ASTM STANDARDS

on

MAGNESIUM OXYCHLORIDE CEMENTS

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STANDARD SPECIFICATIONS FOR, AND METHOD FOR FIELD DETERMINATION OF, SPECIFIC GRAVITY OF GAUGING SOLUTIONS FOR MAGNESIUM OXYCHLORIDE CEMENTS[1]

ASTM Designation: C 250 - 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 250; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. These specifications for, and method for field determination of, specific gravity of gauging solutions are intended to cover solutions of magnesium chloride and magnesium chloride - magnesium sulfate used for the mixing of magnesium oxychloride cements on the job.

General Requirements

2. The stock supply of gauging solution shall be a solution of either magnesium chloride alone or a mixture of magnesium chloride and magnesium sulfate, whichever is specified for the particular job. The specific gravity of the gauging solution, when determined in accordance with Sections 3 to 5, shall conform to the limits given in Table I for magnesium chloride solutions or Table II for solutions of a mixture of magnesium chloride and magnesium sulfate.

Apparatus

3. (*a*) *Hydrometer.*—A hydrometer approximately 12 in. in overall length and with a scale ranging from 20 to 30° Baumé, graduated in 0.1° Baumé subdivisions, shall be used. New hydrometers shall be checked prior to use, and hydrometers in use shall be checked once a week, against the required reference solution as specified in Section 4 and in accordance with the procedure described in Section 5. To be acceptable for use, the hydrometer reading should be midway between the maximum and minimum values corresponding to the temperature of the reference solution at the time the hydrometer reading is taken, as given in Table I or II. The reference solution employed in the determination shall be discarded.

(*b*) *Hydrometer Cylinder.*—A transparent glass jar with a depth approximately equal to the length of the hydrometer and with an inside diameter approximately twice that of the hydrometer shall be provided.

[1] Under the standardization procedure of the Society, these specifications and method are under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, these specifications and method were published as tentative from 1950 to 1952.

(*c*) *Thermometer.*—A Fahrenheit thermometer, covering a temperature range of at least 40 to 160 F., graduated in subdivisions of 2 F., shall be provided.

Reference Solution

4. (*a*) The reference solution for checking hydrometers for magnesium chloride gauging solution shall be a clear solution of magnesium chloride having a specific gravity of 1.177 ± 0.001 at 70 ± 1 F., referred to water at 4 C.

TABLE I.—PERMISSIBLE RANGE OF SPECIFIC GRAVITY OF MAGNESIUM CHLORIDE GAUGING SOLUTION FOR VARIOUS TEMPERATURES.

Temperature, deg. Fahr.	Permissible Hydrometer Reading, deg. Baumé	
	Min.	Max.
40	22.0	23.0
70	21.5	22.5
100	21.0	22.0

TABLE II.—PERMISSIBLE RANGE OF SPECIFIC GRAVITY OF MAGNESIUM CHLORIDE-MAGNESIUM SULFATE GAUGING SOLUTION FOR VARIOUS TEMPERATURES.

Temperature, deg. Fahr.	Permissible Hydrometer Reading, deg. Baumé	
	Min.	Max.
40	24.0	25.0
70	23.5	24.5
100	23.0	24.0

(*b*) The reference solution for checking hydrometers for the magnesium chloride - magnesium sulfate gauging solution shall be a clear solution of magnesium chloride having a specific gravity of 1.198 ± 0.001 at 70 ± 1 F., referred to water at 4 C.

(*c*) The specific gravity of the reference solution shall be determined by any convenient method that is precise to ± 0.0005.

(*d*) The recorded value for the specific gravity of the solution shall be obtained by rounding off to the nearest 0.001 in accordance with the rounding-off method given in Section 3 (*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29).[3]

Procedure

5. (*a*) Make certain that the stock supply of gauging solution is free of undissolved crystals and thoroughly mixed before determining its specific gravity. Fill the clean, dry hydrometer jar with a portion of the stock solution and determine its temperature in the jar by means of the thermometer, which shall also be clean and dry. Immerse the clean, dry hydrometer and obtain the reading at the intersection of the surface of the liquid and the hydrometer. Make this reading by looking through the liquid, the eye being slightly below the plane of the surface of the liquid. Raise the eye slowly until this under surface of the liquid appears to be a straight line. Read the point where this line cuts the hydrometer scale.

(*b*) Round off the values for specific gravity to the nearest 0.1° Baumé and the temperature readings to the nearest 10 F. in accordance with Recommended Practices E 29.

Report

6. The report shall include the following:

(*1*) Indentification of gauging solution as magnesium chloride or a mixture of magnesium chloride and magnesium sulfate, and

(*2*) Temperature and specific gravity of gauging solution.

[3] 1964 Book of ASTM Standards, Part 30.

Standard Specifications for

OXYCHLORIDE MAGNESIA[1]

ASTM Designation: C 275 - 61

ADOPTED, 1961.[2]

This Standard of the American Society for Testing Materials is issued under the fixed designation C 275; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. These specifications cover the chemical and physical requirements for oxychloride magnesia (MgO) suitable for use in magnesium oxychloride cements.

Definition

2. Oxychloride magnesia, also referred to in the trade as oxychloride magnesite, plastic calcined magnesite, or caustic calcined magnesia, is essentially magnesium oxide that is produced by the calcination of natural magnesite (magnesium carbonate) or other magnesium compounds, and that will react with solutions of magnesium chloride or magnesium sulfate of suitable concentrations to form a plastic cement capable of setting and binding inert organic and inorganic fillers and aggregates into a hard, strong, and durable mass.

Chemical Requirements.

3. Oxychloride magnesia for use in flooring formulations shall conform to the following requirements as to chemical composition:

Loss on ignition, max, per cent	5.0
Active calcium oxide, max, per cent	2.0

Physical Requirements

4. Oxychloride magnesia for use in flooring formulations shall conform to the requirements as to physical properties prescribed in Table I.

Packaging and Marking

5. The oxychloride magnesia shall be delivered in moistureproof containers weighing not less than 75 lb. The name of the manufacturer, lot number, and gauging ratio to be employed in making up all test mixes shall be plainly marked on the bags. Similar information shall be provided in the shipping notices accompanying the shipment of oxychloride magnesia.

[1] Under the standardization procedure of the Society, these specifications are under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, these specifications were published as tentative from 1951 to 1961, being revised in 1956.

Storage

6. The oxychloride magnesia shall be stored in such a manner as to permit easy identification of each shipment and in a suitable weathertight building that will protect the magnesia from dampness.

TABLE I.—PHYSICAL REQUIREMENTS.

Sieve analysis:	
Total retained on No. 200 (74-micron) sieve, max, per cent	8.0
Setting time:	
Initial set, minutes, min	100
Initial set, minutes, max	250
Final set, minutes, max	420
Linear change:	
Nonplastic contraction, max, per cent[a]	0.20
Expansion, measured at 7 days from time of maximum contraction, max, per cent[a]	0.25
Flexural strength:	
Modulus of rupture measured at 7 days, average of values for nine breaks, min, psi	1600
Compressive strength:	
Measured at 7 days, average of values for nine cubes, min, psi	5000

[a] Defined in Standard Method of Test for Linear Contraction of Magnesium Oxychloride Cements (ASTM Designation: C 252),[3] and Standard Methods of Test for Linear Change of Magnesium Oxychloride Cements (ASTM Designation: C 253).[3]

Rejection

7. (*a*) The oxychloride magnesia may be rejected if it fails to meet any of the requirements of these specifications as determined by tests completed within 40 days after receipt of the shipment.

(*b*) Packages varying more than 5 per cent from the specified weight may be rejected; and if the average weight of packages in any shipment, as shown by 50 packages taken at random, is less than that specified, the entire shipment may be rejected.

Methods of Sampling and Testing

8. The oxychloride magnesia shall be sampled, and the properties enumerated in these specifications shall be determined, in accordance with the following methods:

(*a*) *Sampling.*—Standard Method of Sampling Magnesium Oxychloride Compositions and Ingredients (ASTM Designation: C 237).[3]

(*b*) *Chemical Requirements.*—Standard Methods of Test for Ignition Loss and Active Calcium Oxide in Magnesium Oxide for Use in Magnesium Oxychloride Cements (ASTM Designation: C 247).[3]

(*c*) *Physical Requirements.*—Standard Methods for Physical Testing of Magnesia for Magnesium Oxychloride Cements (ASTM Designation: C 246),[3] and Standard Method of Test for Sieve Analysis of Plastic Calcined Magnesia (ASTM Designation: C 239).[3]

[3] Appears in this publication.

Standard Specifications for
MAGNESIUM CHLORIDE[1]

ASTM Designation: C 276 – 53

ADOPTED, 1953.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 276; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. These specifications cover magnesium chloride ($MgCl_2 \cdot 6H_2O$) for use in magnesium oxychloride cements.

Composition

2. (*a*) *Dry Form.*—Magnesium chloride in the dry form shall conform to the following requirements as to chemical composition:

Magnesium chloride, calculated as $MgCl_2 \cdot 6H_2O$:	
Minimum, per cent:	
At point of manufacture	99.0
In the field	97.0
Maximum, per cent	107.0
Total calcium, calculated as $CaCl_2$, max, per cent	0.5
Total alkali chlorides, calculated as NaCl, max, per cent	1.0
Magnesium oxide (MgO), max, per cent	0.1

(*b*) *Solutions.*—If a solution of magnesium chloride is supplied, the proportions of calcium and alkali chlorides to magnesium chloride shall not exceed those permitted for a dry form of magnesium chloride.

Packing and Marking

3. The magnesium chloride shall be delivered in moistureproof bags containing approximately 100 lb each, or in airtight steel drums weighing not more than 450 lb each. The name of the manufacturer, the lot number, the approximate net weight, and the percentage of magnesium chloride guaranteed by the manufacturer shall be legibly marked on each container.

Inspection

4. Every facility shall be provided the purchaser, should he elect to have his representative sample the material at the place of manufacture. If the purchaser decides to sample the material after delivery, a minimum content of 97 per cent $MgCl_2 \cdot 6H_2O$ shall be permissible.

Rejection

5. The magnesium chloride may be rejected if it fails to conform to any of the requirements of these specifications.

Methods of Analysis

6. The magnesium chloride shall be analyzed in accordance with the Standard Methods for Chemical Analysis of Magnesium Chloride (ASTM Designation: C 245).[3]

[1] Under the standardization procedure of the Society, these specifications are under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, these specifications were published as tentative from 1951 to 1953.

[3] Appears in this publication.

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Standard Method of

SAMPLING MAGNESIUM OXYCHLORIDE COMPOSITIONS AND INGREDIENTS[1]

ASTM Designation: C 237 – 51

ADOPTED, 1951.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 237; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. This method covers the procedures for sampling magnesia, magnesium chloride, magnesium sulfate, magnesium oxychloride compositions, and gaging solutions for purpose of tests.

Size and Number of Samples

2. (*a*) Samples of magnesia, or of the premixed dry ingredients for magnesium oxychloride compositions, shall weigh at least 20 lb.

(*b*) Samples of dry magnesium chloride and magnesium sulfate shall weigh at least 1 lb. when taken for chemical analysis.

(*c*) Samples of dry materials shall be taken in accordance with the following schedule unless otherwise specified by the purchaser:

Number of Bags in Lot	Percentage of Bags to be Sampled	Minimum Number of Bags to be Sampled
10 to 100	10	10
101 to 200	7.5	10
201 to 300	5.0	10
301 to 400	3.0	10
401 and over	3.0	12

The required number of bags shall be representatively sampled by means of a thief sampler inserted to the full depth of the bag at points well distributed within the bag.

(*d*) Samples of gaging solutions shall be composites taken at the time of preparation, just prior to actual use, and shall be at least 2 gal.

(*e*) The sampling shall be done by or under the direction of a responsible representative of the purchaser.

Preparation of Sample

3. (*a*) Dry samples shall be packed by the purchaser in moistureproof, airtight containers, and liquid samples shall be placed in leakproof, airtight containers. The samples shall be crated, if necessary, by the manufacturer and shipped to the testing laboratory at the expense of the purchaser.

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the A.S.T.M. Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1949 to 1951.

(*b*) Composite samples for the tests shall be prepared by arranging all test samples in groups, each group representing the number of bags required by the test or tests for which the composite sample is intended. From each of the test samples in a group, equal portions shall be taken. The composite sample thus prepared shall be thoroughly mixed before testing.

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Standard Method of

SAMPLING MAGNESIUM OXYCHLORIDE COMPOSITIONS AND INGREDIENTS[1]

ASTM Designation: C 237 – 51

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Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 237; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. This method covers the procedures for sampling magnesia, magnesium chloride, magnesium sulfate, magnesium oxychloride compositions, and gaging solutions for purpose of tests.

Size and Number of Samples

2. (*a*) Samples of magnesia, or of the premixed dry ingredients for magnesium oxychloride compositions, shall weigh at least 20 lb.

(*b*) Samples of dry magnesium chloride and magnesium sulfate shall weigh at least 1 lb. when taken for chemical analysis.

(*c*) Samples of dry materials shall be taken in accordance with the following schedule unless otherwise specified by the purchaser:

Number of Bags in Lot	Percentage of Bags to be Sampled	Minimum Number of Bags to be Sampled
10 to 100	10	10
101 to 200	7.5	10
201 to 300	5.0	10
301 to 400	3.0	10
401 and over	3.0	12

The required number of bags shall be representatively sampled by means of a thief sampler inserted to the full depth of the bag at points well distributed within the bag.

(*d*) Samples of gaging solutions shall be composites taken at the time of preparation, just prior to actual use, and shall be at least 2 gal.

(*e*) The sampling shall be done by or under the direction of a responsible representative of the purchaser.

Preparation of Sample

3. (*a*) Dry samples shall be packed by the purchaser in moistureproof, airtight containers, and liquid samples shall be placed in leakproof, airtight containers. The samples shall be crated, if necessary, by the manufacturer and shipped to the testing laboratory at the expense of the purchaser.

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the A.S.T.M. Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1949 to 1951.

(*b*) Composite samples for the tests shall be prepared by arranging all test samples in groups, each group representing the number of bags required by the test or tests for which the composite sample is intended. From each of the test samples in a group, equal portions shall be taken. The composite sample thus prepared shall be thoroughly mixed before testing.

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Standard Method of Test for

SIEVE ANALYSIS OF MAGNESIUM OXYCHLORIDE COMPOSITIONS, AGGREGATES, AND FILLERS[1]



ASTM Designation: C 238 – 51

ADOPTED, 1951.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing and Materials is issued under the fixed designation C 238; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. This method covers the sieve analysis of complete magnesium oxychloride compositions and the aggregates and fillers used.

NOTE 1.—The procedure for the sieve analysis of plastic calcined magnesia is described in the Method of Test for Sieve Analysis of Plastic Calcined Magnesia (ASTM Designation: C 239).[3]

Apparatus

2. (*a*) *Balance.*—The balance or scale shall be accurate and sensitive to within 0.1 per cent of the weight of the sample to be tested.

