

MIL-M-15842B
MIL-M-15842B
24 August 1964
SUPERSEDING
MIL-M-15842A
5 January 1952

MILITARY SPECIFICATION

MORTAR, REFRACTORY (HIGH TEMPERATURE, AIR SETTING)

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

1. SCOPE

1.1 Scope.--This specification covers dry air-setting refractory mortar for use in laying and bonding refractory brick in ship boiler furnaces; and wet air-setting refractory mortar for use in laying refractory brick in Naval stationary boiler furnaces, bright annealing furnaces, controlled atmosphere furnaces, and furnaces heated by electric elements.

1.2 Classification.--Mortar shall be of the following classes, as specified (see 6.1):

Class 1--Dry.
Class 2--Wet.

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 this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

UU-S-48 - Sacks, Shipping, Paper.
PPP-B-35 - Bags: Textile, Shipping, Burlap, Cotton and Waterproof Laminated.
PPP-P-104 - Pails: Shipping, Steel (1 Through 12 Gallon).

MILITARY

MIL-B-15606 - Bricks, Refractory, Naval Boiler Furnace Lining Quality.

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.

(Copies of specifications, standards, and drawings 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 document forms 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- C24 - Method of Test for Pyrometric Cone Equivalent (PCE) of Refractory Materials.
- C92 - Methods of Test for Sieve Analysis and Water Content of Refractory Materials.
- C133 - Cold Crushing Strength and Modulus of Rupture of Refractory Brick and Shapes.
- C199 - Refractories of Air-Setting Refractory Mortar (Wet Type).

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

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

3. REQUIREMENTS

3.1 Qualification.--The high temperature air-setting refractory mortar furnished under this specification shall be a product which as been tested, and passed the qualification tests specified herein, and has been listed on or approved for listing on the applicable qualified products list.

3.2 Material.--The mortar shall be composed of finely ground heat-resistant clays, minerals, or a mixture of clays and minerals in either a dry or wet condition.

3.3 Consistency.--Mortar, when tempered with water, shall be of such consistency that it will be suitable for spreading easily with a trowel or for dipping, and for laying refractory brick and bonding them strongly upon drying and upon subsequent heating at furnace temperatures. The mixed mortar shall have sufficient water retention to permit a 1/16-inch joint to be made with a trowelling consistency, but not allow the newly laid brick to float out of position.

3.4 Fineness.--Mortar shall be ground to such fineness that not more than 5 percent shall be retained on a No. 40 U.S. standard sieve, and not more than 0.5 percent shall be held on a No. 30 U.S. standard sieve (see 4.4.2).

3.5 Resistance to heat soaking.--Mortar shall not soften nor show any evidence of fusion, and the shrinkage shall not be greater than hairline cracks when tested as specified in 4.4.3.

3.6 Bonding strength.--The average modulus of rupture at the brick joint when tested as specified in 4.4.4 shall be not less than shown in Table I.

Table I - Bonding strength.

Temperatures	Average modulus of rupture (min.)
Degrees F.	p.s.i.
230-----	200
1,000-----	100
2,000-----	100

3.7 Class 1, dry.--Mortar shall be furnished dry, and shall be ready for use as soon as mixed with water. Mortar, after being mixed with water and then dried, shall be capable of being remixed with water.

3.7.1 Pyrometric cone equivalent.--The pyrometric cone equivalent shall be not less than cone 32 (see 4.4.5).

3.7.2 Mortar shall show no deterioration after 1 year's storage.

3.8 Class 2, wet.--Mortar shall be furnished ready for use at a trowelling consistency, and shall be easily mixed with water to a dipping

consistency.

3.8.1 Shelf life.--At any time within one year of shipment from the supplier, the mortar in a previously unopened container shall not have stiffened to such an extent as to interfere with its easy removal and mixing.

3.9 Workmanship.--Workmanship shall be first class in every respect.

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, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 Qualification tests[1].--Qualification tests shall be conducted at a laboratory satisfactory to the Bureau of Ships. These tests shall consist of the tests specified in 4.4.2 through 4.4.5.

4.3 Sampling for quality conformance inspection.--Sampling for quality conformance inspection shall be performed in accordance with the provisions set forth in MIL-STD-105, except where otherwise indicated hereinafter. For purposes of sampling, an inspection lot for inspection and tests shall consist of all material of the same class offered for delivery at one time.

