazard Assessment (HHA). A flowchart for this process can be found as enclosure (1) of BUMEDINST 6270.8. The HHA is a review of the barrier material based on information submitted by the manufacturer, to assess health hazards associated with the handling, application, use and removal of the product. Sufficient data to permit a HHA of the product shall be provided by the manufacturer/distributor to the NAVENVIRHLTHCEN. To obtain current technical information requirements specified by the NAVENVIRHLTHCEN, see 6.5.

4.4.10 Off-gassing. The barrier material shall be tested in accordance with the Nuclear Powered Submarine Atmosphere Control Manual, NAVSEA Technical Manual S9510-AB-ATM-010 Rev 2, by a Government approved testing facility. The results shall be submitted to the Government for evaluation and approval for use (see 3.13 and 6.6).

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. Barrier materials furnished under this specification are intended for application to plane and curved ship structures and machinery surfaces in order to attenuate airborne noise. Type I barrier material (see 1.2) is primarily used as the top or middle layer of thermal, acoustic, or fire insulation materials which are attached to the deck, bulkhead, overhead, ducting, or machinery casing surfaces. Standard application details are contained in Naval Sea Systems Command (NAVSEA) drawings 804-5773931 and 804-5773932. The type II barrier material (see 1.2) is intended as a middle layer (sandwich) component of composite treatments, and uses an insulation material for the lower layer and a faced panel or metal sheathing as the upper layer. Type II barrier material is used when Coast Guard approval is required. Type I and type II barrier materials are specified in sizes that are convenient and economical for shipboard installation. The barrier materials are cut and fit to irregular shapes and the sizes are selected to minimize waste and allow handling by installation personnel.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of the specification.
b. Type and class required (see 1.2).
c. When first article inspection is required (see 3.1 and 4.2).
d. Width of type I rolls (see 3.3.1).
e. Size of type II panels (see 3.3.3).
f. Is off-gas testing required? (see 3.13).
g. Packaging requirements (see 5.1).
h. Is Material Safety Data Sheet required? (see 6.4).
i. Toxicity conformance (see 3.11 and 6.5).

6.3 Fabrication. There are many material combinations that potentially could meet the requirements of this document. Two possible material combinations are as follows. Type I barrier material may consist of barium sulfate-loaded vinyl with fibrous glass cloth facing. Type II barrier material may consist of wire screen mesh, hot roll bonded to lead sheathing. However, if barrier materials are fabricated from these components, there is no assurance that they will meet all the requirements of this document.

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 Off-gassing. Materials to be installed in submarines are to be controlled to prevent off-gassing, which contaminates the atmosphere and results 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 Technical Manual S9510-AB-ATM-010 Rev 2. 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 Commander, Naval Sea Systems Command, ATTN: SEA 05Z9, 1333 Isaac Hull Ave., SE, Stop 5122, Washington Navy Yard DC 20376-5122. The certification request is accompanied by detailed information, including descriptions of the material. 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 Commander, Naval Sea Systems Command, ATTN: SEA 05Z9, 1333 Isaac Hull Ave., SE, Stop 5160, Washington Navy Yard, DC 20376-5160. 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.

Breaking strength
Flex stiffness
Peel strength
Surface density
Tearing strength
Warp

6.8 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.

Preparing activity:
Navy - SH
(Project 5640-N001)

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.