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MIL-PRF-2819F
7 October 1975
SUPERSEDING
MIL-I-2819E
9 November 1967
(See 6.7)

PERFORMANCE SPECIFICATION

INSULATION BLOCK, THERMAL

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

1. SCOPE

1.1 Scope. This specification covers thermal insulation block for use on machinery and equipment at surface temperatures up to the approximate limits for the classes specified.

1.2 Classification. Thermal block insulation shall be of the following classes as specified (see 6.2):

Class 2 - Temperatures up to 1,200° Fahrenheit (°F)

Class 3 - Temperatures up to 1,500°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

SS-C-160 - Cements, Insulation, Thermal.
PPP-8-636 - Boxes, Shipping Fiberboard.

MILITARY

MIL-P-2861 - Cement, Insulation, High Temperature.

STANDARDS

FEDERAL

FED-STD-123 - Marking for Domestic Shipment (Civilian Agencies).

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-1623 - Fire Performance Requirements and Approved Specification for Interior Finish Materials and Furnishings (Naval Shipboard Use).

(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.

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules.

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, Illinois 60606)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

C 165 - Compressive Strength of Preformed Block-Type Thermal Insulation, Test for.
C 177 - Thermal Conductivity of Materials by Means of the Guarded Hot Plate, Test for.
C 203 - Breaking Load and Calculated Flexural Strength of Preformed Block-Type Insulation, Test for.

REL-1-28197

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) (con.).

- C 303 - Density of Performed Block-Type Thermal Insulation, Test for.
- C 356 - Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat, Test for.
- C 411 - Hot-Surface Performance of High-Temperature Thermal Insulation, Test of.
- C 421 - Mechanical Stability of Preformed Thermal Insulation by Tumbling, Test for.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION INCORPORATED, AGENT
National Motor Freight Classification Rules.

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., 1616 P Street, N.W., Washington D.C. 20036.)

(Technical society and technical association specifications and standards are generally available reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Qualification. The insulation block furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.4).

3.2 Material. The insulation block shall be composed of asbestos-free, heat-resisting compounds suitable for the temperature conditions and the purpose intended. A certificate of compliance shall be required (see 6.2.2).

3.3 Dimensions and Tolerances.

3.3.1 Dimensions. Insulation shall be furnished in block form in 18-inch length by 3-inch width or 36-inch length by 6- or 12-inch width (see 6.2). Blocks shall be furnished in thicknesses of 1, 1-1/2, 2, 2-1/2, 3, 3-1/2, or 4 inches (see 6.2).

3.3.2 Tolerances. A tolerance of plus or minus 1/8 inch in length, plus or minus 1/16 inch in width and thicknesses will be permitted.

3.4 Physical requirements. The insulation block shall conform to the physical requirements shown in table I.

Table I - Physical requirements.

Properties	Class 2	Class 3
Density, lb/ft ³ , maximum	14.0	22.0
Compressive strength, at not more than 5 percent deformation min lb/in ²	50.0	50.0
Weight loss by tumbling, loss in weight, percent maximum		
After first 10 minutes	20.0	45.0
After second 10 minutes	40.0	75.0
Flexural strength	1/	1/
Change under soaking heat, 6 hours at °F	1,200	1,500
Linear shrinkage, percent, maximum	2.0	2.0
Thermal conductivity, Btu/hr. ft. deg. F max., at a mean temperature of		
200°F	0.42	----
300°F	0.45	----
400°F	0.50	----
500°F	0.60	0.66
600°F	0.65	0.71
700°F	0.70	0.76
750°F	----	----
1000°F	----	----

^{1/}Three times density (lb/ft³) of the sample tested.

3.5 Simulative performance. Insulation blocks shall be in satisfactory condition upon completion of the test specified in ASTM C 411; except that test duration at specified temperature shall be 30 days.

3.6 Fire resistance and smoke density. The finished material shall conform to the fire resistance and smoke density requirements set forth in MIL-STD-1623 (see 4.5.9).

3.7 Compatibility (class 2 only). The block insulation shall be compatible with high temperature thermal cement MIL-C-2861 and thermal insulation cement of SS-C-160 type III, grade F. Without the application of a primer, the cements must readily adhere to the Class 2 insulation blocks and form a smooth, protective surface which will not separate under force of gravity, vibration or accidental mechanical force such as bumping or jarring. Drying time for each cement after application shall not exceed one hour.

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 in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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 Classification of inspection. The inspection requirements specified herein are classified as follows:

- (a) Qualification inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).

4.3 Qualification tests. Qualification tests shall be conducted at a laboratory satisfactory to the Naval Ship Engineering Center. Qualification tests shall consist of all the tests specified in 4.5.

