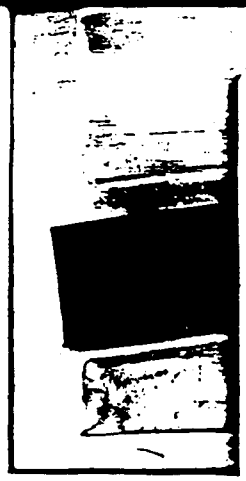

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MIL-C-2861
23 August 1951

MILITARY SPECIFICATION

CEMENT, INSULATION, HIGH-TEMPERATURE

This specification was approved by the Departments of the Army, the Navy, and the Air Force for use of procurement services of the respective Departments, and supersedes the following specification:

Navy 32C14h
1 April 1946

This specification consists of this cover sheet and Navy Department Specification 32C14h, dated 1 April 1946, together with Amendment-1, dated 15 October 1948, attached hereto, without modification.

Copies of this specification 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 Commanding Officer, Naval Supply Depot, Scotia 2, New York. Both the title and identifying number or symbol should be stipulated when requesting copies.

When a request for this specification is received by a supplying activity, it will be necessary to attach this cover sheet to the pertinent specification before issue.

FSC 9350
C14113

CE/HI (F) 33579

CE0107409

32C14h
APR. 1, 1946
SUPERSEDING
32C14d
Nov. 2, 1942
32C14g
Nov. 1, 1944

NAVY DEPARTMENT SPECIFICATION

CEMENT, INSULATION, HIGH-TEMPERATURE

A. APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

A-1. *Specifications.*—The following Navy Department specifications, of the issue in effect on date of invitation for bids, form a part of this specification:

General Specifications for Inspection of Material.
39P16—Packaging and Packing for Overseas Shipment:
Section 0—General Specifications (JAN-P-100).
Section XVIII—Sacks, Paper, Shipping, Multiwall (JAN-P-118).
53S4—Sacks, Multiwall-Kraft-Paper (For Overseas Shipment of Chemical Compounds).
53S5—Sacks, Multiwall-Kraft-Paper (For Domestic Carload Shipment of Chemical Compounds).

A-2. *Other publications.*—The following Bureau of Supplies and Accounts publication, of the issue in effect on date of invitation for bids, forms a part of this specification:

Navy Shipment Marking Handbook.

B. TYPES

B-1. High-temperature insulation cement covered by this specification shall be of the following types (see par. H-1):

Type A—Diatomaceous earth or exfoliated mica.
Type B—Rock or mineral wool.

C. MATERIAL AND WORKMANSHIP

C-1. Insulation cement shall be composed of suitable high-temperature heat-resisting materials as follows:

C-1a. Type A material shall be composed of a dry mixture of suitable refractory material ground fine, asbestos fibers, and clay binders, thoroughly mixed to obtain uniform distribution of the ingredients.

C-1b. Type B material shall be composed of a dry mixture of rock or mineral wool fibers, asbestos fibers, and binders, thoroughly mixed to obtain uniform distribution of the ingredients.

D. REQUIREMENTS COMMON TO ALL TYPES

D-1. *Qualification (type or brand approval).*—The high-temperature insulation cement furnished under this specification shall be of a brand which has been tested and found suitable for the purpose intended as determined by the tests specified in section F. (See also par. H-2).

D-2. The cement shall conform to the chemical analyses obtained on the sample submitted for type or brand approval test.

E. REQUIREMENTS APPLICABLE TO INDIVIDUAL TYPES

E-1. The composition of the cement shall be such that when properly wetted with fresh water it can be applied with a trowel or by hand.