4.3.1 Inspection of the end item.--

4.3.1.1 Examination of the end item.--Examination of the end item shall be made in accordance with the classification of defects, inspection levels and acceptable quality levels (AQLs) set forth below. The lot size, for purpose of determining the sample size in accordance with MIL-STD-105, shall be expressed in units of filled containers for examination in 4.3.1.1.1, 4.3.1.1.2 and 4.3.1.1.3.

4.3.1.1.1 Examination of the end item container for defects in appearance, workmanship, closures and markings.--The sample unit for this examination shall be one filled container.

<u>Examine</u>	<u>Defect</u>
Appearance	Not specified size or style container. Evidence of leakage or seepage. Dents, punctures, breaks or other defects affecting serviceability.
Construction	Container not as specified. Bag not waterproofed sift-proof. Bag laminations not as specified. Drum wall thickness not as specified. Exterior or interior of drum not painted or coated as specified. Bottom seam of drum not as specified.
Closures	Bag closure not as specified. Drum closure not tight. Gasket missing, does not seal properly. Lugs missing or not clamped tightly.

Markings	Exterior markings omitted, illegible, incorrect, incomplete or not in accordance with contract requirements.
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Weight	Gross or net weight exceeds specified requirements.
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[1] Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.2 and 6.3).

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4.3.1.1.2 Examination of the end item for defects in appearance of the refractory mortar.--The sample unit for this examination shall be one bag of dry mortar or one drum of wet mortar, as applicable. This examination may be made during selection of samples for testing (see 4.3.2).

<u>Examine</u>	<u>Defect</u>
Appearance	Presence of foreign material.
	Presence of caked aggregate lumps.
	Wet mortar not mixed to uniform trowelling consistency.

4.3.1.1.3 Examination of end item container for defects in net contents.--The sample unit for this examination shall be one filled primary container. Not less than three containers from each lot shall be examined. The average net contents shall be not less than the specified or indicated quantity.

4.3.1.1.4 Inspection levels and acceptable quality levels (AQLs) for examinations.--The inspection levels for determining the sample size and acceptable quality levels (AQLs) expressed in defects per 100 units shall be as follows:

<u>Examination Paragraph</u>	<u>Inspection Level</u>	<u>AQL</u>
4.3.1.1.1	S-3	2.5
4.3.1.1.2	S-1	6.5
4.3.1.1.3	S-2	-

4.3.2 Testing.--Testing of the end item shall be conducted in accordance with Table II for the characteristics as indicated therein on each lot presented for examination. The sample unit shall be 15 pounds of mortar. The inspection level for determining the sample size shall be S-1 except that no less than 3 sample units shall be randomly selected throughout the lot. No more than one sample shall be drawn from any one container. The test sample shall be a 45-pound composite of the randomly selected sample units. Two or more determinations, as applicable, shall be performed on the composite. There shall be no evidence of failure to meet the specified unit or average requirements.

Table II - Instructions for testing.

CHARACTERISTIC	SPECIFICATION REFERENCE		NUMBER DETERMINA- TIONS PER COMPOSITE	RESULTS REPORTED AS	
	REQUIRE- MENT	TEST METHOD		PASS OR FAIL[1]	NUMERICALLY TO NEAREST[2]
Class 1 and Class 2, as applicable					
Fineness					
Retained on No. 40 U.S. Std. Sieve	3.4	4.4.1	2	-	0.1 percent

Retained on No. 30 U.S. Std. Sieve	3.4	4.4.1	2	-	0.1 percent
Resistance to heat soaking					
Melting	3.5	4.4.3	2	X	-
Shrinkage	3.5	4.4.3	2	X	-

See footnotes at end of table.

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Table II - Instructions for testing. (Continued)

CHARACTERISTIC	SPECIFICATION REFERENCE		NUMBER	RESULTS REPORTED AS	
	REQUIREMENT	TEST METHOD		PASS OR FAIL[1]	NUMERICALLY TO NEAREST[2]
Bonding Strength	3.6				
After heating @ 230 deg. F.		4.4.4	Avg. of 5	-	psi
1000 deg. F.		4.4.4	Avg. of 5	-	psi
2000 deg. F.		4.4.4	Avg. of 5	-	psi
Pyrometric Cone:[3]					
Class 1	3.7.1	4.4.5	2	-	cone number

[1] If failure is indicated report description of failure or numerical point of failure as applicable.

[2] Test report shall include all values on which results are based.

[3] See 4.3.2.1

4.3.2.1 Pyrometric cone equivalent.--The pyrometric cone equivalent shall be determined on two cones of different samples from each lot. If both cones fail, this shall be cause for rejection without retest. If either cone fails, three additional cones shall be made, each from a different sample. If any one of the three retest cones fail, this shall be cause for rejection.

4.4 Test methods.--

4.4.1 Preparation for tests.--The entire sample shall be thoroughly mixed to assure uniformity before any portion is taken for tests. The selected portion of class 1 (dry) mortar shall be mixed with water to a trowelling consistency for tests of 4.4.3 and 4.4.4.

4.4.2 Fineness.--Fineness test shall be made in accordance with ASTM C92.

4.4.3 Heat soak.--A pier of brick laid up with the test mortar shall be prepared and heated at 2910 deg. F. for 5 hours in accordance with ASTM C-199. Bricks shall conform to grade B of MIL-B-15606. The cooled pier shall be examined for evidence of shrinkage, softening or fusion of the mortar. One or more mortar joints shall be broken and the freshly broken mortar surface shall be viewed from various angles. Any shininess or light flash at the mortar surface shall be considered an indication of excessive fusion.

4.4.4 Bonding strength.--Fire bricks conforming to grade B of MIL-B-15606 shall be cut in half. The two halves of each brick shall be placed in a suitable device for bringing, with a straight motion, the molded ends (4 1/2 by 2 1/2 inches) together with the faces parallel when 1/16 inch apart. In forming the bond, a small quantity of the mortar shall be spread by a trowel on the upper face forming the bond to insure intimate contact. Sufficient mortar to make a 1/8 inch thickness shall be spread evenly on the

lower bond forming face, and the upper half brick shall be lowered until 1/16 inch from the lower. The excess mortar shall be cut from the joint, flush with the sides of the brick. The unit thus formed shall be removed at once from the bond-forming machine. The bond specimens shall be allowed to air-dry for 24 hours. Five bond specimens shall be placed in an oven operating at 230 deg. F., for 24 hours and five bond specimens shall be held at each of the other test temperatures for 5 hours and then allowed to cool in the closed furnace for 12-18 hours. The time required to reach test temperatures shall be 3 hours. The bond shall not be broken until they have reached approximately room temperature. The modulus of rupture of the test specimens shall be determined in accordance with ASTM C-133, except that the load shall be applied at the rate of 1000 pounds per minute. In conducting this test, bring the upper bearing edge to bear on the joint itself.

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4.4.5 Pyrometric cone equivalent.--The pyrometric cone equivalent shall be determined in accordance with ASTM C24.

5. PREPARATION FOR DELIVERY

5.1 Packing.--

5.1.1 Class 1, dry mortar.--

5.1.1.1 Levels A and B.--Class 1 mortar shall be packed in multiwall shipping sacks conforming to UU-S-48 with 100-pound content or PPP-B-35.

5.1.2 Class 2, wet mortar.--

5.1.2.1 Levels A and B.--Class 2 mortar shall be packed in steel drums conforming to type II of PPP-P-704, except that use of 22-gage steel for drums of 12-gallon capacity is acceptable. Dropside handles shall be provided.

5.1.2.2 Level C.--Packing of the mortar shall be sufficient to afford adequate protection against deterioration and physical damage during shipment from the supply source to the first receiving activity for immediate use. This level may conform to the supplier's commercial practice when such meets the requirements of this level.

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

6. NOTES

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

- (a) Title, number, and date of this specification.
- (b) Class required (see 1.2).
- (c) Applicable level of packing required (see 5.1).

6.2 With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in Qualified Products List QPL-15842, 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 Chief of the Bureau of Ships, Department of the Navy, Washington 25, D. C., and information pertaining to qualification or products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.3).

6.3 Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pennsylvania.

Custodians:

Army - MO

Navy - SH

Air Force - 69

Review activities:

Preparing activity:

Navy - SH

(Project 9350-0029)

Navy - SH
User activities:
Army - MO
Navy - YD
Air Force - 69