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SUPERSEDING
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MILITARY SPECIFICATION

CEMENTS, FINISHING, INSULATION

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

1.1 *Scope.* This specification covers asbestos finishing cement (type I) for use as a finish coat on thermal insulation, and mineral wool finishing cement (type II) for use as a finish coat on thermal insulation and as a combination insulation and finishing coat on small pipe fittings.

1.2 *Classification.* Finishing cements shall be of the following types, as specified (see 6.1):

Type I — Asbestos.

Type II — Hydraulic setting mineral wool.

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

FEDERAL

RR-S-366 — Sieves, Standard for Testing Purposes.

UU-S-48 — Sacks, Paper, Shipping.

MILITARY

MIL-I-2819 — Insulation, Thermal, Block.

STANDARDS

FEDERAL

Fed. Std. No. 791 — Lubricants, Liquid Fuels, and Related Products; Methods of Testing.

MILITARY

MIL-STD-105 — Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-129 — Marking for Shipment and Storage.

(Copies of specifications, standards, drawings, and publications required by contractors 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. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

FSC 5640

AMERICAN SOCIETY FOR TESTING MATERIALS STANDARDS

ASTM Method C-177 — Thermal Conductivity of Materials by Means of the Guarded Hotplate, Method of Test for.

ASTM Method C-354 — Compressive Strength of Thermal Insulating Cement, Method of Test for.

(Application for copies should be addressed to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.)

OFFICIAL CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules.

(Application for copies should be addressed to the *Official Classification Committee, 1 Park Avenue* at 33rd Street, New York 16, N. Y.)

3. REQUIREMENTS

3.1 Materials.

3.1.1 *Type I.* Type I cement shall be composed of a dry mixture of asbestos fibers, fillers, and suitable binders thoroughly mixed to obtain a uniform distribution of the ingredients.

3.1.1.1 *Asbestos fiber content.* The asbestos fiber retained on a U.S. Standard No. 100 mesh sieve, conforming to Specification RR-S-366, shall be not less than 60 percent nor more than 85 percent by weight of the cement (see 4.4.1).

3.1.2 *Type II.* Type II cement shall be composed of a dry mixture of nodulated rock or mineral wool fibers and a hydraulic binder.

3.1.3 The composition of type I and type II cements shall be such that when they are properly wetted with fresh water they can be applied with a trowel or by hand.

3.2 Physical requirements. The cement shall conform to the physical requirements shown in table I.

TABLE I. *Physical requirements.*

	Type I	Type II
Coverage (wet), board feet per 100 pounds of dry material, minimum.	30.0	30.0
Shrinkage, volumetric, wet to dry, percent, maximum.	.....	10.0
Density, after being molded and dried, pounds per cubic foot, maximum.	.....	40.0
Hardness, after being molded and dried, penetration, millimeter, maximum.	0.40	.....
Resistance to abrasion, after being molded and dried, loss in weight, percent, maximum:		
After first 10 minutes	.....	20.0
After second 10 minutes	.....	40.0
Compressive strength (at 5 percent deformation), average, pounds per square inch, minimum.	.....	100
Change under soaking heat after 5 hours at °F.	300	1200
Hardness, penetration, millimeter, maximum.	0.40	.....
Loss in weight, percent, maximum.	.....	10.0
Linear shrinkage, percent, maximum.	.....	2.0
Thermal conductivity, maximum, B.t.u./hr./sq. ft. 1°F./inch at mean temperatures:		
200° F.	.....	0.90
600° F.	.....	1.10
Corrosion of metal test plate	.....	None

4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified herein the supplier is responsible for the performance of all inspection requirements prior to submission for Government inspection and acceptance. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order.

4.2 Sampling.

4.2.1 *Lot.* For purposes of sampling, a lot shall consist of not more than 50,000 pounds of finishing cement of one type produced under essentially the same conditions and offered for delivery at one time.

4.2.2 *Sampling for examination of filled containers.* A random sample of filled containers shall be selected from each lot offered for inspection in accordance with Standard MIL-STD-105 at inspection level I and acceptable quality level = 2.5 percent defective to verify compliance with all stipulations of this specification regarding fill, marking, and other requirements not involving tests.

4.2.3 *Sampling for acceptance tests.* From each lot offered for inspection, 2 sample containers shall be selected at random for the tests specified in 4.3.2.

4.3 Acceptance inspection.

4.3.1 *Examination of filled containers at the place of manufacture.* Each sample filled container selected in accordance with 4.2.2 shall be examined for defects of the container and for unsatisfactory markings. Each sample filled container shall also be weighed to determine the amount of the contents. Any container in the sample having one or more defects, or under required fill, shall be rejected, and if the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of Standard MIL-STD-105, the lot represented by the sample shall be rejected. Rejected lots may be resubmitted for acceptance inspection provided that the contractor has removed or repaired all nonconforming containers.

4.3.2 *Acceptance tests.*

4.3.2.1 *Type I cement.* The sample specimens selected in accordance with 4.2.3 shall be subjected separately to the tests specified in 4.4.1, 4.4.2.1, 4.4.5 and 4.4.8.1.

4.3.2.2 *Type II cement.* The sample specimens selected in accordance with 4.2.3 shall be subjected separately to the tests specified in 4.4.2.2, 4.4.3, 4.4.4 and 4.4.6. to 4.4.10, inclusive.