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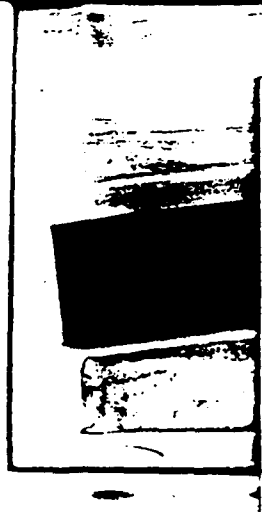


E-2. The cement shall conform to the following requirements:

	Type A	Type B
Conductivity, B.t.u./sq. ft./hr./inch/° F. temperature difference at a mean temperature of 500° F. between the inner and outer surfaces	0.90	0.90
Coverage (wet), board feet per 100 pounds of dry material, minimum	50.0	50.0
Adhesive properties, lbs./sq. in., minimum	None	3.0
Shrinkage, volumetric, wet to dry, percent, maximum	20.0	20.0
Weight, after being molded and dried, pounds per cubic foot, maximum	28.0	30.0
Hardness, after being molded and dried, by plastometer, 1/100 millimeter, maximum penetration	80.0	125.0
Structural strength after being molded and dried, by abrasion, loss in weight, percent, maximum:		
After first 10 minutes	40.0	40.0
After second 10 minutes	60.0	60.0
Change under soaking heat:		
Hardness, by plastometer, 1/100 millimeter, maximum penetration:		
After 6 hours at 750° F.	85.0	150.0
After 6 hours at 1,200° F.	90.0	135.0
After 6 hours at 1,500° F.	95.0	120.0
Loss in weight, percent, maximum:		
After 6 hours at 750° F.	6.0	5.0
After 6 hours at 1,200° F.	10.0	8.0
After 6 hours at 1,500° F.	15.0	10.0
Linear shrinkage, percent, maximum:		
After 6 hours at 750° F.	1.0	None
After 6 hours at 1,200° F.	1.5	2.0
After 6 hours at 1,500° F.	2.0	3.0

E-3. *Type B.*—

E-3a. The sulfur content shall not exceed 0.50 percent.

E-3b. The shot (globules, nonfibrous material) content shall be not more than 10 percent, by weight.

E-3c. When tested by the method described in paragraph F-3a(6), the cement shall not cause corrosion of the metal test plate.

F. METHODS OF SAMPLING, INSPECTION, AND TESTS

F-1. *Sampling.*—

F-1a. *Lot.*—For purposes of sampling, a lot shall consist of not more than 50,000 pounds of insulation cement of the same type offered for delivery at one time.

F-1b. *Sampling procedure.*—

F-1b(1). *Sampling procedure for lot acceptance tests.*—The Naval inspector shall select 4 packages at random from each lot. The 4 packages shall be dumped in 1 pile, thoroughly mixed, and quartered. Two opposite quarters shall be discarded. The remainder shall be thoroughly mixed and quartered. Two opposite quarters shall then be taken as the sample for lot acceptance tests (see par. F-1b(2)).

F-1b(2). *Sampling procedure for production check tests.*—One-half of the sample taken as specified in paragraph F-1b(1) from the first lot of each type offered for delivery by a company, and thereafter one-half of the sample taken from one lot out of each group of 10 successive lots which have passed the acceptance tests prescribed in paragraph F-2a, shall be forwarded to the Engineering Experiment Station, Annapolis, Md., for production check tests.

F-2. *Tests.*—

F-2a. *Lot acceptance tests (at the place of manufacture).*—The sample selected in accordance with paragraph F-1b(1) shall be subjected to the tests prescribed in paragraphs F-3b, F-3c, F-3d, and F-3k. If the sample

is found not to conform to the requirements of this specification, the lot shall be rejected.

F-2b. *Production check tests (at a Government laboratory).*—The sample selected in accordance with paragraph F-1b(2) shall be subjected to the tests described in paragraphs F-3a to F-3*l*, inclusive. From the results of the coverage and shrinkage tests the work value (see par. F-4) shall be computed. If this value is less than that used in determining the service cost (see par. F-5) for the contract or order, this fact shall be reported to the bureau concerned.

F-2b(1). *Action in case of failure.*—Except as hereinafter specified, acceptance and rejection of lots shall normally be on the basis of the sampling, inspection and tests of paragraphs F-1b(1) and F-2a and acceptance shall not be withheld pending receipt of test reports on production check test samples. However, upon receipt of an unsatisfactory test report on a production check test sample, the Naval inspector shall select additional samples from every subsequent lot offered for delivery. The samples so selected shall be submitted to the Government laboratory, and shall there be subjected to the test or tests wherein failure was observed. Lots shall then be accepted only upon receipt of a satisfactory test report on the samples so selected. This additional testing shall be discontinued and lot acceptance returned to the normal basis of F-1b(1) and F-2a when 4 successive lots have been accepted.

F-3. Methods of test.—

F-3a. *Chemical analyses.*—Chemical analyses shall be made by standard methods. The sulfur content of the type B material shall be determined by the evolution method.

F-3b. *Water of formation.*—A weighed quantity of the dry insulation cement shall be mixed with a weighed quantity of water. Weighed quantities of water shall be added and the mixture thoroughly kneaded until the consistency is such as to permit satisfactory application to a surface by troweling. The water of formation of the cement shall be expressed as the pounds of water added per pound of dry cement material to attain the aforesaid troweling consistency. The results reported shall be the average of three mixes.

F-3c. *Coverage capacity.*—The samples mixed for the water of formation test shall be employed in this test. Three separate determinations shall be made. Immediately after being mixed to a troweling consistency, the cement shall be troweled into a rectangular trough 8 inches wide and 1 inch deep and of length variable up to 30 inches. The surface of the cement shall be squared with the top edge of the trough and at both ends of the area covered. The surface area shall be measured. The coverage shall be expressed as board feet covered per 100 pounds of dry, unmixed material. The average of the three determinations made on the samples from the water of formation test shall be reported in the results of this test. This sample shall also be used for the shrinkage test (see par. F-3d).

F-3d. *Shrinkage.*—The samples prepared for the coverage capacity test shall be used for this test (see par. F-3c). Each sample shall be placed in a metal ring mold 10 inches in diameter and 1½ inches deep, mounted in a horizontal position on a 12- by 12-inch piece of plate glass. The top surface of the cement shall be troweled smooth and a piece of ordinary writing paper shall be placed thereon. A steel plate 12 inches square by ⅛ inch thick, with nine equally spaced ⅜-inch diameter holes in the central area 10 inches in diameter, shall be then place on top of the mold. The paper shall be punctured through the holes and the entire assembly inverted. The plate glass shall be removed and the surface of the cement

troweled smooth and leveled with the surface of the mold. The mold shall be carefully removed. The perforated plate with the molded cement thereon shall be placed on an open shelf of an electrically heated oven and dried to constant weight at 300° F. The samples shall be measured within 10 minutes after cooling and the shrinkage reported as the percentage reduction in the original volume suffered during drying.

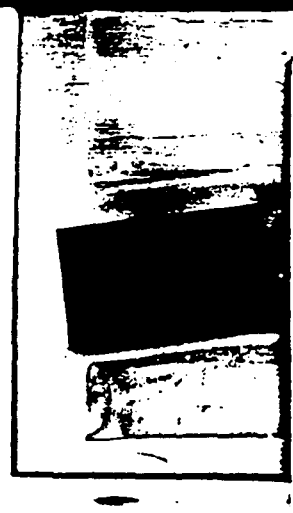
F-3e. *Adhesive properties.*—The adhesive properties of the insulation cement shall be determined on the cement adhesion test apparatus. This apparatus consists of a steel plate and a steel ring, each 10¼ inches in diameter and ⅛ inch thick, centered and held in parallel planes 2 inches apart, by four studs set in the ring. The inside diameter of the steel ring is 6½ inches. The material under test shall be held between the ring and the plate. A steel disk, with mil scale intact, 6 inches in diameter and ⅛ inch thick, completes the surface in the plane of the ring. The adhesion of the material to the disk shall be measured. The insulation cement shall be applied to the apparatus as follows: The steel ring shall be laid on a flat, horizontal plate. The steel disk shall be laid in the hollow of the ring, its center concentric with that of the ring. The continuous, flat surface thus presented shall be covered with a 2-inch troweled layer of the insulation cement. Ring, disk, supporting plate, and cement are dried at 300° F. to constant weight in an electric oven. The 10¼-inch steel plate shall be secured in place by the four studs. Hooks shall be screwed into centered holes on the outside surface of plate and disk. A measured load shall be applied to the hook in the steel disk while the specimen is suspended from the hook in the steel plate. Adhesive properties shall be expressed in pounds of load (to cause rupture of bond) per square inch of sample. The average of three determinations shall be used.

F-3f. *Corrosion-resisting properties.*—The test for determining the corrosion-resisting properties of heat-insulating cement consists of applying cement in plastic form to a polished steel test plate 4 inches wide and 5 inches long. The test plate shall be of clear finish cold rolled strip steel, 0.020 inch thick, American quality quarter hard, temper No. 3, weighing 0.85 pound per square foot. The cement shall be built up to a 3-inch thickness on the test plate in a wooden mold 4 inches wide and 5 inches long, and allowed to stand at room temperature for 30 days. On completion of the test the material shall be removed from the test plate. The test plate shall be immediately cleaned with water, wiped dry, and examined for corrosion. Corrosion along the edges of the plate will be disregarded.

F-3g. *Conductivity.*—For this test 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 450° and 1,100° F.

F-3h. *Physical properties.*—The tests for determining the physical properties of heat-insulating cements shall be conducted on samples 5 by 2 by 1 inch, cut from the molded disks 10 inches in diameter and 1½ inches thick as used for the shrinkage determinations (see par. F-3d).

F-3i. *Hardness by plastometer.*—Hardness shall be determined on the plastometer. It consists mainly of two parallel metal disks supported on uprights, to which are fastened a thin rod with ¼-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 ¼-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 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 be read on the graduated measuring gage dial to 1/100 of a millimeter. The results shall be reported as the average of ten readings. All readings taken in contact with the rock wool nodule shall be disregarded.

F-3j. *Resistance to abrasion.*—The structural strength of the material shall be determined by an abrasion test. In this test, twelve 1-inch cube specimens of the material and twenty-four ¾-inch oak cubes (specific gravity of wood, 0.65) shall be placed in an oak box having inside dimensions of 7½ by 7¾ by 7¾ inches. The opening of the oak box shall be closed and it shall be 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 under test shall be removed from the box and the percentage loss in weight, due to pulverization and breakage, shall be determined.

F-3k. *Weight.*—Weight is expressed in pounds per cubic foot. In the case of cements this weight shall be determined with the molded and dried samples described in the foregoing paragraph.

F-3l. *Physical changes under soaking heats.*—The specimens described in paragraph F-3j shall be placed in electrically heated ovens. Duplicate specimens shall be subjected to heats of 750° and 1,000° F. for 6 hours. If the material under test is recommended for higher temperatures (as in the case of some cements), the duplicate specimens shall be subjected to heats of 1,200°, 1,500°, and 1,800° 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-4. *Work value.*—Upon completion of the tests, a work value shall be calculated in the following manner:

$$\frac{C(100-V.S.)}{100} = \text{work value},$$

in which:

C = Wet coverage, square feet per inch thickness per 100 pounds of dry material.

V.S. = Volumetric shrinkage, wet to dry, precent.

F-5. *Service cost.*—The service cost will be calculated as follows:

$$\frac{\text{Bid price}}{\text{Work value}}$$

F-6. *Qualification (type or brand approval) tests at a Government laboratory.*—Unless otherwise specified, qualification (type or brand approval) tests shall be conducted at the Engineering Experiment Station, Annapolis, Md. These tests shall consist of the tests described in paragraph F-3 to determine that the high-temperature insulation cement is suitable for Naval use.

G. PACKAGING AND PREPARATION FOR SHIPMENT

G-1. *Packing.*—

G-1a. *For domestic shipment.*—Unless otherwise specified, the subject commodity shall be packed not to exceed 100 pounds net weight in creped paper lined textile shipping bags or textile laminated shipping bags; or shall be packed not to exceed 50 pounds net weight in multiwall paper shipping sacks, as follows:

[1] Packing requirements for domestic shipment apply only for direct Navy purchases. Unless otherwise specified, packing requirements for domestic shipments to subcontractors, contractors, or shipbuilders, may be in accordance with best commercial practice.

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G–1a(1). Creped paper lined textile shipping bags and textile laminated shipping bags shall be as specified by the procuring agency. The creped paper bag liner used shall conform to the requirements for Grade 5 of *Navy Department* Specification 39P16, Section 0 (JAN–P–100).

G–1a(2). Multiwall paper shipping sacks shall be of the sewn open-mouth or valve type conforming to the performance requirements of Navy Department Specification 39P16, Section XVIII (JAN–P–118) and the construction requirements for type 7D, of Navy Department Specification 53S5.

G–1b. *For overseas shipment.*—Unless otherwise specified, the subject commodity shall be packed in waterproof paper lined textile shipping bags, or multiwall paper shipping sacks. The net weight of type A material shall not exceed 75 pounds and the net weight of type B material shall not exceed 50 pounds.

G–1b(1). Waterproof paper lined textile shipping bags and textile laminated shipping bags shall be as specified by the procuring agency.

G–1b(2). Multiwall paper shipping sacks shall be of the sewn open-mouth or valve type conforming to the performance requirements of Navy Department Specification 39P16, Section XVIII (JAN–P–118) and the construction requirements for type 9X, for type A material, and type 2X, for type B material, of *Navy Department Specification* 53S4.

G–1c. *For domestic*[1] *or overseas shipment.*—Each bag or sack shall be of the same size and shall contain the identical quantity of material.

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

H. NOTES

H–1. *Ordering information.*—Invitations for bids and contracts or orders should specify the following:

Title, number, and date of this specification.
Type required (see par. B–1).
Whether the subject commodity is to be packaged and prepared for domestic or overseas shipment (see section G).

H–2. *QUALIFICATION (TYPE OR BRAND APPROVAL).*—UNLESS OTHERWISE APPROVED BY THE BUREAU CONCERNED, BIDS WILL BE CONSIDERED AND AWARDS MADE ONLY FOR BRANDS AND TYPES OF PRODUCTS 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 HIGH-TEMPERATURE INSULATION CEMENT 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–3. *Specifications and other publications—where obtainable.*—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 Naval activities should make application to

[1] Packing requirements for domestic shipment apply only for direct Navy purchases. Unless otherwise specified, packing requirements for domestic shipments to subcontractors, contractors, or shipbuilders, may be in accordance with best commercial practice.

the Supply Officer in Command, Naval Supply Depot, Bayonne, N. J. When requesting specifications, refer to both title and number (or symbol).

H-4. *Patent notice.*—When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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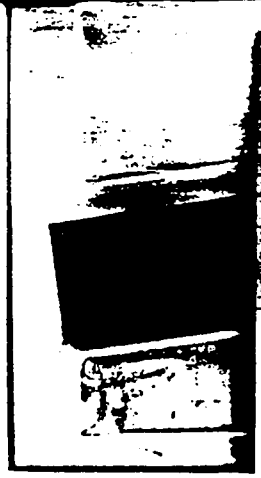

32C14h
AMENDMENT—1
OCT. 15, 1948

NAVY DEPARTMENT SPECIFICATIONS

CEMENT, INSULATION, HIGH-TEMPERATURE

This amendment forms a part of Navy Department Specification 32C14h, dated April 1, 1946.

Page 6, paragraphs H-2 and H-3: Delete and substitute:

"H-2. *QUALIFICATION (TYPE OR BRAND APPROVAL).*—IN THE PROCUREMENT OF MATERIALS REQUIRING QUALIFICATION (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 MATERIAL 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-3. *Specifications and other publications—where obtainable.*—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 Naval activities should make application to the Supply Officer in Command, Naval Supply Center, Norfolk 11, Va. When requesting specifications, refer to both title and number (or symbol)."

END.

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