(*b*) *Sieves.*—Suitable sieves shall be selected to furnish the information required by the specifications covering the material to be tested. The sieves shall conform to the Specifications for Sieves for Testing Purposes (ASTM Designation: E 11)[4] and shall be 8 in. in diameter and of full height (about 2 in.). When a $\frac{1}{8}$-in. fraction is to be determined, a No. 6 (3.36-mm) sieve shall be used.

NOTE 2.—Tyler standard testing sieves may be substituted, provided the Tyler openings are the same as those of the respective ASTM standard sieves.

Samples

3. (*a*) The material shall be sampled in accordance with the Method of Sampling Magnesium Oxychloride Compositions and Ingredients (ASTM Designation: C 237).[3]

(*b*) Samples for sieve analysis shall be obtained by quartering or by use of a sampler from the sample selected in accordance with Paragraph (*a*).

(*c*) Samples of fine aggregates and fillers for sieve analysis shall weigh, after drying, the amounts indicated in the following table:

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1949 to 1951.

[3] Appears in this publication.

[4] 1964 Book of ASTM Standards, Part 30.

Material with at least 90 per cent passing a No. 50 (297-μ) sieve	100 ± 0.1 g
Material with at least 90 per cent passing a No. 16 (1.19-mm) sieve and not more than 10 per cent retained on a No. 50 (297-μ) sieve	500 ± 0.5 g
Material with at least 90 per cent passng a $\frac{3}{8}$-in. sieve and more than 10 per cent retained on a No. 16 (1.19-mm) sieve	1000 ± 1.0 g

Preparation of Sample

4. Samples shall be dried to constant weight at a temperature not exceeding 110 C (230 F).

Procedure

5. (*a*) The sieving operation shall be conducted by means of a lateral and vertical motion of the sieve, accompanied by a jarring action so as to keep the sample moving continuously over the surface of the sieve. In no case shall fragments in the sample be turned or manipulated through the sieve by hand. If hand operation is employed, sieving shall be continued until not more than 1 per cent by weight of the residue passes any sieve during 1 min. On that portion of the sample retained on the No. 4 (4.76-mm) sieve, the sieving shall be carried out with a single layer of material until not more than 1 per cent by weight of the residue passes during 1 min.

(*b*) If mechanical sieving is used, the device shall be such as to impart the type of agitation described in Paragraph (*a*) and the shaking shall be continued for a period of 15 min.

Report

6. (*a*) The results of the sieve analysis shall be reported as the total percentages retained on each sieve, calculated on the basis of the weight of the sample used.

(*b*) The percentages shall be rounded off to the nearest whole number in accordance with the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29).[4]

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Standard Method of Test for

SIEVE ANALYSIS OF PLASTIC CALCINED MAGNESIA[1]

ASTM Designation: C 239-51

ADOPTED, 1951.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 239; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. This method of test covers a procedure for the sieve analysis of plastic calcined magnesia for use in magnesium oxychloride cements.

NOTE.—The procedure for the sieve analysis of magnesium oxychloride compositions, aggregates, and fillers is described in A.S.T.M. Method C 238.[3]

Apparatus

2. (*a*) *Sprinkler Head.*—The sprinkler head shall be $1\frac{3}{4}$ in. in diameter across the face. The face shall be a plane surface of non-ferrous metal of a thickness not greater than No. 18 gage (0.05 in.) and shall be perforated with 45 to 50 holes 0.041 ± 0.001 in. in diameter uniformly distributed over the face. The sprinkler shall be connected to the water tap with at least 24 in. of standard $\frac{3}{4}$-in. garden hose.

(*b*) *Balance.*—The balance or scale shall be accurate and sensitive to within 0.1 per cent of the weight of the sample to be tested.

(*c*) *Sieve.*—A No. 200 (74-micron) sieve shall be used. The sieve shall conform to the Specifications for Sieves for Testing Purposes (A.S.T.M. Designation: E 11),[4] and shall be 8 in. in diameter and of full height (about 2 in.).

NOTE.—A Tyler standard testing sieve may be substituted, provided the Tyler opening is the same as that of the A.S.T.M. standard sieve.

(*d*) *Mechanical Shaking Device.*—The shaking device shall be such as to produce a lateral and vertical motion of the sieve, accompanied by a jarring action so as to keep the sample moving continuously over the surface of the sieve.

(*e*) *Drying Oven.*—The drying oven may be heated by any suitable means, provided the heating source is so controlled that the temperature in the oven is maintained at 110 ± 5 C.

Samples

3. (*a*) The magnesia shall be sampled in accordance with the Standard Method of Sampling Magnesium Oxychloride Compositions and Ingredients (A.S.T.M. Designation: C 237).[3]

(*b*) Samples for sieve analysis shall be obtained by quartering or by the use of a sampler from the sample selected in accordance with Paragraph (*a*).

(*c*) Samples for sieve analysis shall weigh 100 ± 0.1 g.

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the A.S.T.M. Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1949 to 1951.

[3] Appears in this publication.

[4] 1964 Book of ASTM Standards, Part 30.

Procedure

4. (*a*) Water shall be applied to the sample in the sieve by use of the sprinkler in such manner that no dust is driven up from the sample. After the sample is thoroughly wetted, the flow of water shall be increased so that a turbulence is produced on the sieve, but this shall not be great enough to wash any of the sample over the sides of the sieve. Washing shall be continued until the wash water passing through the sieve is clear.

(*b*) The sieve with the wet residue shall be transferred to the drying oven and the residue dried to a dry granular condition.

(*c*) The dried residue shall be brushed from the original sieve to another sieve conforming to Section 2(*c*). This sieve shall be placed over a sieve-pan and the nest then transferred to the shaking device. The sieve shall be agitated in the shaking device for a period of 15min.

(*d*) The weight of the residue on the sieve shall then be determined.

Report

5. (*a*) The results of the sieve analysis shall be reported as the total percentage retained on the sieve, calculated on the basis of the weight of the sample used.

(*b*) The percentages recorded shall be rounded off to the nearest 0.1 per cent in accordance with the Recommended Practices for Designating Significant Places in Specified Limiting Values (A.S.T.M. Designation: E 29).[4]

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Standard Methods for

CHEMICAL ANALYSIS OF MAGNESIUM CHLORIDE[1]

ASTM Designation: C 245 – 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 245; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

NOTE.—Editorial changes in Sections 4, 6(*f*), 7(*a*), 9(*d*), and 10(*a*), (*b*), and (*e*) were made in June and December, 1954.

Scope

1. (*a*) These methods cover procedures for the chemical analysis of magnesium chloride ($MgCl_2 \cdot 6H_2O$) for use in magnesium oxychloride cements.

(*b*) The analytical procedures and the method of reporting results appear in the following order:

	SECTIONS
Magnesium Chloride	4 and 5
Total Calcium	6 and 7
Total Alkali Chlorides	8 to 10
Magnesium Oxide	11 and 12
Report	13

Purity of Reagents and Water

2. (*a*) *Reagents.*—Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.[3] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

(*b*) *Water.*—Unless otherwise indicated, references to water shall be understood to mean distilled water.

Sampling

3. The magnesium chloride shall be sampled in accordance with the Standard Method of Sampling Magnesium Oxychloride Compositions and Ingredients (ASTM Designation: C 237).[4]

MAGNESIUM CHLORIDE

Reagents

4. (*a*) *Standard Sodium Hydroxide Solution (1.0 N).* — Dissolve low-carbonate NaOH pellets in an equal weight of water. After the solution has cooled, place it in a stoppered bottle for several days in order that the carbonate may settle. Carefully decant the clear liquid and determine the approximate strength by titrating a measured volume of the liquid with 1 *N* HCl, using 3 drops of methyl red indicator. Dilute to approximately 1 *N* with water.

Standardize the solution as follows: Dry 10 g. of potassium acid phthalate from the National Bureau of Standards standard sample No. 84*b* (purity 100.04 per cent) for 2 hr. at 120 C. After cooling, weigh out 8 to 9 g. to the nearest 1 mg. and dissolve in 125 ml. of water containing 3 drops of phenolphthalein indicator, using a stoppered 250-ml. wide-mouth Erlenmeyer flask for dissolution of the salt in order to avoid absorption of CO_2. Titrate the solution in the 250-ml. flask with the NaOH solution to a faint pink end point, estimating all buret readings to the nearest 0.01 ml. Calculate the normality of the NaOH solution as follows:

$$N_b = \frac{A \times 1.0004}{B \times 0.20422}$$

where:

N_b = normality of the NaOH solution,
A = grams of potassium acid phthalate used,
B = milliliters of the NaOH solution required for the titration, and
1.0004 = purity of the potassium acid phthalate.

Dilute the solution to 1 ± 0.002 *N* with water.

(*b*) *Phenolphthalein Indicator Solution.*

(*c*) *Standard Sodium Hydroxide Solution (0.10 N).*—Dilute 100 ml. of 1.0 *N* NaOH solution to 1 liter and standardize as described in Paragraph (*a*). Adjust the concentration to 0.10 *N*.

(*d*) *Standard Hydrochloric Acid (0.10 N).*—Dilute 8.5 ml. of HCl (sp. gr. 1.18) to 1 liter. Standardize against the 0.10 *N* NaOH solution, using methyl red indicator, and adjust the concentration to 0.10 *N*.

(*e*) *Methyl Red Indicator Solution (1 g. per l.).*—Dissolve 0.1 g. of sodium *p*-dimethylaminobenzene-*p*-carboxylate in water and dilute to 1 liter.

Procedure

5. (*a*) Weigh to the nearest 1 mg. a portion of the sample calculated to contain from 4.2 to 4.7 g. of $MgCl_2 \cdot 6H_2O$ and transfer to a 150-ml. beaker. Add 100 ml. of water and a drop of methyl red indicator. If the indicator turns pink, add 0.10 *N* NaOH solution dropwise, while stirring vigorously, until the color changes to an intermediate shade. If the indicator remains yellow, no further neutralization is necessary.

(*b*) Transfer the solution to a 500-ml. volumetric flask and dilute to about 400 ml. with water. From a pipet, add 50 ml. of 1.0 *N* NaOH solution. Dilute to the mark with water and mix thoroughly. Allow to settle until the supernatant liquid becomes perfectly clear (Note 1); then pipet out a 50-ml. aliquot into a 250-ml. Erlenmeyer flask. Add a drop of methyl red indicator and titrate to a persistent orange-pink color with 0.10 *N* HCl (Note 2).

NOTE 1.—The supernatant liquid should be approximately 0.01 *N* in alkalinity.

NOTE 2.—The titration does not include any $Mg(OH)_2$ or MgO present in the sample. At least 0.5 per cent of $CaCl_2$ may be present without causing appreciable interference.

(*c*) *Calculation.*—Calculate the percentage of magnesium chloride as $MgCl_2 \cdot 6H_2O$, as follows:

$$MgCl_2 \cdot 6H_2O, \text{ per cent} = \frac{(A - B) \times 0.1017}{C} \times 100$$

where:

A = milliliters of 1.0 *N* NaOH solution added (Paragraph (*b*)),
B = milliliters of 0.10 *N* HCl required for titration of the excess NaOH, and
C = grams of sample used.

[1] Under the standardization procedure of the Society, these methods are under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, these methods were published as tentative from 1950 to 1952.

[3] "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, D. C. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, N. Y., and the "United States Pharmacopeia."

[4] Appears in this publication.

TOTAL CALCIUM

Reagents

6. (*a*) *Sugar.*—Granulated cane sugar.

(*b*) *Standard Sodium Hydroxide Solution (1.0 N).*—See Section 4 (*a*).

(*c*) *Methyl Red Indicator Solution.*—See Section 4(*d*).

(*d*) *Ammonium Chloride Solution (saturated).*

(*e*) *Ammonium Oxalate Solution (saturated).*

(*f*) *Standard Potassium Permanganate Solution (0.10 N).*—Dissolve 3.2 g. of $KMnO_4$ in water and dilute to 1 liter. Let age for 1 month. Filter, using a fritted-glass filter, and standardize as follows: Weigh out 0.25 to 0.30 g. of sodium oxalate (National Bureau of Standards standard sample No. 40) that has been dried at 110 C. for 2 hr. Dissolve the sodium oxalate in 200 ml. of hot water (90 C.) and 40 ml. of H_2SO_4 (1:2). Titrate with the $KMnO_4$ solution to the first persistent pink color. The temperature at the end of the titration should be not less than 60 C. Calculate the normality of the $KMnO_4$ solution as follows:

$$N = \frac{A}{B \times 0.067}$$

where:

N = normality of the $KMnO_4$ solution,
A = grams of sodium oxalate,
B = milliliters of $KMnO_4$ solution required for the titration, and
0.067 = milliequivalent weight of sodium oxalate.

Procedure

7. (*a*) Transfer 12.50 g. of the sample to a 600-ml. beaker. Dissolve in a small amount of water and add enough HCl (1:1) to give a clear solution. (Usually only a few drops of HCl are required.) Dissolve 12.5 g. of sugar in 250 ml. of water and add to the solution in the 600-ml. beaker. Neutralize the solution with 1.0 *N* NaOH, using methyl red indicator. Transfer to a 500-ml. volumetric flask and add sufficient 1.0 *N* NaOH to precipitate 95 per cent of the $MgCl_2$ present (Note 1). Dilute the solution to 500 ml. and mix thoroughly. Filter through a dry, 8-in., medium paper, discarding the first 50 ml. that passes through.

NOTE 1.—Knowing the $MgCl_2 \cdot 6H_2O$ content of the sample, the volume of 1.0 *N* NaOH solution to add can be calculated as follows:

$$A = \frac{12.5 \times 0.95B}{0.1017 \times 100}$$

where:
A = milliliters of 1.0 *N* NaOH to be added, and
B = percentage of $MgCl_2 \cdot 6H_2O$ in the sample.

(*b*) Take 300 ml. of the filtrate, make distinctly acid to methyl red with HCl, and add 20 ml. of NH_4Cl solution and 25 ml. of ammonium oxalate solution. Heat the solution to boiling and, while stirring continuously, slowly add NH_4OH (1:3) from a pipet. When the precipitate begins to appear, allow time between each drop for the precipitate to form. Add NH_4OH (1:3) until the solution is yellow to methyl red. Continue to boil for 1 min. and then allow to stand for 2 hr.

(*c*) Filter off the precipitate, using a low-ash, fine paper. Wash the beaker several times with several portions of hot water, adding the washings to the precipitate; then continue to wash the precipitate with hot water until free of oxalates (Note 2).

NOTE 2.—The precipitate shall be considered free of oxalates when the filtrate shows only a slight turbidity (trace of chlorides), when tested with 0.10 *N* $AgNO_3$ solution slightly acidified with HNO_3.

(*d*) Add 10 ml. of H_2SO_4 (1:4) and 50 ml. of water to the original beaker. Then wash the precipitate over the edge of the funnel into the beaker, folding the paper over the edge of the beaker. Heat the solution to about 90 C. and titrate with 0.10 *N* $KMnO_4$ to a pink color, add the

filter paper, and again titrate to a pink color.

(*e*) *Calculation.*—Calculate the percentage of total calcium as $CaCl_2$, as follows:

$$CaCl_2, \text{ per cent} = \frac{A \times 0.0056}{7.5} \times 100$$

where:

A = milliliters of 0.10 *N* $KMnO_4$ required for the titration, and
7.5 = grams of sample represented in the 300-ml. portion of the sample solution (Paragraph (*b*)).

TOTAL ALKALI CHLORIDES

Outline of Method

8. The $MgCl_2$ is precipitated as $MgCO_3$ in the presence of ethyl alcohol. The filtrate is evaporated to dryness and ignited to remove ammonium salts. The alkali chlorides are titrated with standard $AgNO_3$ solution.

Reagents

9. (*a*) *Barium Chloride Solution (100 g. $BaCl_2$ per l.).*—Dissolve 117 g. of $BaCl_2 \cdot 2H_2O$ in water and dilute to 1 liter.

(*b*) *Ammonium Carbonate Solution (saturated).* — Prepare a saturated $(NH_4)_2CO_3$ solution by long standing over an excess of $(NH_4)_2CO_3$, with occasional shaking.

(*c*) *Alcohol.*—Ethyl alcohol (95 per cent), or suitable denatured alcohol.

(*d*) *Alcoholic Ammonium Carbonate Solution.*—Mix 90 ml. of NH_4OH (sp. gr. 0.90) with 370 ml. of cold, saturated $(NH_4)_2CO_3$ solution and 480 ml. of ethyl or denatured alcohol (95 per cent).

(*e*) *Standard Silver Nitrate Solution (0.050 N).*—Dissolve 8.495 g. of $AgNO_3$ in water and dilute to 1 liter in a volumetric flask.

(*f*) *Potassium Chromate Solution (50 g. K_2CrO_4 per l.).*

Procedure

10. (*a*) Dissolve 4.000 g. of the sample in 50 ml. of water. Make acid with HCl (1:4) and add 10 ml. of $BaCl_2$ solution to precipitate sulfate. Filter and wash into a 250-ml. volumetric flask. If sulfate is absent, the filtration can be omitted. Keep the total volume of solution under 75 ml. and as low as possible.

(*b*) Add 100 ml. of alcoholic ammonium carbonate solution to the solution in the volumetric flask and dilute to 250 ml. with alcohol. Let stand for 2 hr. Dilute to the mark with alcohol and filter through a fine paper.

(*c*) Pipet 100 ml. of the solution into a 250-ml., heat-resistant glass beaker. Evaporate to incipient dryness over a steam bath; then add 1 ml. of HCl (sp. gr. 1.18). Ignite at 350 to 400 C. until free of NH_4Cl. Best results will be obtained by the use of a well-regulated electric furnace or muffle. In case this apparatus is not available, the ignition may be carefully done over a Bunsen flame. Heating in the muffle for ½ hr. should be sufficient.

(*d*) Wash down the sides of the beaker and dissolve the residue in a small amount of water. Add 3 drops of K_2CrO_4 solution as an indicator, and titrate with $AgNO_3$ solution to a pink or red color.

(*e*) *Calculation.*—Calculate the percentage of total alkali chlorides as NaCl, as follows (Note):

$$NaCl, \text{ per cent} = \frac{A \times 0.00292}{1.6} \times 100$$

where:

A = milliliters of 0.05 *N* $AgNO_3$ solution required for the titration.

NOTE.—For the most accurate results, known samples should be analyzed to determine an empirical correction factor, usually about 1.05. For example, 0.0029 multiplied by the empirical correction factor gives the true factor for use in this calculation.

MAGNESIUM OXIDE

Reagents

11. (*a*) *Methyl Red Indicator Solution.*—See Section 4(*d*).

(*b*) *Standard Hydrochloric Acid (0.10 N).*—See Section 4 (*c*).

(*c*) *Standard Sodium Hydroxide Solution (0.10 N).*—See Section 4 (*b*).

Procedure

12. (*a*) Transfer 10.00 g. of the sample to a 250-ml. beaker. Add 50 ml. of water and 2 drops of methyl red indicator, or more if necessary. Titrate with 0.10 *N* HCl to a red color, adding approximately 0.5 ml. of the HCl in excess. Boil for 2 min. to expel CO_2, cool, and back-titrate to the orange-yellow end point with 0.10 *N* NaOH.

(*b*) *Calculation.*—Calculate the percentage of MgO as follows:

$$\text{MgO, per cent} = \frac{(A - B) \times 0.002}{10} \times 100$$

where:

A = milliliters of 0.10 *N* HCl required for the titration, and

B = milliliters of 0.10 *N* NaOH required for the back-titration.

REPORT

Report

13. The values for the percentages of the constituents determined shall be rounded off in accordance with the rounding-off method given in Section 3(*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29),[5] and reported as follows:

(*1*) Magnesium chloride as $MgCl_2 \cdot 6H_2O$ to the nearest 0.1 per cent,

(*2*) Total calcium as $CaCl_2$ to the nearest 0.1 per cent,

(*3*) Total alkali chlorides as NaCl to the nearest 0.01 per cent, and

(*4*) Magnesium oxide to the nearest 0.1 per cent.

[5] 1964 Book of ASTM Standards, Part 30.

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UDC 624.025:691.31

Standard Methods for

PHYSICAL TESTING OF MAGNESIA FOR MAGNESIUM OXYCHLORIDE CEMENTS[1]

ASTM Designation: C 246 - 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 246; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. These methods of test cover physical test procedures for evaluating magnesia (MgO) for use in magnesium oxychloride cements.

Magnesia

2. The sample of magnesia to be tested shall be dry and shall have been taken in accordance with the Standard Method of Sampling Magnesium Oxychloride Compositions and Ingredients (ASTM Designation: C 237).[3] The sample as received shall be thoroughly mixed and, if necessary, reduced to convenient size by quartering or by means of an automatic sample splitter. The sample shall be stored in an airtight container.

Inert Ingredients

3. (*a*) *Standard Sand.*—The sand to be used in preparing the test mix shall be dry, natural silica sand from Ottawa, Ill., and shall conform to the following sieve analysis when tested in accordance with the Standard Method of Test for Sieve Analysis of Magnesium Oxychloride Compositions, Aggregates, and Fillers (ASTM Designation: C 238).[3]

Sieve	Percentage Retained
No. 20 (841-micron)	15 max.
No. 30 (595-micron)	95 min.

(*b*) *Standard Silex.*—The silex (ground silica) to be used in preparing the test mix shall be dry, natural silica sand from Ottawa, Ill., ground and air-separated to conform to the following sieve analysis when tested in accordance with Method C 238 (Note 1).

Sieve	Percentage Retained
No. 140 (105-micron)	2 max.
No. 200 (74-micron)	10 ±2
No. 325 (44-micron)	33 max.

NOTE 1.—This grade of ground silica is commonly referred to as "minus 140-mesh" silex.

(*c*) *Standard Asbestos Fiber.*—The asbestos fiber to be used in preparing the test mix shall be a clean, dry, air-separated, short fiber, chrysolite type asbestos of Canadian origin, commercially designated as 7RF and approved for this use (Note 2).

[1] Under the standardization procedure of the Society, these methods are under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, these methods were published as tentative from 1950 to 1952.

[3] Appears in this publication.

MAGNESIUM OXIDE

Reagents

11. (*a*) *Methyl Red Indicator Solution.*—See Section 4(*d*).

(*b*) *Standard Hydrochloric Acid (0.10 N).*—See Section 4 (*c*).

(*c*) *Standard Sodium Hydroxide Solution (0.10 N).*—See Section 4 (*b*).

Procedure

12. (*a*) Transfer 10.00 g. of the sample to a 250-ml. beaker. Add 50 ml. of water and 2 drops of methyl red indicator, or more if necessary. Titrate with 0.10 *N* HCl to a red color, adding approximately 0.5 ml. of the HCl in excess. Boil for 2 min. to expel CO_2, cool, and back-titrate to the orange-yellow end point with 0.10 *N* NaOH.

(*b*) *Calculation.*—Calculate the percentage of MgO as follows:

$$\text{MgO, per cent} = \frac{(A - B) \times 0.002}{10} \times 100$$

where:

A = milliliters of 0.10 *N* HCl required for the titration, and

B = milliliters of 0.10 *N* NaOH required for the back-titration.

REPORT

Report

13. The values for the percentages of the constituents determined shall be rounded off in accordance with the rounding-off method given in Section 3(*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29),[5] and reported as follows:

(*1*) Magnesium chloride as $MgCl_2 \cdot 6H_2O$ to the nearest 0.1 per cent,

(*2*) Total calcium as $CaCl_2$ to the nearest 0.1 per cent,

(*3*) Total alkali chlorides as NaCl to the nearest 0.01 per cent, and

(*4*) Magnesium oxide to the nearest 0.1 per cent.

[5] 1964 Book of ASTM Standards, Part 30.

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Inert Ingredients

3. (*a*) *Standard Sand.*—The sand to be used in preparing the test mix shall be dry, natural silica sand from Ottawa, Ill., and shall conform to the following sieve analysis when tested in accordance with the Standard Method of Test for Sieve Analysis of Magnesium Oxychloride Compositions, Aggregates, and Fillers (ASTM Designation: C 238).[3]

Sieve	Percentage Retained
No. 20 (841-micron)	15 max.
No. 30 (595-micron)	95 min.

(*b*) *Standard Silex.*—The silex (ground silica) to be used in preparing the test mix shall be dry, natural silica sand from Ottawa, Ill., ground and air-separated to conform to the following sieve analysis when tested in accordance with Method C 238 (Note 1).

Sieve	Percentage Retained
No. 140 (105-micron)	2 max.
No. 200 (74-micron)	10 ±2
No. 325 (44-micron)	33 max.

NOTE 1.—This grade of ground silica is commonly referred to as "minus 140-mesh" silex.

(*c*) *Standard Asbestos Fiber.*—The asbestos fiber to be used in preparing the test mix shall be a clean, dry, air-separated, short fiber, chrysolite type asbestos of Canadian origin, commercially designated as 7RF and approved for this use (Note 2).

[1] Under the standardization procedure of the Society, these methods are under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, these methods were published as tentative from 1950 to 1952.

[3] Appears in this publication.

NOTE 2.—The term 7RF is a trade designation or grading and specifications for the particular material are relatively indefinite. A stock of satisfactory material from a Canadian source has been set aside for availability on order and subsequent lots will be tested by the supplier to determine that they yield the same results when all other ingredients of the standard test mix (Section 4(*a*)) remain constant.[4]

Proportioning and Preparation of Standard Test Mix

4. (*a*) The proportions by weight of the dry materials for the standard test mix shall be as follows:

	Percentage by Weight
Magnesia	30
Standard sand	52
Standard silex	15
Standard asbestos fiber	3

(*b*) The calculated quantities of the dry materials, sufficient to yield the required amount of the test mix, shall be mixed in accordance with the Standard Method for Mixing Magnesium Oxychloride Cement Compositions with Gauging Solution (ASTM Designation: C 251).[3] The required quantity of standard asbestos fiber shall be brushed through a No. 8 (2380-micron) sieve into the mixing can prior to dry mixing in accordance with Section 5(*a*) of Method C 251.

Methods of Testing

5. Test the plastic cement (Section 4) in accordance with the following methods of the American Society for Testing Materials:

(*a*) *Consistency.*—Standard Method of Test for Consistency of Magnesium Oxychloride Cements by the Flow Table (ASTM Designation: C 255).[3]

(*b*) *Setting Time.*—Standard Method of Test for Setting Time of Magnesium Oxychloride Cements (ASTM Designation: C 254).[3]

(*c*) *Linear Change.*—Standard Methods of Test for Linear Change of Magnesium Oxychloride Cements (ASTM Designation: C 253).[3]

(*d*) *Linear Contraction.*—Standard Method of Test for Linear Contraction of Magnesium Oxychloride Cements (ASTM Designation: C 252).[3]

(*e*) *Flexural Strength.*—Standard Method of Test for Flexural Strength of Magnesium Oxychloride Cements (ASTM Designation: C 256).[3]

(*f*) *Compressive Strength.*—Standard Method of Test for Compressive Strength of Magnesium Oxychloride Cements (ASTM Designation: C 257).[3]

Check Tests

6. In the event of disagreement between results of tests by different laboratories, confirmation of the identity of mixing procedures and of conformity to these Methods C 246 shall be required. Confirmation of the identity of mixing procedures shall be established as prescribed in Section 6 of Method C 251. Conformity to these Methods C 246 shall be considered to have been established when the two laboratories, employing the manufacturer's recommended ratio of gauging solution to magnesia and equivalent representative portions of a single magnesia sample and testing in accordance with the methods listed in Section 5 (*b*) to (*f*), obtain values within the permissible differences. Check tests shall consist of ten determinations, the average of which shall agree within the following permissible differences:

Test	Permissible Difference in Results Between Two Laboratories, plus or minus
Setting time, min:	
Initial set	16
Final set	30
Linear change, per cent:	0.005
Linear contraction, per cent:	
Nonplastic contraction	0.030
Net contraction	0 033
Flexural strength, psi	300
Compressive strength, psi	400

[4] Suitable tested asbestos fiber may be purchased in 100-lb. bags from F. E. Schundler & Co., Inc., Joliet, Ill.

Report

7. The report shall include the following:

(*1*) Identification and preparation of the sample of magnesia, with any pertinent information regarding its nature and source,

(*2*) Weights of ingredients used,

(*3*) Ratio of volume of gauging solution to weight of magnesia and the value obtained for flow-table consistency,

(*4*) Information required in all physical testing methods employed, and

(*5*) Results of check tests, when required.

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Standard Methods of Test for

IGNITION LOSS AND ACTIVE CALCIUM OXIDE IN MAGNESIUM OXIDE FOR USE IN MAGNESIUM OXYCHLORIDE CEMENTS[1]

ASTM Designation: C 247 - 57

ADOPTED 1957.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 247; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. These methods cover procedures for determining loss on ignition and active calcium oxide (Note) in magnesium oxide (MgO) for use in magnesium oxychloride cements.

NOTE.—The term "active calcium oxide" includes those compounds of calcium which may be present and which are capable of reacting with magnesium chloride under the specified conditions. These constituents are commonly referred to as "active lime."

Purity of Reagents and Water

2. (*a*) *Reagents.*—Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.[3] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

(*b*) *Water.*—Unless otherwise indicated, references to water shall be understood to mean CO_2-free distilled water.

Samples

3. (*a*) The magnesium oxide shall be sampled in accordance with the Standard Method of Sampling Magnesium Oxychloride Compositions and Ingredients (ASTM Designation: C 237).[4]

(*b*) The samples shall be of such fineness that at least 90 per cent will pass a No. 200 (74-micron) sieve, when tested in accordance with the Standard Method of Test for Sieve Analysis of Plastic Calcined Magnesia (ASTM Designation: C 239),[4] and shall be thoroughly mixed and reduced by the usual method of quartering and splitting to minimum portions of 100 g each. These operations shall be performed as rapidly as possible and with minimum exposure to the atmosphere to avoid increase in the loss on ignition.

[1] Under the standardization procedure of the Society, these methods are under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to their present adoption as standard, these methods were published as tentative from 1950 to 1952, and published as standard from 1952 to 1954. They were reverted to tentative and revised in 1954 and published as tentative from 1954 to 1957.

[3] "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, D. C. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, N. Y., and the "United States Pharmacopeia."

LOSS ON IGNITION

Procedure

4. (*a*) Ignite a clean platinum crucible, with a well-fitting cover, at 1000 ± 25 C, for at least 5 min in a muffle furnace. Remove the crucible from the muffle and cool rapidly to room temperature by immediately placing it on a piece of unglazed tile. (When the crucible has reached a temperature of 100 C or below, it may be placed on a clean metal plate.) Weigh the ignited crucible to the nearest 0.1 mg and record as weight *A*.

(*b*) Transfer 2.5 to 3.5 g of the sample to the crucible, cover immediately, and weigh to the nearest 0.1 mg. Record as weight *B*. Heat to 1000 C by placing the crucible in front of an open muffle furnace and slowly moving it inside. Approximately 10 min should be required to bring the crucible to 1000 C; more rapid heating may produce spattering and loss of sample, particularly if the ignition loss is high. Close the muffle and ignite the sample for 1 hr at 1000 ± 25 C. Remove the crucible from the muffle and cool rapidly to room temperature as directed in Paragraph (*a*). Since the ignited material is slightly hygroscopic, the cover must be kept on the crucible at all times. If for any reason it is not possible to make the weighing within 5 min after removal of the crucible from the muffle, ignite the sample again at 1000 C for 10 min and cool before weighing. Weigh the crucible and contents to the nearest 0.1 mg and record as weight *C*.

(*c*) *Calculation.*—Calculate the percentage loss on ignition as follows:

$$\text{Loss on ignition, per cent} = \frac{B - C}{B - A} \times 100$$

[4] Appears in this publication.

ACTIVE CALCIUM OXIDE

Reagents

5. (*a*) *Standard Magnesium Chloride Solution.*—Dissolve 214 g of $MgCl_2 \cdot 6H_2O$ in water and dilute to 10 liters. This solution contains approximately 10 g of $MgCl_2$ per liter.

Standardize the $MgCl_2$ solution as follows:

Pipet three 200-ml portions of the $MgCl_2$ solution into 500-ml Erlenmeyer flasks. Add from a buret 44.00, 45.00, 46.00 ml, respectively, of 1 *N* NaOH to the three portions of $MgCl_2$ solution. Transfer the solutions quantitatively to 500 ml glass-stoppered graduates, dilute to 500 ml with water, and mix well. Allow to settle until there is about 400 ml of supernatant liquid. Decant about 350 ml into a dry Erlenmeyer flask and filter through a 12.5-cm, medium paper, using dry apparatus (Note 1).

Measure 300 ml of the clear filtrate in a graduate and transfer to a 500 ml Erlenmeyer flask. Add 5 drops of methyl red indicator and titrate the excess NaOH with 0.1 *N* HCl.

Calculate the magnesium equivalent

of the $MgCl_2$ solution as follows (Note 2):

$$E = BN_b - \frac{5}{3} AN_a$$

where:

E = milliequivalents of Mg^{++} in 200 ml of the $MgCl_2$ solution,
B = total milliliters of 1 N NaOH solution added,
N_b = normality of the NaOH solution,
A = milliliters of 0.1 N HCl required for titration of 300 ml of the filtered solution to the methyl red end point, and
N_a = normality of the HCl

Prepare a plot of E *versus* 5/3 AN_a. The term, 5/3 AN_a should not vary outside the limits 1.5 to 4.5.

NOTE 1.—The filtrate must be clear. This is easily assured if care is taken in decanting the supernatant liquid.

NOTE 2.—The $MgCl_2$ solution should be adjusted so that E = 42.00 ± 0.5 milliequivalents Mg^{++} per 200 ml. This value will not change if the solution is protected against absorption of CO_2. If a precipitate forms while standing, the solution should be restandardized.

(*b*) *Phenolphthalein Indicator Solution (10 g per l).*—Dissolve 10 g of phenolphthalein in 1 liter of ethyl alcohol (95 per cent).

(*c*) *Standard Sodium Hydroxide Solution (1.0 N).*—Dissolve low-carbonate NaOH pellets in an equal weight of water. After the solution has cooled, place it in a stoppered bottle for several days in order that the carbonate may settle. Carefully decant the clear liquid and determine the approximate strength by titration with 1 N HCl, using 3 drops of methyl red indicator. Dilute to 1 ± 0.002 N with water.

Standardize the solution as follows: Dry 10 g of potassium acid phthalate from the National Bureau of Standards standard sample No. 84*b* (purity 100.04 per cent) for 2 hr at 120 C. After cooling, weigh 8 to 9 g, to the nearest 1 mg, and dissolve in 125 ml of water containing 3 drops of phenolphthalein indicator, using a stoppered 250-ml wide-mouth Erlenmeyer flask for dissolution of the salt in order to avoid absorption of CO_2. Titrate the solution in the 250-ml flask with the NaOH solution to a faint pink end point, estimating all buret readings to the nearest 0.01 ml. Calculate the normality of the NaOH solution as follows:

$$N_b = \frac{A \times 1.0004}{B \times 0.20422}$$

where:

N_b = normality of the NaOH solution,
A = grams of potassium acid phthalate used,
B = milliliters of the NaOH solution required for the titration, and
1.0004 = purity of the potassium acid phthalate.

(*d*) *Methyl Red Indicator Solution.*—Dissolve 0.4 g of sodium *p*-dimethylaminobenzene - *p* - carboxylate in water and dilute to 1 liter.

(*e*) *Borax.*—Dissolve approximately 180 g of $Na_2B_4O_7 \cdot 10H_2O$ in 1 liter of hot water. Cool to room temperature with occasional stirring in order to insure the formation of small crystals. When cold, filter by suction. Drain as dry as possible and place in a desiccator over a solution saturated with both NaCl and sucrose. Spread the borax out in a thin layer and allow to remain in the desiccator at least a week before it is used.

(*f*) *Standard Hydrochloric Acid (0.1 N).*—Dilute 150 ml of HCl (sp gr 1.18) to 18 liters with water. Standardize by titrating against 0.8 to 0.9 g of $Na_2B_4O_7 \cdot 10H_2O$ (Paragraph (*e*)), weighed to the

nearest 0.1 mg and dissolved in about 200 ml of water, to the end point of methyl red. Estimate all buret readings to the nearest 0.01 ml. Calculate the normality of the HCl as follows:

$$N_a = \frac{A}{B \times 0.19072}$$

where:

N_a = normality of the HCl,
A = grams of $Na_2B_4O_7 \cdot 10H_2O$ used, and
B = milliliters of the HCl required for the titration.

Adjust the normality of the HCl to 0.1 ± 0.0002 N.

Procedure

6. (*a*) Transfer 2.80 ± 0.01 g of the sample to a dry 500-ml Erlenmeyer flask. Add 200 ml of $MgCl_2$ solution by means of a 200-ml pipet. Stopper securely and agitate for 16 hr on a shaking machine. Slurry 2 g of diatomaceous earth filter aid[5] in 100 ml of water and filter with suction on a 9-cm, fine, very dense, qualitative paper in a Büchner funnel, using suction. Filter the sample on this prepared mat, using suction. Wash five times with water.

(*b*) Add from a buret 43.00 ml of 1 N NaOH solution.

(*c*) Transfer the solution to a 500-ml glass-stoppered graduate, dilute to 500 ml, and mix well. Allow to settle 2 hr. Decant about 350 ml into a dry Erlenmeyer flask and filter through a 12.5-cm medium paper, using dry apparatus.

(*d*) Measure 300 ml of the clear filtrate in a graduate and transfer to a 500-ml Erlenmeyer flask Add 5 drops of methyl red indicator and titrate the excess NaOH with 0.1 N HCl. The end point may fade, due to the presence of $CaCO_3$ formed by reaction of Ca^{++} with CO_2. Add 0.1 N HCl until the end point no longer fades.

(*e*) *Calculation.*—Calculate the percentage of active calcium oxide as follows:

$$S = BN_b - \frac{5}{3} AN_a$$

Active calcium oxide, per cent

$$= \frac{E - S}{1000} \times \frac{28.0}{2.80} \times 100 = E - S$$

where:

S = milliequivalents of unconsumed Mg^{++} after reaction of the active calcium oxide with 200 ml of the $MgCl_2$ solution,
B = total milliliters of 1 N NaOH solution,
N_b = normality of the NaOH solution,
A = milliliters of 0.1 N HCl solution required for titration of 300 ml of the filtered solution to the methyl red end point,
N_a = normality of the HCl, and
E = milliequivalents of Mg^{++} in 200 ml of the $MgCl_2$ solution. (Select from the graph prepared in accordance with Section 5(*a*) the value of E corresponding to the value of the term 5/3 AN_a obtained in the calculation of S in this Section 5(*e*).)

REPORT

Report

7. The values for the percentages of the constituents determined shall be rounded off in accordance with the rounding-off method given in Section 3 (*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29),[6] and reported as follows:

(*1*) Loss on ignition to the nearest 0.1 per cent, and

(*2*) Active calcium oxide to the nearest 0.1 per cent.

[5] Hyflo Super-Cel has been found satisfactory for this purpose.

[6] 1964 Book of ASTM Standards, Part 30.

APPROVED AS
AMERICAN STANDARD A88.17-1953
BY AMERICAN STANDARDS ASSOCIATION
UDC 624.025:691.31

Standard Method of Test for

BULK DENSITY OF MAGNESIUM OXYCHLORIDE CEMENTS[1]

ASTM Designation: C 248 - 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 248; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

NOTE.—An editorial change in Section 5(*b*) was made in June, 1954.

Scope

1. This method of test covers the procedure for determining the bulk density of magnesium oxychloride cements.

Apparatus

2. The apparatus shall consist of the following:

(*a*) *Balance.*—A bow balance sensitive to 0.01 g. under a load of 200 g. The pan support bow shall be not less than 6 in. wide. Some type of beaker support shall be provided.

(*b*) *Beaker* of 1000-ml. capacity.

(*c*) *Copper Wire*, No. 22 gage.

Preparation of Sample

3. (*a*) The sample shall consist of at least five pieces or fragments of the cement being tested, each weighing not less than 100 nor more than 200 g. The cement shall be mixed, molded, and cured for seven days in accordance with the procedure prescribed for the test specimens in the Standard Method of Test or Flexural Strength of Magnesium Oxychloride Cements (Using Simple Bar with Two-Point or Single-Point Loading) (ASTM Designation: C 256).[3] Where broken test specimens from Method C 256 are available, suitable pieces or fragments from these specimens may be used.

(*b*) Each specimen shall be free of all loosely adhering particles. Visibly defective specimens, such as those containing cracks or bubbles, shall not be used.

(*c*) Specimens shall be selected from test specimens that have been cured in a standard atmosphere and that have not been in contact with water from the time of removal from the forms.

Procedure

4. (*a*) *Dry Weight, D.*—The dry weight, *D*, of each specimen cured as described in Section 3(*c*) shall be determined by weighing in air to the nearest 0.05 g. at 7 days of age.

(*b*) *Water Immersion.*—After the dry weight has been determined, the specimens shall be placed in water at 70 ± 1 F., for 1 hr. During this 1-hr. soaking period they shall be completely covered with water and shall be so placed in the container that the water has free access to all surfaces.

(*c*) *Suspended Weight, S.*—The weight, *S*, of each test specimen, after the soaking period and while suspended in water at 70 ± 1 F., shall be determined to the nearest 0.05 g. by suspending the specimen by means of a loop or halter of No. 22 gage copper wire hung from one arm of the balance. The balance shall be previously counterbalanced with the wire in place and immersed in water to the same depth as is used when the test specimens are in place.

(*d*) *Saturated Weight, W.*—After determining the suspended weight, each specimen shall be blotted lightly with a moist cloth to remove all drops of water from the surface and the saturated weight, *W*, in grams determined immediately by weighing in air to the nearest 0.05 g. The blotting operation shall be performed by rolling the specimen lightly on the wet cloth which has previously been saturated with water and then pressed only enough to remove such water as will drop from the cloth. Excessive blotting will introduce error by withdrawing water from the pores of the specimen.

Calculations

5. (*a*) *Exterior Volume, V.*—The exterior volume, *V*, in cubic centimeters of the test specimens may be obtained by subtracting the suspended weight from the saturated weight, both in grams, as follows:

$$V = W - S$$

(*b*) *Bulk Density, B.*—The bulk density at 70 F., *B*, in grams per cubic centimeters of a specimen is the quotient of its dry weight, *D*, divided by the exterior volume, *V*, including pores, and shall be calculated as follows:

$$B = \frac{D}{V}$$

The bulk density in pounds per cubic foot at 70 F. shall be calculated as follows:

$$\text{Bulk density, lb. per cu. ft.} = B \times 62.4$$

(*c*) *Rounding Off.*—The value for bulk density shall be rounded off to the nearest pound per cubic foot in accordance with the rounding-off method given in Section 3 (*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29).[4]

Report

6. The average of the values obtained with at least five specimens, and preferably also the individual values, shall be reported.

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1950 to 1952.

[3] Appears in this publication.

[4] 1964 Book of ASTM Standards, Part 30.

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ASA NO.: A88.18-1953
UDC 624.025:691.31

Standard Method of

SLUMP TEST FOR FIELD CONSISTENCY OF MAGNESIUM OXYCHLORIDE CEMENTS[1]

ASTM Designation: C 249 - 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 249; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. This method of test covers the procedure to be used in the field for determining the consistency of magnesium oxychloride cements.

Apparatus

2. The test specimen shall be formed in a mold of No. 16 gage galvanized metal in the form of the lateral surface of the frustrum of a cone with the base 8 in. in inside diameter, the top 4 in. in inside diameter, and the altitude 12 in. The base and the top shall be open and parallel to each other and at right angles to the axis of the cone. The mold shall be provided with foot pieces and handles as shown in Fig. 1.

Sample

3. (*a*) Samples of oxychloride cement for test specimens shall be taken at the mixer or mixing box immediately after completion of the mixing and shall be representative of the entire batch.

(*b*) Samples from a mechanical mixer shall be taken from the first discharge of the mixer.

(*c*) Samples of batches mixed by hand in a mixing box shall consist of approximately equal portions taken from not less than six points uniformly distributed over the entire batch. These portions shall be combined and mixed to form a single sample for test.

(*d*) The sample thus obtained shall be transported not more than a few feet from the working area to the place of molding the specimen and, to counteract segregation, shall be mixed in the container with a shovel or scoop until it is uniform in appearance before testing for consistency.

Procedure

4. Dampen the mold and place it on a level, moist, nonabsorbent surface. From the sample of oxychloride cement obtained as described in Section 3, fill the mold immediately in three layers, each approximately one third the volume of the mold. In placing each scoopful of oxychloride cement, move the scoop

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1950 to 1952.

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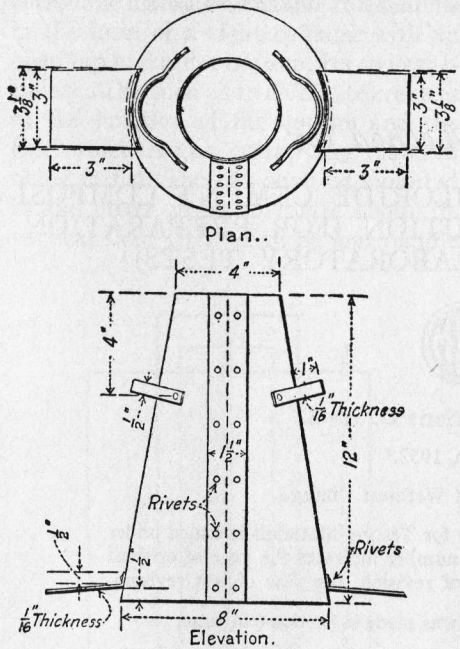


FIG. 1.—Mold for Slump Test.

around the top edge of the mold as the cement slides from it, in order to ensure symmetrical distribution of cement within the mold. Rod each layer with 25 strokes of a $\frac{5}{8}$-in. round rod, approximately 24 in. in length and tapered for a distance of 1 in. to a spherically shaped end having a radius of approximately $\frac{1}{4}$ in. The strokes shall be distributed in a uniform manner over the cross-section of the mold and shall penetrate into the underlying layer. Rod the bottom layer throughout its depth. After the top layer has been rodded, strike off the surface of the cement with a trowel so that the mold is exactly filled. Remove the mold immediately from the oxychloride cement by raising it carefully in a vertical direction. Measure the height at the vertical axis of the specimen to the nearest 0.5 in., and calculate and report the slump as follows:

Slump = 12 — inches of height after subsidence

11-48 X

AMERICAN STANDARD
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UDC 624.025:691.31

Standard Method for

MIXING MAGNESIUM OXYCHLORIDE CEMENT COMPOSITIONS WITH GAUGING SOLUTION (FOR PREPARATION OF SPECIMENS FOR LABORATORY TESTS)[1]

ASTM Designation: C 251 – 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 251; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

NOTE.—An editorial change was made in Section 6 in June, 1954.

Scope

1. This method describes the procedure for mixing dry, premixed magnesium oxychloride compositions with magnesium chloride gauging solution to produce cements for the preparation of laboratory test specimens.

Apparatus

2. (*a*) *Weighing Device.*—A balance or scales having a capacity of 2 kg. or more and a sensibility reciprocal not greater than 2 g. shall be used.

NOTE.—The sensibility reciprocal is a measure of the sensitiveness of a balance, and is the weight required to move the position of equilibrium of the pointer one division.[3]

(*b*) *Weights.*—The permissible variations on weights used in weighing materials shall be as prescribed in Table I.

TABLE I.—PERMISSIBLE VARIATIONS ON WEIGHTS.

Weight, g.	Permissible Variations on Weights in Use, plus or minus, g.
1000	0.5
900	0.45
750	0.4
500	0.35
300	0.3
250	0.25
200	0.20
100	0.15
50	0.10
20	0.05
10	0.04
5	0.03
2	0.02
1	0.01

(*c*) *Mixing Equipment.*—A mechanical mixer of the change-can type, in which the can and the mixing paddles are driven by the same motor and suitably geared to rotate in opposite directions, shall be employed. All parts of the mixer that come in contact with the oxychloride cement shall be of a non-corrodible metal. The mixing can shall be in the form of a right cylinder with an open top and a flat bottom. Its construction shall be such as to eliminate crevices at the junction of the bottom and the side which might entrap the material being mixed. The can shall be mounted in the mixer so as to rotate about its vertical axis. There shall be four paddle blades of uniform rectangular cross-section, 1 to 1¼ in. wide, and thick enough for good mechanical strength, symmetrically mounted in an assembly so that, in operating position, the longitudinal axes of the blades are parallel to each other and to the axis of the mixing can. The broad side of the blades shall be presented to the direction of rotation. The paddle assembly shall rotate about a point midway between the vertical axis and the periphery of the can (Fig. 1), but the blades shall not contact the side of the can. The paddle assembly shall rotate in a direction counter to and at a speed (in revolutions) 1.54 times that of the can. The clearance between the tips of the paddle blades and the bottom of the can shall be not less than ⅛ nor more than ¼ in. and shall be checked at monthly intervals. The diameter of the mixing can shall be such that the average depth of the wet mix is not less than 1 in. Its rim speed shall be between 155 and 190 ft. per min. There shall be a fixed blade of uniform cross-section mounted close to, but not touching, the periphery and so designed as to move the mix toward the center of the can. The leading edge of the fixed blade shall be located approximately 60 deg. in the direction of the rotation of the can, from the nearest approach of the paddle blades to the periphery of the mixing can. The clearance between the end of the fixed blade and the bottom of the can shall be not less than ⅛ nor more than ⅜ in.

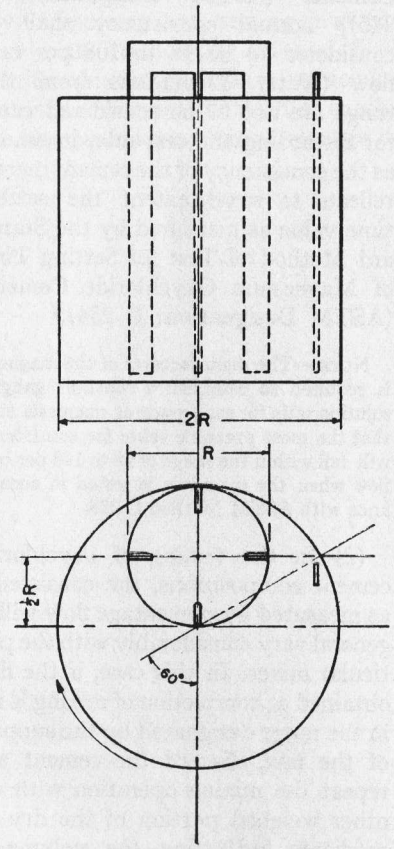


FIG. 1. — Schematic Diagram of Mixing Equipment.

(*d*) *Volumetric Equipment.*—The dispensing burets and graduated cylinders used in measuring the volume of gauging solution shall be calibrated so that each division is equal to not more than 1 per cent of the indicated volume of the vessel.

(*e*) *Timing Device.*—A stop watch or stop clock having a sweep second hand and an integrating minute hand and minute scale shall be provided for timing the operations.

Test Conditions

3. All operations shall be performed in an atmosphere maintained at 70 ± 1 F. and a relative humidity of 50 ± 5 per cent (corresponding to a wet bulb temperature range of 56.5 to

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1950 to 1952.

[3] For a complete definition of sensibility reciprocal, see "Specifications, Tolerances, and Regulations for Commercial Weighing and Measuring Devices," *Handbook H29*, Nat. Bureau Standards, September, 1942, pp. 87 and 88.

60.5 F.). All materials and apparatus shall be equilibrated to these conditions at time of use.

Gauging Solution

4. The gauging solution shall be a clear solution (filtered if necessary) of magnesium chloride in distilled water. The solution shall have a specific gravity of 1.177 ± 0.001 at 70 ± 1 F., determined by any convenient method precise to ± 0.0005, and shall be prepared from materials conforming to the Standard Specifications for Magnesium Chloride (ASTM Designation: C 276).[4]

Procedure

5. (*a*) Weigh to the nearest 1 g. a quantity of dry ingredients sufficient to yield the volume of cement necessary to prepare the required test specimens (but not less than 3 kg.), and record the weight. Transfer the material to a clean, dry mixing can and mix mechanically for 4 min. Stop the mixer and exchange cans. Transfer the material to another can by tumbling to avoid stratification and mix mechanically for an additional 2 min. While the mixer is operating, add the amount of gauging solution recommended by the supplier of the ingredients (or the manufacturer of the magnesia) as being proper to yield a cement of normal consistency at the completion of the mixing procedure, as determined by the Standard Method of Test for Consistency of Magnesium Oxychloride Cements by the Flow Table (ASTM Designation: C 255),[4] and simultaneously start the timing device. The addition of the solution, including drainage of the containers, should be completed within 20 sec. Continue the mixing without interruption or interference for 12 min. ± 5 sec., measured from the time of first addition of gauging solution.

(*b*) At completion of mixing, check the consistency as percentage flow of a portion of the cement in accordance with Method C 255.

(*1*) In the testing of oxychloride grade magnesia for flooring composition in accordance with the Standard Methods for Physical Testing of Magnesia for Magnesium Oxychloride Cements (ASTM Designation: C 246),[4] normal consistency shall be considered to be 98 to 108 per cent flow (Note). Deviations from this range are not to be considered cause for discarding the test mix, inasmuch as the consistency of the cement merely reflects to some extent the setting time value as measured by the Standard Method of Test for Setting Time of Magnesium Oxychloride Cements (ASTM Designation: C 254).[4]

NOTE.—The manufacturer of the magnesia is required to establish a constant gauging solution ratio for each grade of magnesia such that the most probable value for consistency will fall within the range of 98 to 108 per cent flow when the magnesia is tested in accordance with ASTM Method C 255.

(*2*) In the testing of oxychloride cement compositions, the consistency as measured by percentage flow will in general vary considerably with the particular mixes. In this case, if the flow obtained at completion of mixing is not in the range designated by the supplier of the mix, discard the cement and repeat the mixing operation with another weighed portion of the dry ingredients, adjusting the volume of gauging solution as required to give the desired flow value.

(*c*) The desired test specimens shall be prepared promptly after completion of mixing, as provided in the applicable test methods.

Check Tests

6. In the event of disagreement between testing laboratories, confirmation of the identity of mixing procedures with this Method C 251, and of conformity to Method C 255 for determination of consistency by flow-table, shall be required and shall be considered to have been established when the two laboratories, employing a single standard ratio of gauging solution to magnesia and equivalent representative portions of the dry ingredients and testing in accordance with Methods C 251 and C 255, obtain consistency values agreeing to within ± 4 per cent flow. In so checking the test procedures, the percentage flow values compared shall be taken as the average of ten consistencies measured at the end of ten independent mixings.

[4] Appears in this publication.

Report

7. The report shall include the following:

(*1*) Source and preparation of the laboratory sample.

(*2*) Ratio of volume of gauging solution to weight of dry mix or to weight of magnesia contained in the dry mix, and

(*3*) Consistency of the cement as percentage flow.

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AMERICAN STANDARD
BY THE AMERICAN STANDARDS ASSOCIATION
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UDC 624.025:691.31

Standard Method of Test for

LINEAR CONTRACTION OF MAGNESIUM OXYCHLORIDE CEMENTS[1]

ASTM Designation: C 252 – 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 252; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. This method of test covers a procedure for the laboratory determination of linear changes occurring in magnesium oxychloride cements prior to the point of maximum contraction.

Apparatus

2. (*a*) *Measuring Apparatus.*—The measuring apparatus (Fig. 1) shall consist essentially of a base on which shall be rigidly mounted a section of angle brass, 1½ in. by 1½ in. in dimensions and approximately 11 in. long, to serve as a cradle for the specimen. A rigidly mounted tail piece at one end of the cradle shall be provided with a bolt for anchoring the test specimen. At the opposite end of the cradle shall be mounted a suitable measuring instrument graduated to permit reading to 0.001 in. and estimating to 0.0001 in. This instrument may be either a micrometer comparator or a dial gage. The tip of the stem of the measuring device shall be hemispherical and shall contact the end of the specimen with a total force of not less than 80 nor more than 120 g. The bolt of the tail piece and the stem of the device shall be horizontal and parallel with the long dimension of the cradle with their centers ½ in. above the apex of the cradle.

(*b*) *Brass Face Plates.*—Pieces of light-gage, but rigid, brass cut in the form of a right triangle with the two adjacent sides each 1½ in. long shall be used to confine the ends of the test specimen. Shim stock approximately 0.010 to 0.020 in. thick is recommended. One face plate shall have soldered to its surface a brass nut of the proper size and thread to engage the bolt of the tail piece of the cradle. The other face plate shall have soldered to its surface a brass washer approximately $\frac{1}{16}$ in. thick with a center opening sufficiently large to make a loose fit over the stem of the measuring device. The centers of the brass nut and washer, respectively, shall be $\frac{7}{16}$ in. from the apex of the face plate and on a line bisecting the right angle. Three $\frac{3}{32}$-in. holes shall be punched in each end plate for keying to the specimen.

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1950 to 1952.

Storage and Test Conditions

3. (*a*) The preparation and subsequent testing of the test specimens shall be conducted in an atmosphere maintained at 70 ± 1 F. and at a relative humidity of 50 ± 5 per cent (corresponding to a wet bulb temperature range of 56.5 to 60.5 F.). All materials and apparatus shall be equilibrated to these conditions at time of use.

(*b*) An air circulation velocity of not less than 50 and not more than 100 ft. per min. shall be maintained in the vicinity of the molded specimens for the full duration of the test.

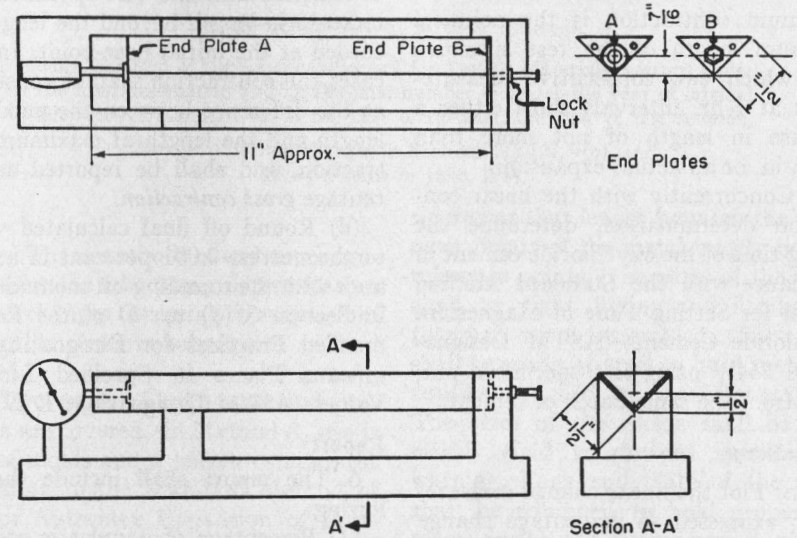


FIG. 1.—Apparatus for Determining Linear Contraction.

Procedure

4. (*a*) Cut four pieces of thin, non-sticky, waxed paper (kitchen type) to approximately 4 by 11 in. and fold in half lengthwise. Line the cradle with these folded papers without wrinkling and install the fixed end plate at the tail piece. Insert the other end plate at its approximate location near the opposite end of the cradle. Fill the resulting trough with the plastic cement prepared in accordance with the Standard Method for Mixing Magnesium Oxychloride Cement Compositions with Gauging Solution (ASTM Designation: C 251).[3] The cement shall not have aged more than 10 min. from the time of completion of the mixing. Remove the entrapped air by a cutting motion with the spatula and extrude a small amount of cement through the holes in and around the edges of the end plates. Strike off the excess cement and engage the end plate and stem of the indicating device. Adjust the end plate so that it is vertical and does not bind on the sides of the mold, and so that the test specimen is 10 ± 0.05 in. in length. The test specimen shall remain undis-

[3] Appears in this publication.

turbed in the apparatus until the completion of the determination.

(*b*) Exactly 30 min. after starting to add the gauging solution to the dry ingredients in the mixing procedure, record the reading of the indicating device to the nearest 0.0001 in. No adjustment of the end plate or the specimen length shall have been made within 5 min. prior to this base-point readng. Record the length of the test specimen at ½-hr. intervals until maximum contraction is reached. Maximum contraction is the point of minimum length of the test specimen after which two consecutive measurements at ½-hr. intervals show either a decrease in length of not more than 0.0001 in. or an actual expansion.

(*c*) Concurrently with the linear contraction determination, determine the setting time of the oxychloride cement in accordance with the Standard Method of Test for Setting Time of Magnesium Oxychloride Cements (ASTM Designation: C 254),[3] using test specimens prepared from the same batch of cement.

Calculations

5. (*a*) Plot the linear change measurements, expressed as percentage change from the base-point, against time on suitable coordinates in order to make it possible to interpolate linear change values corresponding to the independently measured setting times.

(*b*) Calculate *nonplastic contraction* as the percentage change in length of the test specimen between the time of final set and the time at which maximum contraction occurs.

(*c*) Calculate *net contraction* as the percentage decrease in length of the test specimen between the initial base-point (at ½-hr. age) and the point of maximum contraction. With some types of mixes expansion may occur prior to maximum contraction and the test specimen may increase in length beyond the length recorded at the initial base-point. In such cases the contraction shall be considered as the difference between the maximum length and the length at maximum contraction, and shall be reported as percentage *gross contraction.*

(*d*) Round off final calculated values to the nearest 0.001 per cent in accordance with the rounding-off method given in Section 3 (*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29).[4]

Report

6. The report shall include the following:

(*1*) Percentage of nonplastic contraction, and

(*2*) Percentage of net contraction, or percentage of gross contraction.

[4] 1964 Book of ASTM Standards, Part 30.

BY THE AMERICAN STANDARDS ASSOCIATION
ASA NO.: A88.22-1953
UDC 624.026:691.31

Standard Methods of Test for

LINEAR CHANGE OF MAGNESIUM OXYCHLORIDE CEMENTS[1]

ASTM Designation: C 253 – 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 253; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

NOTE.—Editorial changes in Sections 7(*a*)(*2*), 9(*a*), and 12 were made in June, 1954.

Scope

1. (*a*) These methods of test cover procedures for the laboratory determination of linear changes occurring in magnesium oxychloride cements subsequent to final set.

(*b*) Two types of apparatus and procedures are covered. In Method A, use is made of molds and a length comparator conforming to the Standard Method of Test for Autoclave Expansion of Portland Cement (ASTM Designation: C 151).[3] Method B covers the apparatus and procedure currently in use by the oxychloride cement industry.[4]

METHOD A

Apparatus

2. (*a*) *Molds.*—The test specimen molds shall provide for 1 by 1-in. test specimens of 10-in. effective gage length. The effective gage length shall be considered as that length between the innermost points of the metal inserts used as reference points. The parts of the molds shall be tight fitting and firmly held together when assembled. The molds shall be made of steel or hard metal not readily attacked by the cement paste. The sides of the molds shall be sufficiently rigid to prevent spreading or warping. Each end plate of the molds shall be equipped to hold properly in place, during the setting period, a stainless steel or noncorroding metal reference point having a diameter of ¼ in. The reference points shall be set so that their principal axes coincide with the principal axis of the test specimen, and shall extend into the specimen ⅝ in. The distance between the inner ends of the reference points shall be 10 ± 0.1 in. The distance between opposite faces of the molds shall be 1 ± 0.03 in. The height of the molds, measured separately for each specimen compartment, shall be 1 ± 0.03 in., both for new molds and for molds in use.

(*b*) *Length Comparator.*—Changes in length of the test specimen shall be measured by a dial gage or micrometer comparator having a range of at least

[1] Under the standardization procedure of the Society, these methods are under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, these methods were published as tentative from 1950 to 1952.

[3] Appears in this publication.

[4] It is anticipated that further experience with the two different types of equipment and procedures may result in the selection of one method as standard.

0.3 in. The instrument shall be graduated to at least 0.001 in., and when tested at any point throughout its range, the error shall not be greater than plus or minus 0.002 in. The difference between repeated measurements shall not be greater than 0.001 in. The comparator shall be equipped with a steel reference bar having an insulating grip and shall be frequently checked with this reference bar.

Storage and Test Conditions

3. (*a*) The preparation and subsequent testing of the test specimens shall be conducted in an atmosphere maintained at a temperature of 70 ± 1 F. and at a relative humidity of 50 ± 5 per cent (corresponding to a wet bulb temperature range of 56.5 to 60.5 F.). All materials and apparatus shall be equilibrated to these conditions at time of use.

(*b*) The temperature of the storage cabinet or storage room shall be maintained at 70 ± 1 F. and the relative humidity at 50 ± 5 per cent. An air circulation velocity of not less than 20 and not more than 500 ft. per min. shall be maintained in the vicinity of the specimens during the entire period of curing and storage.

Preparation of Test Specimens

4. (*a*) *Preparation of Molds.*—Coat the test specimen molds with a saturated solution of stearic acid in trichloroethylene sufficiently in advance of molding of the specimens to permit complete evaporation of the solvent. When the solvent has evaporated, set the stainless steel or noncorroding metal reference points, taking care to keep them free of the parting compound.

(*b*) *Molding Specimens.*—Fill the mold with the plastic cement prepared in accordance with the Standard Method for Mixing Magnesium Oxychloride Cement Compositions with Gauging Solution (ASTM Designation: C 251).[3] The cement shall not have aged more than 20 min. from completion of the mixing. Remove entrapped air and completely fill the corners of the mold by applying a spatula with a cutting motion. Strike off the excess cement flush with the top of the mold.

Storage and Measurement of Test Specimens

5. (*a*) After filling the test specimen mold, place it immediately in the curing cabinet. At 30 ± 5 min. after final set of the cement, as determined in accordance with the Standard Method of Test for Setting Time of Magnesium Oxychloride Cements (ASTM Designation: C 254),[3] carefully remove the specimen from the mold and measure its length to the nearest 0.0001 in. Then place the specimen on a rack or grating in the storage area in such a position that the standard atmosphere (Section 3 (*b*)) will have access to all faces at all times.

(*b*) Repeat the measurement of the length of the specimen at ½-hr. intervals until maximum contraction is reached. Maximum contraction is the point of minimum length of the specimen after which two consecutive measurements at ½-hr. intervals show either a decrease in length of not more than 0.0001 in. or an actual expansion. With some types of magnesium oxychloride cement mixes the test specimens will not contract after removal from the mold. In this event, the fact shall be noted in the record of measurements of the specimen. Finally, measure the length of the specimen at the age of 24 hr. after starting to add the gauging solution to the dry ingredients in the mixing procedure, and at subsequent ages as prescribed in the specifications for the material being tested.

NOTE.—In determining linear change, a suitable initial reference point, in terms of age or history of the specimen, to which subsequent changes are referred, must be selected. The difference between the length of the specimen at the initial reference point and its length at any specified subsequent point provides the basis for calculation of the percentage of linear change. The initial and final reference points to be selected are designated in the specifications for the material under test. Customary initial reference points are: (*1*) point of maximum contraction, or (*2*) point at age of 1 day (24 hr.) after starting to add the gauging solution to the dry ingredients in the mixing procedure. Final reference points may be at ages of 1, 3, 7, or 28 days.

Calculations

6. (*a*) Calculate the percentage of linear change by multiplying by ten the difference between the length, in inches, of the test specimen at the initial reference point and its length at the specified final reference point (Note, Section 5). If the test specimen increases in length between the initial and final reference points, the change shall be reported as expansion (this expansion may be indicated by a plus sign); if it decreases in length the change shall be reported as contraction (may be indicated by a minus sign).

(*b*) Final calculated values shall be rounded off to the nearest 0.001 per cent in accordance with the rounding-off method given in Section 3 (*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29).[5]

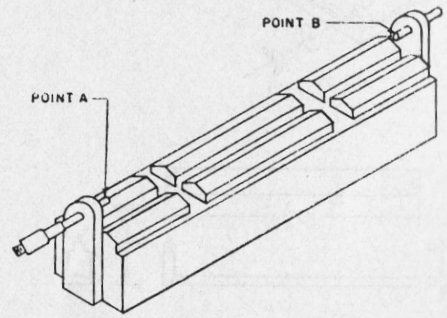
METHOD B

Apparatus

7. (*a*) *Measuring Apparatus:*

(*1*) A cradle similar to that illustrated in Fig. 1, suitable for holding the test specimen at an angle of 45 deg. to the vertical, shall be provided.

(*2*) *Length Comparator*—Changes in length of the test specimen shall be measured by a dial gage or a micrometer comparator with ratchet stop. The measuring instrument shall be fitted to the cradle (Item (*1*)), as indicated in Fig. 1. It shall have a range of at least 1.0 in. The instrument shall be graduated to at least 0.001 in. The graduations shall be such that length changes of 0.0001 in. may be estimated. When tested at any point throughout its range, the error shall not be greater than ±0.002 in. The difference between repeated measurements shall not be greater than 0.0001 in. The calibrations of the dial gage or micrometer shall be such that length changes of 0.0001 in. may be estimated. A standard invar reference bar 10 ± 0.1 in. long shall be provided and the instrument shall be checked frequently with this reference bar.



NOTE.—Distance between points *A* and *B* is variable.

FIG. 1.—Micrometer Cradle.

(*b*) *Mold.*—A collapsible brass mold with internal dimensions of 1 by 1 by 10 in., suitable for forming the test specimen with its longitudinal axis in the horizontal position, shall be provided. A suitable mold is shown in Fig. 2.

(*c*) *Ground Glass Inserts.*—Pieces of glass microscope slides that have been roughened on one side with carborundum until they are translucent, and of the proper size to fit into the ends of the mold, shall be provided.

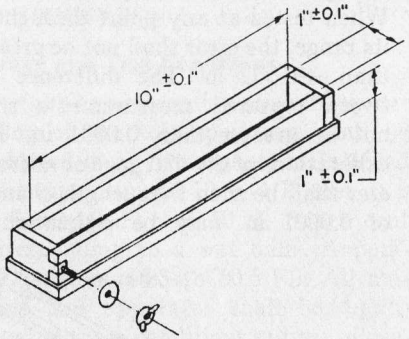
[5] 1964 Book of ASTM Standards, Part 30.

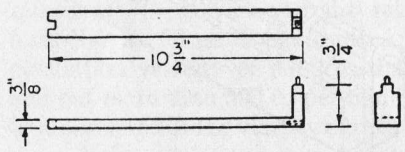
Storage and Test Conditions

8. The storage and test conditions shall be as prescribed in Section 3.

Preparation of Test Specimens

9. (*a*) *Preparation of Molds.*—Coat the test specimen mold with a saturated solution of stearic acid in trichloroethylene





Material $\frac{3}{8}$" Brass

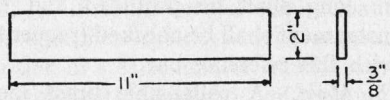


FIG. 2.—Linear Change Specimen Mold.

sufficiently in advance of molding the specimen to permit complete evaporation of the solvent. Place the ground-glass inserts at each end of the mold so that their smooth surfaces are next to the mold.

(*b*) *Molding Specimens.*—Fill the mold with the plastic cement prepared in accordance with the Standard Method for Mixing Magnesium Oxychloride Cement Compositions with Gauging Solution (ASTM Designation: C 251).[3] The cement shall not have aged more than 20 min. from completion of mixing. Remove entrapped air and completely fill the corners of the mold by applying a spatula with a cutting motion. Strike off the excess cement flush with the top of the mold. At 30 ± 5 min. after final set of the cement, as determined in accordance with the Standard Method of Test for Setting Time of Magnesium Oxychloride Cements (ASTM Designation: C 254),[3] carefully remove the test specimen from the mold. Clean the exposed faces of the ground glass inserts so that they are free of cement and stearic acid and proceed with the specified measurements as described in Section 10. After removal from the mold, place the test specimen on a rack or grating so that the standard atmosphere will have access to all four sides at all times.

Storage and Measurement of Test Specimens

10. (*a*) Place the specimen, immediately upon removal from the mold, in the cradle (Fig. 1) so that the faces of the anvil and spindle of the micrometer or dial gage will touch only the faces of the glass inserts in the ends of the specimen. Measure and record the length of the specimen to the nearest 0.0001 in. If, in a series of measurements, it is necessary to remove the specimen from the cradle, make all subsequent readings with the specimen in exactly the same position relative to the micrometer as when the original measurement was made. At least once each day, preferably just prior to or after measuring the specimen, check the micrometer dial gage against the standard reference bar (Section 6 (*b*)(*2*)) and correct the measurement of the specimen accordingly if deviations greater than plus or minus 0.0001 in. from the

length of the standard reference bar are noted.

(*b*) Continue in accordance with Section 5 (*b*).

Calculations

11. Calculate the percentage of linear change in accordance with Section 6.

REPORT

Report

12. The report shall include the following:

(*1*) Method used—Method A or Method B,

(*2*) Initial and final reference points, and

(*3*) Percentage expansion or contraction (Note).

NOTE.—Typical forms for reporting linear change are:

(*1*) Expansion, 1 to 7 days = 0.*xyz* per cent, or

(*2*) Linear change, 1 to 7 days = ±, as the case may be, 0.*xyz* per cent.

APPROVED AS
AMERICAN STANDARD
BY THE AMERICAN STANDARDS ASSOCIATION
ASA NO.: A88.23-1953
UDC 624.025:691.31

Standard Method of Test for

SETTING TIME OF MAGNESIUM OXYCHLORIDE CEMENTS[1]

ASTM Designation: C 254 - 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 254; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. This method of test covers the procedure for the determination of setting time of magnesium oxychloride cements by means of Westvaco needles on an automatic setting-time machine.

Apparatus

2. (*a*) *Westvaco Needles.*—The needles (Fig. 1) shall be of a noncorrodible metal, suitably weighted, and shall conform to the following requirements:

Initial setting time needle:

Weight.....	1 lb. ± 8 grains (453.6 ± 0.5 g.)
Tip diameter.....	0.167 ± 0.002 in. (4.24 ± 0.05 mm.)
Tip length.....	0.015 ± 0.001 in. (0.38 ± 0.03 mm.)
Shoulder diameter	0.250 ± 0.002 in. (6.35 ± 0.05 mm.)

Final setting time needle:

Weight.....	4 lb. ± 16 grains (1814.4 ± 1.0 g.)
Tip diameter.....	0.083 ± 0.002 in. (2.12 ± 0.05 mm.)
Tip length.....	0.015 ± 0.001 in. (0.38 ± 0.03 mm.)
Shoulder diameter	0.167 ± 0.002 in. (4.24 ± 0.05 mm.)

The needle tips shall be cylindrical and of the same diameter for the entire length. There shall be no undercutting or tapering at the junction of the tip and the shoulder. The needle ends and the faces of the shoulders shall be plane, free of tool marks, and at right angles to the axis of the stem. The shoulder shall be cylindrical and of the same diameter for a distance of approximately 0.187 in. The needles shall be maintained in a clean condition at all times and, in routine use, shall be checked at least once a week to determine conformity with requirements. Needles used infrequently shall be checked prior to each determination.

(*b*) *Automatic Setting Time Machine.*—A suitable machine, illustrated in Fig. 2, consists essentially of a base, *A*, on which are mounted suitable guides, *B*, for one or more carriages, *C*. These carriages are 4 in. by 15 in. in size and are moved horizontally in one direction at a uniform rate of from 1.95 to 2.25 in. per

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1950 to 1952.

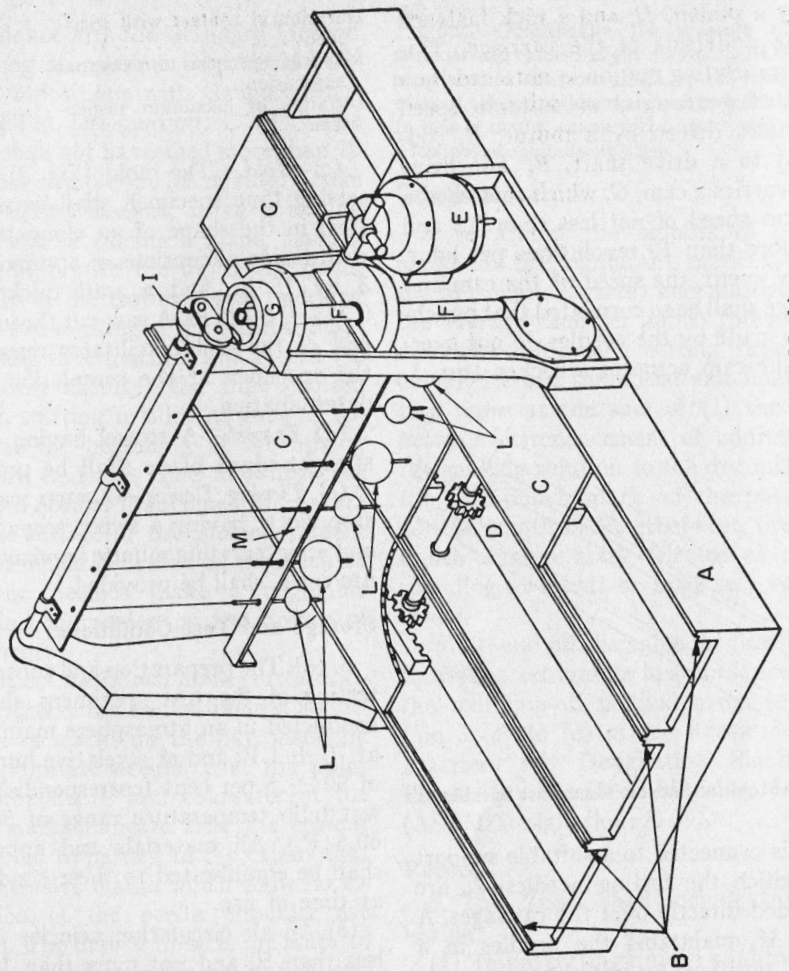
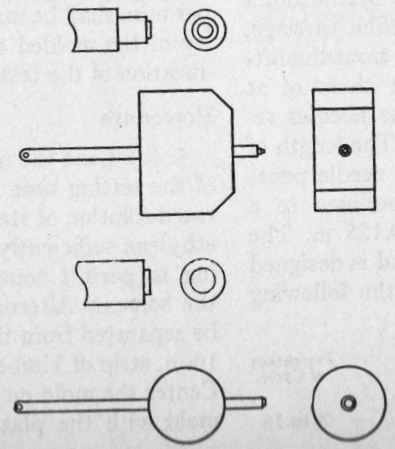


FIG. 2.—Automatic Setting Time Machine.



Initial Setting Time Needle — Final Setting Time Needle

FIG. 1.—Westvaco Setting Time Needles.

hr. by a pinion, *D*, and a rack fastened to the underside of the carriage. This slow translating motion is obtained by a series of gear units of suitable speed reduction, driven by a motor, *E*, connected to a drive shaft, *F*. The drive shaft carries a cam, *G*, which rotates at a uniform speed of not less than 7.5 and not more than 10 revolutions per hour. In any event, the speed of the cam and carriage shall be so correlated that punch-marks made by the needles do not overlap. The cam actuates a rocker arm, *I*,

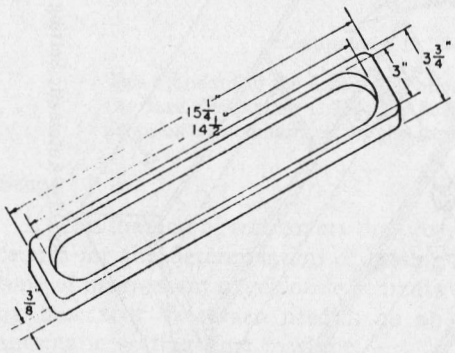


FIG. 3.—Mold for Setting Time Test Specimens.

which is connected to a suitable support from which the testing needles, *L*, are suspended directly over the carriages. A guide, *M*, maintains the needles in a vertical position. An initial needle and a final needle are used for each carriage. The needles are suspended from the lifting mechanism by a light chain of at least three links so that the needles receive no downward thrust. The length of the chain is such that the needle penetrates the setting time specimen to a depth of not more than 0.125 in. The cam has a throw of 1 in. and is designed to provide a cycle within the following limits:

Operation	Percentage of Cycle
Drop from maximum suspension to contact with specimen	8 to 16
Duration of contact with specimen	7 to 15
Rise from specimen to maximum suspension	4 to 14
Duration of maximum suspension	67 to 75

(*c*) *Mold.*—The mold (Fig. 3) for the setting time specimen shall be made of steel in the shape of an elongated "O" with inside dimensions of approximately 3 by 15 in. and a wall thickness of 0.375 ± 0.125 in. A saw-cut through one end of the mold facilitates removal of the specimen at the completion of the determination.

(*d*) *Trowel.*—A trowel having a 5-in. straight-edged blade shall be provided.

(*e*) *Timing Device.*—A stop watch or stop clock, having a sweep second hand and an integrating minute hand and minute scale, shall be provided.

Storage and Test Conditions

3. (*a*) The preparation and subsequent testing of the test specimens shall be conducted in an atmosphere maintained at 70 ± 1 F. and at a relative humidity of 50 ± 5 per cent (corresponding to a wet bulb temperature range of 56.5 to 60.5 F.). All materials and apparatus shall be equilibrated to these conditions at time of use.

(*b*) An air circulation velocity of not less than 50 and not more than 100 ft. per min. shall be maintained in the vicinity of the molded specimens for the full duration of the test.

Procedure

4. (*a*) Coat the mold and the carriage of the setting time machine with a saturated solution of stearic acid in trichloroethylene sufficiently in advance of molding to permit complete evaporation of the solvent. Alternately, the mold may be separated from the carriage by a 4 by 16-in. strip of kitchen-type waxed paper. Center the mold on the carriage. Fill the mold with the plastic cement prepared

in accordance with the Standard Method for Mixing Magnesium Oxychloride Cement Compositions with Gauging Solution (ASTM Designation: C 251).[3] The cement shall not have aged more than 20 min. from completion of mixing. Strike off the excess cement, using a sawing motion and producing a plane, smooth surface, flush with the top of the mold, by means of the trowel. Avoid puddling or excessive working of the cement. Start the setting time machine and record (to the nearest minute) the time elapsed between starting to add the gauging solution at the beginning of the mixing procedure and the time at which the Westvaco needles first come into contact with the surface of the molded cement pat. The molds shall stay on the machine until the needles make a negligible (0.001-in.) impression on the surface of the cement.

(*b*) Select the punch mark corresponding to initial or final set as follows: Follow the line of marks on the pat, made by the appropriate needle, past the point where the depth and character of the punch marks indicate that the cement has started to harden to the extent that two successive marks which show no indentation of the needle shoulder are reached. The first of these is the mark to be taken as indicating initial or final set, as the case may be.

[3] Appears in this publication.

NOTE.—Occasionally the pressure of the shoulder will cause a slight darkening of the cement around the print made by the needle tip without the formation of a shoulder indentation. In case of doubt, examine the punch mark with a low-power magnifying glass.

Calculations

5. (*a*) Count the number of punch marks to the significant mark (taking the first mark as zero) and multiply by the average time per punch (previously determined for each setting time machine). Record the initial and final setting times as the sum of (*1*) the time between commencement of addition of the gauging solution to the dry mix and the first punch mark on the pat, and (*2*) the length of time between the first punch and the mark selected as corresponding to initial or final set, respectively.

(*b*) Round off the value for time of set to the nearest minute in accordance with the rounding-off method given in Section 3 (*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29).[4]

Report

6. The report shall include the following:

(*1*) Initial setting time in minutes, and

(*2*) Final setting time in minutes.

[4] 1964 Book of ASTM Standards, Part 30.

APPROVED AS
AMERICAN STANDARD
BY THE AMERICAN STANDARDS ASSOCIATION
ASA NO.: A88.24-1953
UDC 624.025:69131.

Standard Method of Test for

CONSISTENCY OF MAGNESIUM OXYCHLORIDE CEMENTS BY THE FLOW TABLE[1]

ASTM Designation: C 255 - 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 255; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

NOTE—An editorial change in Section 2(*a*) was made in June, 1954.

Scope

1. This method of test covers the procedure for determining the consistency of magnesium oxychloride cements by means of a flow table.

Apparatus

2. (*a*) *Flow Table, Flow Table Mounting, Mold, and Caliper* shall conform to the Tentative Specifications for Flow Table for Use in Tests of Hydraulic Cement (ASTM Designation: C 230),[3] except (*1*) that the apparatus may be operated either manually or by means of a motor and (*2*) that the apparatus be adjusted to $\frac{1}{2}$-in. drop.

(*b*) *Timing Device.*—A stop watch or stop clock having a sweep second hand and an integrating minute hand and a minute scale shall be provided for timing.

Test Conditions

3. All operations shall be performed in an atmosphere maintained at a temperature of 70 ± 1 F. and at a relative humidity of 50 ± 5 per cent (corresponding to a wet-bulb temperature range of 56.5 to 60.5 F.). All apparatus and materials shall be equilibrated to these standard conditions at time of use.

Procedure

4. (*a*) Make certain that the top surface of the table and the contacting surfaces of the shaft collar and top of the frame are dry and free of grease and soil. Place flow mold, with its smaller end uppermost, on the table top with its center over the center of the table.

(*b*) Partially fill the mold with the plastic cement and rod gently. Complete the filling and again rod through the first portion to ensure complete filling. Strike off the excess cement with a straightedge, using a sawing motion. Repeat with a stroke in the opposite direction. Carefully lift the mold from the cement and rotate the cam so as to cause the table to drop 25 times at a uniform rate during the succeeding period of 15 ± 1 sec., starting the dropping cycles at 75 ± 5 sec. after cessation of the mixing procedure (Note).

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1950 to 1952.

[3] 1964 Book of ASTM Standards, Part 9

NOTE.—An alternate procedure for filling the mold is as follows: Place the flow mold on a section of plate glass (approximately 5 by 5 in.) with the larger end uppermost. Fill the mold and strike off the excess cement in the manner described above. Place the top of the flow table on the filled mold, and carefully grasp and invert the table and mold. Insert the shaft in the base, center the mold, and slide the glass plate off. Proceed from this point in the operation as directed above.

(*c*) Measure the diameter of the spread specimen with the caliper at four symmetrically distributed points and record the caliper readings.

Calculations

5. Calculate the percentage flow by adding the four caliper readings recorded in accordance with Section 4 (*c*). Before addition, round off the recorded readings to the nearest 0.1 per cent in accordance with the rounding-off method given in Section 3 (*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29).[4]

Report

6. The report shall include:

(*1*) Designation of flow table used, including distance of drop, and

(*2*) Percentage of flow.

[4] 1964 Book of ASTM Standards, Part 30.

APPROVED AS
AMERICAN STANDARD
BY THE AMERICAN STANDARDS ASSOCIATION
ASA NO.: A88.25-1953
UDC 624.025:691.31

Standard Method of Test for

FLEXURAL STRENGTH OF MAGNESIUM OXYCHLORIDE CEMENTS (USING SIMPLE BAR WITH TWO-POINT OR SINGLE-POINT LOADING)[1]

ASTM Designation: C 256 – 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 256; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

NOTE.—An editorial change in Section 4 (*b*) was made in June, 1954.

Scope

1. This method of test covers the procedure for determining the flexural strength of magnesium oxychloride cement compositions by the use of a simple flat bar with two-point loading, or, alternatively single-point loading.

Apparatus

2. (*a*) *Flexure Test Apparatus:*

(*1*) *Two-Point Loading.*—The apparatus for two-point loading shall employ bearing blocks that will ensure that the forces applied to the beam will be vertical only and applied without eccentricity, provided the points of load application are spaced equidistant between the supports and provided that the ratio of the distance between point of load application and nearest reaction to the depth of the beam is not less than one. The essential features of one type of flexure testing machine that satisfactorily meet these requirements are as follows: The testing machine (Fig. 1) is self-contained in a 26 by 30-in. frame of channel iron. The load is applied to the test bar by shot from a reservoir, *A*, which throws the system out of balance and allows the weights *B*, *C*, and *D* to load the test bar, *E*, through a series of fulcrums, *F*, *G*, *H*, and *I*, with a mechanical advantage of approximately four. The two-point loading jig, *J*, is designed so that the load applied will be entirely perpendicular (no horizontal component). It is adjustable vertically by a turnbuckle, *K*, and means is provided for automatically centering it on the test piece. The support fulcrums, *L* and *M*, are separated by a fixed distance of 10 in. Support *L* is rigid while support *M* is pivoted at the center to take care of possible nonuniformities in the test bar. Stops are provided at the rear of each to ensure that the test bar will always be centered properly. When the specimen breaks, the flow of shot is automatically cut off at *N*. The system is balanced before starting the test by removing or adding shot to the reservoir, *A*, until the pointer, *O*, coincides with the reference mark, *P*. After breaking the test bar, the system is again balanced by sliding the weights *B* and *C* along the graduated beams *Q* and the load applied to the specimen is read directly.

(*2*) *Single-Point Loading.*—The apparatus for single-point loading shall consist of knife edges 10 ± $\frac{1}{16}$ in. apart and means for applying the load through a knife edge at a point within $\frac{1}{32}$ in. of the center of the 10-in. span. A diagram of an apparatus that accomplishes this purpose is shown in Fig. 2.

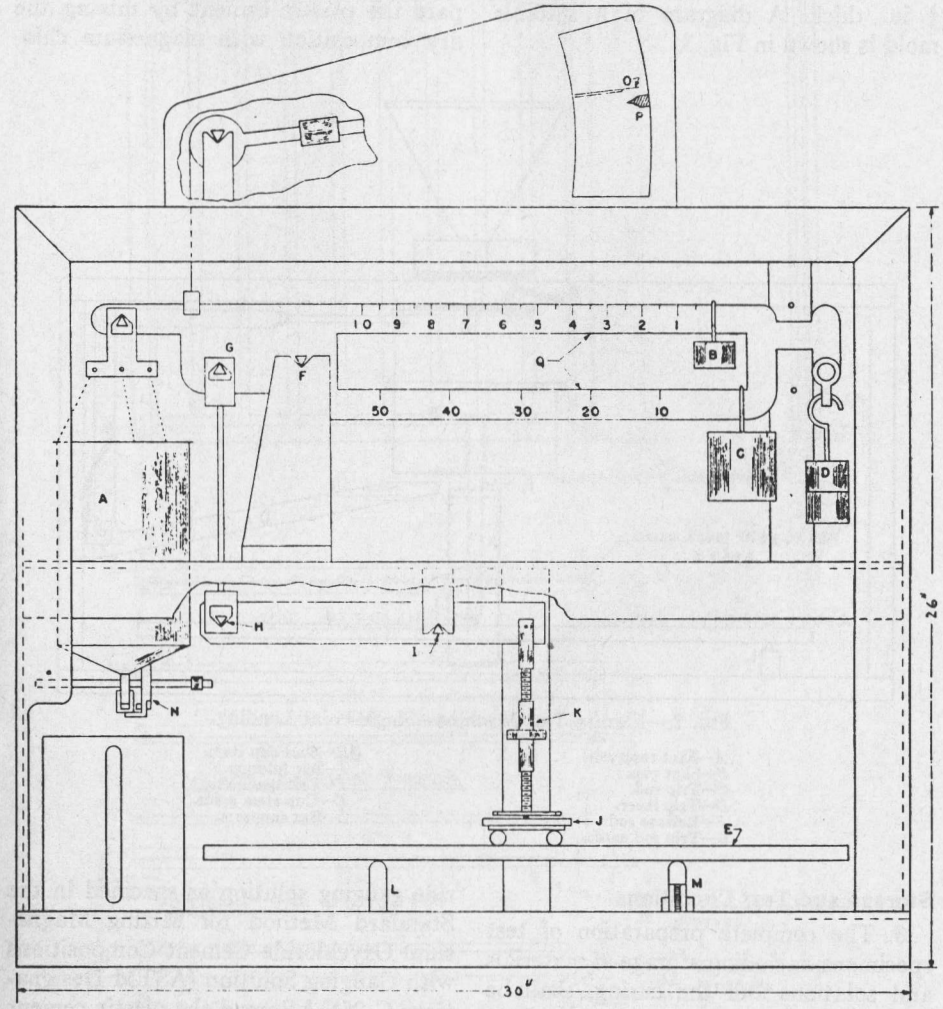


FIG. 1.—Flexure Test Machine—Two-Point Loading.

(*3*) The accuracy of load indication for either two-point or single-point loading shall be within plus or minus 1 per cent of the applied load over the entire range and shall be verified, at least every three months, by means of a

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1950 to 1952.

dynamometer that is accurate within plus or minus 0.25 per cent.

(*b*) *Test Specimen Molds.*—Suitable molds shall be provided for the preparation of test specimens in the form of flat bars 23 ± 1 in. long, 2 in. wide, and ½ in. thick. A diagram of a suitable mold is shown in Fig. 3.

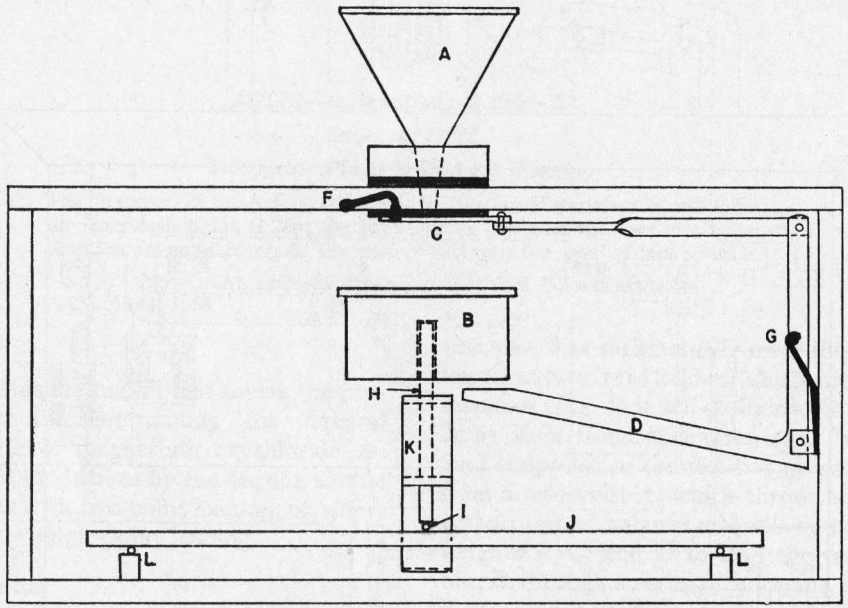


FIG. 2.—Flexure Test Machine—Single-Point Loading.

A—Shot reservoir.
B—Shot cup.
C—Trip rod.
D—Trip lever.
F—Release rod.
G—Trip rod catch.
H—Shot cup stem.
I—Bar fulcrum.
J—Test specimen.
K—Cup stem guide.
L—Bar supports.

Storage and Test Conditions

3. The complete preparation of test specimens, including storage of materials and solutions and the curing, shall be carried out in an atmosphere maintained at 70 ± 1 F. and at a relative humidity of 50 ± 5 per cent (corresponding to a wet bulb temperature range of 56.5 to 60.5 F.). After removal from the molds, the test specimens shall be stored, for the designated duration of the test, on a rack or grating that will permit access of the standard atmosphere at a velocity of not less than 20 nor more than 500 ft. per min. to all sides of the test specimen.

Test Specimens

4. (*a*) *Molding Test Specimens.*—Prepare the plastic cement by mixing the dry composition with magnesium chloride gauging solution as specified in the Standard Method for Mixing Magnesium Oxychloride Cement Compositions with Gauging Solution (ASTM Designation: C 251).[3] Spread the plastic cement along the length of the mold and work it into the corners with a trowel. Use somewhat more than needed to fill the molds, and strike off the excess by not more than three strokes of the trowel forward and three backward over the full length of the mold. Further trowel-

[3] Appears in this publication.

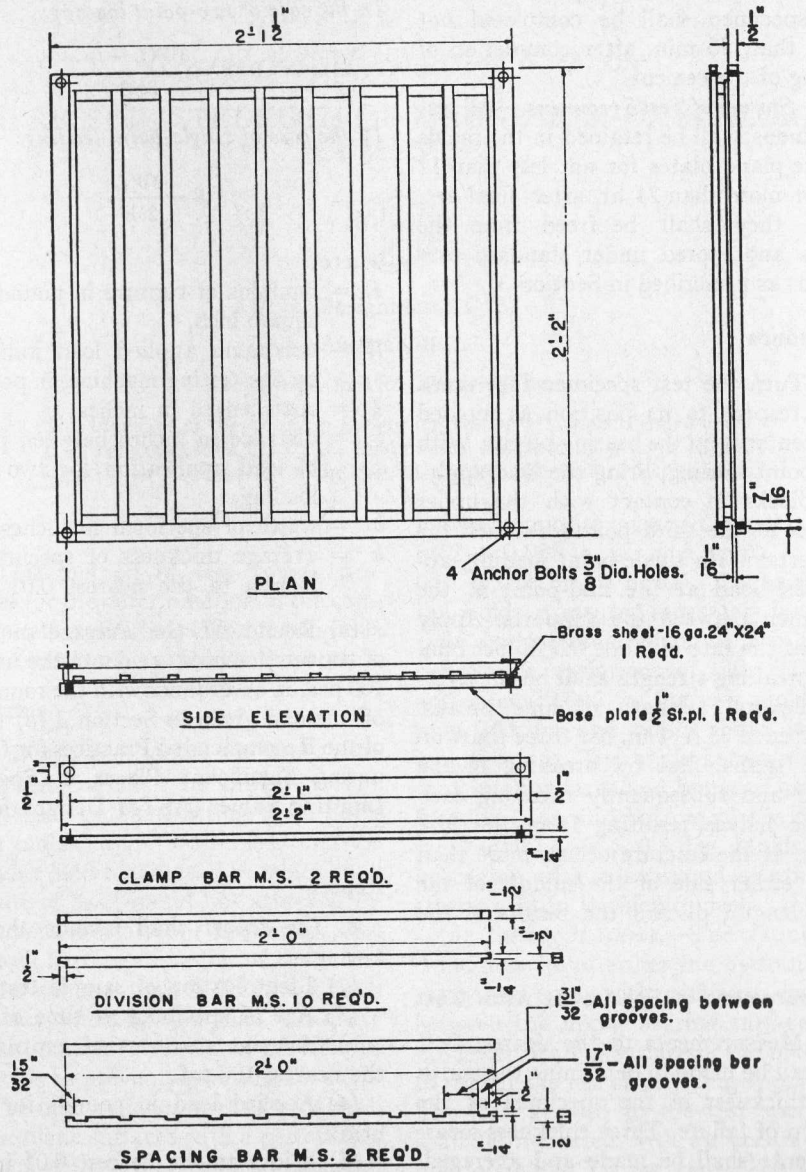


FIG. 3.—Molds for Flexure Test Specimens.

ing should not be done, since excessive troweling materially changes the surface of the test piece. The preparation of the last specimen shall be completed not more than 20 min. after completion of mixing of the cement.

(*b*) *Storage of Test Specimens.*—All test specimens shall be retained in the molds on the plane plates for not less than 12 hr nor more than 24 hr after final set, when they shall be freed from the forms and stored under standard conditions as prescribed in Section 3.

Procedure

5. Turn the test specimen face down with respect to its position as molded and center it on the bearing blocks. With two-point loading, bring the load-applying blocks in contact with the upper surface at the third points between the supports. With single-point loading, apply the load at the mid-point of the specimen between the supports. Apply load at the rate of 20 ± 0.5 lb. per min. The breaking strength shall be the average flexural strength of nine breaks. Break each 23 ± 1-in. bar three times on 10-in. spans, first by breaking in the center and subsequently breaking each of the halves resulting from the first break. If the fracture occurs more than 1 in. either side of the middle of the span length, discard the results of the test.

Measurement of Specimens After Test

6. Measurements to the nearest 0.01 in. shall be made to determine the width and thickness of the specimen at the section of failure. Three thickness measurements shall be made and averaged.

Calculations

7. (*a*) If the fracture occurs within 1 in. on either side of the middle of the 10-in. span length, calculate the modulus of rupture as follows:

In the case of two-point loading:

$$R = \frac{3W(L - l)}{2bh^2}$$

In the case of single-point loading:

$$R = \frac{3WL}{2bh^2}$$

where:

R = modulus of rupture in pounds per square inch,
W = maximum applied load indicated by the testing machine, in pounds,
L = span length in inches,
l = distance in inches between points of load application for two-point loading,
b = width of specimen in inches, and
h = average thickness of specimen in inches, to the nearest 0.01 in.

(*b*) Round off the average modulus of rupture for nine breaks to the nearest 100 psi., in accordance with the rounding-off method given in Section 3 (*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29).[4]

Report

8. The report shall include the following:

(*1*) Identification of sample tested,
(*2*) Age of specimen at time of test,
(*3*) Average modulus of rupture, to the nearest 100 psi.,
(*4*) Applied load in pounds for each break,
(*5*) Width to the nearest 0.01 in. for each break, and
(*6*) Average thickness to the nearest 0.01 in. for each break.

[3] 1964 Book of ASTM Standards, Part 30.

APPROVED AS
AMERICAN STANDARD
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Standard Method of Test for

COMPRESSIVE STRENGTH OF MAGNESIUM OXYCHLORIDE CEMENTS[1]

ASTM Designation: C 257 - 52

ADOPTED, 1952.[2]

Reapproved in 1961 Without Change.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 257; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. This method of test covers procedures for the determination of the compressive strength of oxychloride magnesia and magnesium oxychloride cements.

Apparatus

2. (*a*) *Molds.*—Molds for 2-in. cube test specimens shall be provided. The molds shall be tight-fitting. The parts of the molds, when assembled, shall be positively held together. The molds shall be made of hard metal not attacked by the cement mortar. For new molds, the Rockwell hardness number of the metal shall be not less than B 55 (the Brinell hardness number not less than 95). There shall be sufficient material in the sides of the molds to prevent spreading or warping. The interior faces of the molds shall be true plane surfaces with a permissible variation of 0.001 in. for new molds and 0.002 in. for molds in use. The distance between opposite faces of the molds shall be 2 ± 0.005 in. for new molds, or 2 ± 0.01 in. for molds in use. The height of the molds, measured separately for each cube compartment, shall be 2 in. with permissible variations of plus 0.01 in. and minus 0.005 in. for new molds, or plus 0.01 in. and minus 0.015 in. for molds in use. The angle between adjacent interior faces and between interior faces and top and bottom planes of the mold shall be 90 ± 0.5 deg. