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Closure shall be accomplished by metal stitching, by suitable adhesive applied to the entire area of contact between flaps or by a combination of these methods.

"G-1b. *For overseas shipment.*—The subject commodity shall be packed in clented plywood or nailed wood boxes conforming to the requirements of Joint Army-Navy Specifications JAN-P-105 and JAN-P-106, respectively. Each box shall be lined with a sealed waterproof bag made from material conforming to the requirement of Joint Army-Navy Specification JAN-P-125. The seams and closures shall be sealed with adhesive conforming to the requirements of Joint Army-Navy Specification JAN-P-140. The gross weight shall not exceed approximately 400 pounds.

"G-1c. *For domestic or overseas shipment.*—Containers shall be of uniform size, and shall contain the identical number of items of one size and class. Containers shall be designed to fit the contents in a compact manner without shifting, and shall be of a design and strength which will protect the contents from rough handling in transit and storage.

"G-2. *Marking.*—In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with the requirements of the Navy Shipment Marking Handbook."

Page 5, paragraphs H-3 to H-5, inclusive: Delete and substitute:

"H-3. *QUALIFICATION (TYPE OR BRAND APPROVAL).*—IN THE PROCUREMENT OF MATERIALS REQUIRING QUALIFICATIONS (TYPE OR BRAND APPROVAL) THE RIGHT IS RESERVED TO REJECT ANY BIDS ON BRANDS OR TYPES OF MATERIAL WHICH HAVE NOT BEEN SUBJECTED TO THE REQUIRED TESTS AND FOUND SATISFACTORY FOR INCLUSION ON THE NAVY DEPARTMENT ACCEPTABLE LIST OF APPROVED MATERIALS. THE ATTENTION OF SUPPLIERS IS CALLED TO THIS REQUIREMENT AND MANUFACTURERS ARE URGED TO COMMUNICATE WITH THE BUREAU OF SUPPLIES AND ACCOUNTS AND ARRANGE TO HAVE THE SAMPLES OF THE TYPE OR BRANDS OF MATERIALS THEY PROPOSE TO OFFER TO THE NAVY IN THE FUTURE TESTED FOR APPROVAL IN ORDER THAT THEY MAY BE ELIGIBLE TO BE AWARDED CONTRACTS OR ORDERS.

"H-4. Copies of Navy Department specifications, Joint Army-Navy specifications, and the Navy Shipment Marking Handbook may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington 25, D. C., except that activities of the Armed Forces should make application to the Supply Officer in Command, Naval Supply Center, Norfolk 11, Va. When requesting specification, refer to both title and number (or symbol)."

SHOST.

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NAVY DEPARTMENT SPECIFICATION

INSULATION, THERMAL, BLOCK

A. APPLICABLE SPECIFICATIONS.

A-1. The following Navy Department specifications, of the issue in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies:

General Specifications for Inspection of Material.
39P10—General specification for packaging and packing for overseas shipment.
53B11—Boxes, fiberboard, corrugated and solid.

B. CLASSES.

B-1. Thermal block insulation covered by this specification shall be furnished in the following classes, as specified in the contract or order (see par. H-2):

Class a—Temperatures up to 500° F.
Class b—Temperatures 501° to 1,000° F.
Class c—Temperatures 1,000° to 1,500° F.

C. MATERIAL AND WORKMANSHIP.

C-1. *Material.*—Thermal block insulation shall be composed of heat-resisting compounds suitable for the temperature conditions and for the purpose intended.

C-2. *Workmanship.*—The constituents shall be thoroughly and evenly mixed.

D. GENERAL REQUIREMENTS.

D-1. *Composition.*—The composition of block insulation shall conform in all respects to that of the sample upon which type or brand approval is based. (See par. F-3a.)

D-2. *Dimensions.*—Block insulation shall be flat and rectangular. Unless otherwise specified, the dimensions shall be as follows, as required:

Width—3 or 6 inches.
Length—18 or 36 inches.
Thickness—as specified.

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D-3. *Tolerance.*—A tolerance in dimensions will be permitted, as follows: Length, minus none, plus ¼ inch. Width and thickness, minus none, plus 1/8 inch.

D-4. *Stability.*—Block insulation shall pass the test described in paragraph F-3a (3).

E. DETAIL REQUIREMENTS.

E-1. *Physical characteristics.*—Thermal block insulation shall conform to the physical requirements shown in Table I.

TABLE I.—*Physical requirements*

	Class a	Class b	Class c
Density, lbs./cu. ft.	15.00	23.00	27.00
Thermal conductivity, B. t. u./sq. ft./hr./degree F. temperature difference at a mean temperature of:			
300° F. (max.)	.88		
550° F. (max.)		.66	
800° F. (max.)			.76
Hardness, as received, mm penetration (max.)	1.15	.95	.75
Resistance to abrasion, loss in weight, (max.):			
After first 10 minutes	40 00	30.00	40 00
After last 10 minutes	70 00	50.00	60 00
Modulus of rupture lbs./sq. inch (min.)	(1)	(1)	(1)
Change under soaking heat, 6 hours at	800° F.	1,000° F.	1,500° F.
Hardness by plastometer mm. (max.)	1.40	1.15	.90
Loss in weight, percent (max.)	18 00	12 00	10 00
Linear shrinkage percent (max.)	2.00	5 00	5 00
Moisture absorption, percent (max.) by volume	1.00	3.00	3 00

(1) 3 times the density in lbs./cu. ft.

F. METHODS OF SAMPLING, INSPECTION, AND TESTS.

F-1. *Sampling.*—From each lot of 5,000 pieces, or less, offered for delivery, two pieces shall be selected by the naval inspector and forwarded to the Engineering Experiment Station, Annapolis, Md., at the expense of the contractor, for test purposes. Each sample shall be properly marked with the contractor's name, brand name, class, and contract or order number.

F-2. *Inspection (at place of manufacture).*—Inspection for workmanship, dimensions, and density shall be made by the naval inspector. For density, several lengths shall be selected, the dimensions checked, and the weight per cubic foot determined.

F-3. *Tests.*—

F-3a. *Type or brand approval tests.*—

F-3a (1). *Composition.*—The composition shall be determined by chemical analysis, using accepted laboratory methods.

F-3a (2). *Thermal conductivity.*—The sample shall be such as to provide specimens in the form of disks 8 inches in diameter by 1 inch thick. Conductivity shall be determined on a guarded hot-plate apparatus at several temperatures on the hot side between 300° and 600° F. for class a, 450° and 1,100° F. for class b, and 450° and 1,600° F. for class c.

F-3a (3). *Stability.*—The test for determining ability of the material to withstand vibration while subjected to temperature shall be conducted on two blocks, mounted on the faces of an electrical heater plate. The ends of the heater plate shall be insulated with cut sections of the material and the entire assembly shall be fitted and mounted with a 1/16-inch-thick sheet-iron casing. The casing shall be mounted in a vertical position on a vibration test apparatus. Five iron-constantan thermocouples shall be equally spaced and secured in each face of the heater plate and the outer surfaces of the metal casing, to afford a means of ascertaining the inner and the exposed temperature of the assembly. During the test the material shall be subjected to 720 vibrations per minute through an arc of 15 minutes for a period of 100 to 400 hours of operation. At the end of each 100 hour period of operation, the outer metal casing of the assembly shall be removed and the condition of the blocks noted.

F-3a (4). *Hardness.*—Hardness shall be determined on the pinstometer, a commercial instrument consisting mainly of two parallel metal disks supported on uprights to which are fastened a thin rod with a 1/8-inch-diameter ball point, a measuring gage graduated in 1/100 millimeter divisions, and a kilogram weight. A specimen of the material to be tested shall be placed under the instrument and the 1/8-inch ball point brought down on the surface of the specimen until the index hand of the measuring gage makes two complete revolutions. The kilogram weight shall then be slowly released from its supporting disk and allowed to rest on a shoulder of the ball point holder, causing the ball point to sink into the specimen. The depth that the ball point is depressed into the specimen shall then be read on the graduated measuring gage dial to 1/100 of a millimeter.

F-3a (5). *Abrasion test.*—The structural strength shall be determined by an abrasion test. Twelve 1-inch cube specimens of the material and twenty-four 3/4-inch oak cubes (specific gravity of the wood 0.65) shall be placed in an oak box having inside dimensions of 7 1/2 by 7 3/4 by 7 3/4 inches. The opening of the box shall then be closed and rotated about its own axis at a speed of 60 revolutions per minute for two 10-minute periods. At the end of each 10-minute period, the cubes of the material shall be removed from the box and the percentage loss in weight, due to pulverization and breakage, shall be determined.

F-3a (6). *Heating loss and shrinkage.*—Carefully sized specimens shall be placed in an electrically heated oven. For class a, specimens shall be heated at 500° F. for 6 hours. For class b, specimens shall be heated at 1000° F. for 6 hours. For class c, specimens shall be heated at 1,500° F. for 6 hours. After removal from the oven the specimens shall be examined to determine loss of weight, linear shrinkage, and change in hardness.

F-3a (7). *Moisture absorption.*—Specimens 4 by 4 by 2 1/2 inches shall be subjected to an atmosphere of 90 percent relative humidity at 120° F. dry-bulb temperature for 6 hours. The increase in weight shall be noted and recorded as percentage increase in weight and volume.

F-3a (8). *Modulus of rupture.*—Four specimens, 6 inches wide and 12 inches long shall be taken for test. The thickness and the width shall be measured to the nearest 0.01 inch. The specimens shall be sup-

ported flatwise on parallel supports 10 inches apart and the load applied gradually at midspan on a bearing parallel to the end supports. The breaking load shall be recorded to the nearest 5 pounds. The modulus of rupture shall be calculated from the following formula:

$$R = \frac{3Wl}{2bd^2}$$

W = breaking load, in pounds
l = length of span, in inches
b = width of specimen, in inches
d = thickness of specimen, in inches.

The bearing and supports shall be rounded to a radius of approximately ¼ inch. The modulus of rupture in each direction shall be the average of four specimens.

F-3b (9). *Density.*—Three blocks shall be measured and weighed and the weight per cubic foot computed from these data.

F-3b. *Inspection tests (at a Government laboratory).*—Thermal block insulation shall be inspected and tested to determine compliance with the insulation which was previously given type or brand approval tests and found satisfactory for naval use. Inspection tests shall consist of those described in paragraphs F-3a (4), F-3a (5), F-3a (6), F-3a (8), and F-3a (9).

t. PACKAGING, PACKING, AND MARKING FOR SHIPMENT.

G-1. *Packing.*—

G-1a. *For domestic shipment.*—Unless otherwise specified, thermal block insulation shall be packed in standard commercial wood or fiberboard containers, so constructed as to insure acceptance by common or other carrier for safe transportation, at the lowest rate, to the point of delivery. Each container shall conform to the requirements of Consolidated Freight Classification Rules in effect at time of shipment and shall be able to withstand storage, rehandling, and reshipment without the necessity of repacking.

G-1b. *For overseas shipment.*—Unless otherwise specified, the subject commodity shall be packed in wood boxes of either nailed or wire-bound construction or in fiberboard boxes, as follows:

G-1b (1). Nailed wood boxes shall conform to the requirements of table 13 of section VI of Navy Department Specification 39P16, listed in section A.

G-1b (2). Wirebound boxes shall conform to the requirements of table 22 of section VII of Navy Department Specification 39P16.

G-1b (3). Each wood box, nailed or wirebound, shall be reinforced with at least two flat or round metal straps in accordance with the strapping requirements for the applicable box. The gross weight shall not exceed approximately 250 pounds.

G-1b (4). Fiberboard boxes (corrugated or solid) shall conform to the requirements for style R. S. C., type CF, grade 8, or type SF, grade 8, of Navy Department Specification 53B11, listed in section A. All flaps shall be wire-stitched, or glued by the application of a water-resistant adhesive to the entire area of flaps, or a combination of both

may be used. Each box shall be reinforced with at least two metal straps (flat or round), completely encircling the box and placed at right angles to each other. Unless otherwise specified, the gross weight shall not exceed 70 pounds.

G-1c. *For domestic and overseas shipment.*—Each container shall be of a uniform size and shall contain the identical number of items of one size and class. Each container shall be designed to fit the contents in a compact manner.

G-2. *Marking.*—Unless otherwise specified, shipping containers shall be marked with the name of the material, the class, the size, and the quantity contained therein, as defined by the contract or order under which the shipment is made, the name of the contractor, the number of the contract or order, and the gross weight. In addition to the foregoing, marking shall conform to the requirements of the latest issue of the Navy Shipment Marking Handbook.

H. NOTES.

H-1. Requests, requisitions, schedules, and contracts or orders must contain the title of the specification, the number, and date.

H-2. Requests, requisitions, schedules, and contracts or orders should specify the class required (see par. B-1).

H-3. The right is reserved to reject any bids on brands of thermal block insulation which have not been subjected to the required tests and found satisfactory. The attention of the manufacturers is called to this requirement and they are urged to apply for type or brand approval tests on samples of the insulation which they propose to offer to the Navy. Information relative to the conditions that govern tests will be supplied upon aplication to the Bureau of Supplies and Accounts or the bureau concerned. It is to be understood that the manufacturers shall pay all transportation charges to and from the point where tests are made. In the case of failure of the sample or samples submitted to prove satisfactory, consideration will be given to the requests of the manufacturers for additional tests only after it has been clearly shown that changes have been made in the product with reference to method of manufacture, etc., which the bureau concerned considers sufficient to warrant conducting such additional tests.

H-4. Copies of the Navy Shipment Marking Handbook may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.

H-5. Copies of Navy Department specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., except that naval activities should make application to the Commandant, Navy Yard, New York, N. Y. When requesting, refer to specification by both title and number.

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