4.3.1 Sampling for qualification tests. Three samples shall be tested for the tests specified in 4.5.2, 4.5.3, 4.5.4 (class 2 only), 4.5.5, and 4.5.6; two samples shall be tested for the tests specified in 4.5.7, 4.5.9 and 4.5.10 (class 2 only). One sample shall be tested for the tests specified in 4.5.8 and 4.5.10 (class 2 only). The average test results shall be within the limits specified in table I and the individual test results shall not exceed these limits by more than 10 percent.

4.4 Quality conformance inspection.

4.4.1 Sampling for quality conformance inspection. For purposes of sampling, an inspection lot shall consist of all block insulation of the same class, produced under similar conditions and procured at one time.

4.4.1.1 Examination of the end item. Examination of the end item shall be made in accordance with 4.4.1.1.1 through 4.4.1.1.3. The lot size, for determining the sample size in accordance with MIL-STD-105, shall be in units of insulation block (see 4.4.1.1.1 and 4.4.1.1.2) and units of shipping containers (see 4.4.1.1.3).

4.4.1.1.1 Examination of the end item for defects in appearance and workmanship. The sample unit for the following examination shall be one insulation block. The inspection level for determining the sample size shall be level I, with an acceptable quality level (AQL) of 2.5 percent defective.

Categories	Defect
Critical	
01	Classification Class not as specified
Major	
101	Appearance and workmanship
102	Cracked, broken, or damaged.
103	Bad edges.
104	Excessive voids.
	Warped.
Minor	None defined

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4.4.1.1.2 Examination of the end item for defects in dimensions. The sample unit for the following examination shall be one block. The inspection level for determining the sample size, shall be inspection level I, with an AQL of 2.5 percent defective.

Critical	Defect
Critical	None defined
Major 101	Length, width, and thickness Not within limits or tolerance specified, or by contract requirement.
Minor	None defined

4.4.1.1.3 Examination for preparation for delivery. An examination shall be made to determine that the packing and markings comply with the requirements of section 5 of this specification. The sample unit for the following examination shall be one shipping container, selected just prior to closing operation. The inspection level for determining the sample size shall be level I, with an AQL of 2.5 percent defective. Shipping containers, fully prepared for delivery, shall be examined for closure defects.

Categories	Defect
Critical	None defined
Major 101 102 103 104 105 106	Packing Not as specified. Container not as specified, closures not accomplished by specified or required methods of material. Any nonconforming component, component missing, damaged or otherwise defective. Count No. of blocks per container less than specified or indicated quantity. Weight Gross or net weight exceeds specified requirements. Markings Omitted, illegible, incorrect, incomplete, or not as specified (see 5.2).
Minor	None defined

4.4.2 Sampling for tests. The lot size shall be the number of blocks in the lot. The sample size shall be the number of specimens subjected to each test. For tests 4.5.2, 4.5.3, and 4.5.5, the sample size shall be as specified by table II. For tests 4.5.4 (class 2 only) and 4.5.6, the sample size shall consist of three specimens per lot for lots over 160, and the number of allowable test failures shall be zero. For lots under 160, tests 4.5.4 (class 2 only) and 4.5.6 are not required.

Table II - Sampling for tests.

Lot size in blocks	Sample size = Number of test specimens for each test (4.5.2, 4.5.3, and 4.5.5)	Number of specimen failures allowed for each test
Up to 63	None	-
64 to 160	2	0
161 to 400	3	0
401 to 1,000	5	0
1,001 to 2,500	8	0
2,501 to 6,300	13	1
6,301 to 16,000	20	2
16,001 to 40,000	32	3

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4.4.2.1 Testing of end item. The end item shall be tested for the applicable characteristic as specified in table III from each lot presented. The sample unit shall be one block. Samples shall be selected throughout the lot (see 4.4.2).

Table III - Instruction for testing.

Characteristic	Specification reference		Number determinations per unit	Results reported as numerically to nearest 1/
	Requirement	Test method		
Density	3.4	4.5.2	1	0.1 lb/ft ³
Compressive strength	3.4	4.5.3	1	lb/in ²
Weight loss by tumbling	3.4	4.5.4	1	1 percent
Flexural strength	3.4	4.5.5	1	lb/in ²
Changes under soaking heat				
Linear shrinkage	3.4	4.5.6	1	0.1 percent

Test reports shall include all values on which results are based.

4.5 Test procedures.

4.5.1 Conditioning samples. Test specimens shall be conditioned by drying to constant weight in an oven at a temperature of 215°F to 250°F preceding a test.

4.5.2 Density. The density shall be determined in accordance with the method specified in ASTM C 303.

4.5.3 Compressive strength. The compressive strength shall be determined in accordance with the method specified in ASTM C 165.

4.5.4 Weight loss by tumbling (class 2 only). Weight loss by tumbling shall be determined in accordance with the method specified in ASTM C 421.