4.3.2.3 *Action in case of failure.* If any sample is found not to be in conformance with the requirements of this specification, the lot which it represents shall be rejected. Rejected lots may be resubmitted for acceptance inspection provided the contractor has removed or reworked all nonconforming products.

4.4 Test procedures.

4.4.1 *Asbestos fiber content.* A standard laboratory testing sieve shaker which operates with a horizontal eccentric circular motion at 285 ± 10 revolutions per minute and a tapping action of 150 ± 5 strokes per minute shall be used to determine the asbestos fiber content. A weighed quantity of the material shall be placed in a covered 8-inch diameter 100-mesh sieve over a retaining pan and secured in the shaker. After shaking for 10 minutes with tapper in operation the asbestos fibers remaining on the sieve and the fillers and binders contained in the retaining pan shall be weighed separately and their respective percentages of the total sample calculated.

4.4.2 *Coverage capacity.*

4.4.2.1 *Type I.* Dry cement shall be mixed with water to a wet consistency of 26.5 ± 0.5 mm. as determined by method 311 of Standard Fed. Std. No. 791, and immediately troweled into a rectangular trough 8 inches wide and one 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 material. The average of three determinations shall be reported as the wet coverage.

4.4.2.2 *Type II.* A weighed quantity of the dry cement shall be mixed with a weighed quantity of water. Weighed quantities of water shall be added and mixed until the consistency is such as to permit satisfactory application to a surface by troweling. 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 20 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 material. The average of 3 determinations shall be reported as the wet coverage.

4.4.3 *Shrinkage.* The samples prepared for the coverage capacity test of 4.4.2 shall be used for this test. Each sample shall be placed in a metal ring mold 10 inches in diameter and 1¼ 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 $^{31}/_{64}$-inch diameter holes in the central area 10 inches in diameter, shall be then placed 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, and the molded sample allowed to stand at room temperature (77° ± 2°F.) for 24 hours. 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.

4.4.4 *Density.* Molded specimens shall be air dried for 24 hours and then dried at 300°F. in an electric oven to constant weight and the density computed on the oven dried volume.

4.4.5 *Hardness.*

4.4.5.1 *Apparatus.* Hardness shall be determined on the plastometer, which shall consist mainly of 2 parallel metal disks supported on uprights, to which are fastened a thin rod with ⅛-inch diameter ball point, a measuring gage graduated in 1/100 mm. divisions, and a kilogram weight.

4.4.5.2 *Specimens.* The specimens for the test shall be made by applying the cement, prepared as specified in 4.4.2, to the surface of an insulation block conforming to Specification MIL-I-2819. A thickness of ½ inch shall be obtained by securing ½-inch diameter rod guides along the edges of the block insulation. The specimens shall be air dried.

4.4.5.3 *Procedure.* The specimen shall be placed under the instrument and the ⅛-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 0.01 mm. The results shall be reported as the average of 10 readings.

4.4.6 *Resistance to abrasion.* Twelve 1-inch cube specimens, cut from the molded disks used in 4.4.3 to determine shrinkage, 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 7½ by 7¾ inches. The horizontal axis of rotation of the test chamber shall be normal to and in the center of the 7¾ by 7¾ inch face. 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 shall be removed from the box, the box shall be cleaned, and the cubes of the material under test shall be weighed to determine the percentage loss in weight due to pulverization and breakage.

4.4.7 *Compressive strength.* The compressive strength shall be determined in accordance with ASTM method C-354.

4.4.8 *Physical changes under soaking heat.*

4.4.8.1 *Type I cement.* Specimens prepared as specified in 4.4.5.2 shall be air dried and then subjected for 6 hours to a temperature of 300°F. in an electric oven. Then the specimens shall be removed from the oven and the hardness determined by the method specified in 4.4.5.3.

4.4.8.2 *Type II cement.* Specimens 5 by 2 by 1 inch, cut from the molded disks used in 4.4.3 to determine shrinkage, shall be weighed and measured. They shall then be subjected for 6 hours to a temperature of 1200°F. in an electric oven. The specimens shall be removed from the oven and tested to determine loss of weight, linear shrinkage, and hardness.

4.4.9 *Thermal conductivity.* Thermal conductivity shall be determined in accordance with ASTM method C-177.

4.4.10 *Corrosion resistance. Cement in plastic form* shall be applied to a polished steel test plate 4 inches wide and 5 inches long. The test plate shall be 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. Then the cement 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 shall be disregarded.

5. PREPARATION FOR DELIVERY

5.1 **Packing.**

5.1.1 *Level A.* Cement shall be furnished in 50-pound quantities in paper shipping sacks (construction 5x) conforming to Specification *UU-S-48.* No additional packing will be required.

5.1.2 *Level B.* Cement shall be furnished in 50-pound quantities in paper shipping sacks (construction 1w) conforming to Specification UU-S-48. No additional packing will be required.

5.1.3 *Level C.* Cement shall be packed in a manner to insure carrier acceptance and safe delivery to destination at the lowest applicable rate. Containers shall comply with the Uniform Freight Classification Rules or other carrier regulations applicable to the mode of transportation.

5.2 **Marking.** In addition to any special marking required in the contract or order, marking for shipment shall be in accordance with Standard MIL-STD-129.

6. NOTES

6.1 **Ordering data.** Procurement documents should specify the following:

(a) Title, number, and date of this specification.

(b) Type required (see 1.2).

(c) Selection of applicable level of packing required (see 5.1).

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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