4.5.5 Flexural strength. The flexural strength shall be determined in accordance with ASTM C 203.

4.5.6 Physical changes under soaking heat. Specimens shall be measured. Then the specimens shall be placed in an electrically heated oven and subjected to the maximum temperature for the respective class for 6 hours for linear shrinkage. The specimens shall be removed from the oven and tested to determine linear shrinkage in accordance with the method specified in ASTM C 356.

4.5.7 Thermal Conductivity. Conductivity shall be determined in accordance with the method specified in ASTM C 177.

4.5.8 Simulative performance. Simulative performance shall be determined in accordance with the method specified in ASTM C 411, except the plate shall be maintained at the maximum temperature for the respective class for 30 days.

4.5.9 Fire resistance and smoke density. Specimens shall be tested in accordance with test procedures and requirements set forth in MIL-STD-1623.

4.5.10 Compatibility (for class 2 only). A 6- by 6-inch block, 1-1/2 inches thick, shall be uniformly surface coated, while at room temperature, with approximately a 1/4-inch layer of finishing cement in accordance with type III, grade F of SS-C-160. Drying time under ambient air temperature conditions shall be determined. This test shall be repeated with a second block using a cement in accordance with MIL-C-2861. The drying time for this cement shall also be determined.

5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements.)

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5.1 Level C packaging. Unless otherwise specified (see 6.2), the insulation blocks shall be packaged to afford protection against deterioration and damage during shipment from the supply source to the first receiving activity for immediate use. The suppliers normal retail packaging methods may be utilized when such meets the requirements of this level.

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

5.2.1 Level A. Insulation block, packaged as specified (see 6.2), shall be packed in containers conforming to class weather-resistant of PPP-B-636. Boxes shall be closed, waterproofed and reinforced in accordance with Method V of the appendix to the box specification.

5.2.2 Level B. Insulation block, packaged as specified (see 6.2), shall be packed in containers conforming to class domestic of PPP-B-636. Box closure shall be in accordance with Method II of the appendix to the box specification.

5.2.3 Level C. Block insulation, packaged as specified (see 6.2), shall be packed in containers of type, size, and kind commonly used for the purpose in a manner which will insure acceptance and safe delivery at destination. Shipping containers shall comply with the Uniform Freight or National Motor Freight Classification Rules or other regulations as applicable to the mode of transportation.

5.3 Marking.

5.3.1 Civil agencies. In addition to any special marking required (see 6.2), interior packages and exterior shipping containers shall be marked in accordance with FEI-STD-123.

5.3.2 Military agencies. In addition to any special marking required (see 6.2), interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129.

5.3.3 Special marking. Packages and shipping containers shall be marked "ASBESTOS-FREE" (see 6.2).

6. NOTES

6.1 Intended use. For thermal insulation of machinery and equipment operating to 1200°F surface temperature for class 2 and to 1500°F for class 3.

6.2 Ordering data. Procurement documents should specify:

6.2.1 Procurement requirements:

- (a) Title, number, and date of this specification.
- (b) Class required (see 1.2).
- (c) Thickness, width, and length required (see 3.3).
- (d) Packaging other than specified (see 5.1).
- (e) Level of packing required (see 5.2).
- (f) Special marking required (see 5.3.1, 5.3.2, and 5.3.3).

6.2.2 Contract data requirements. When this specification is used in a procurement invoking the data requirement clause of the Armed Services Procurement Regulations (ASPR) paragraph 7-104.9(n) and which incorporates a DS Form 1123 Contract Data Requirements List (CDRL), the data requirements identified below will be developed as specified in the cited Data Item Description (DID) and delivered in accordance with such CDRL. When the ASPR provisions are not invoked, the data specified below shall be delivered in accordance with the contract requirements.

<u>Specification paragraph</u>	<u>Data requirements</u>	<u>Service</u>	<u>Applicable DID</u>	<u>Options</u>
3.2	Certificate of compliance	SH	DI-E-2121	---

(Copies of DID's required by the supplier in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.)

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6.3 Commercial sizes. Commercial sizes and thicknesses of block insulation covered by this specification are industry standards. Other sizes and thicknesses may be obtained upon request.

6.4 With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in applicable Qualified Products List QPL-2819 whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Ship Engineering Center, Prince George's Center, Center Building, Hyattsville, Maryland 20782, and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.5).

6.5 Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

6.6 Classes 1 and 2 of MIL-I-2819E were combined, and class 4 of MIL-I-2819E was deleted. Class 3 is recommended for use in place of class 4 in Boilers.

6.7 THE MARGINS OF THIS SPECIFICATION ARE MARKED "+" TO INDICATE WHERE CHANGES (ADDITIONS, MODIFICATIONS, CORRECTIONS, DELETIONS) FROM THE PREVIOUS ISSUE HAVE BEEN MADE. 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 AND RELATIONSHIP TO THE LAST PREVIOUS ISSUE.

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Preparing activity:

Navy - SH
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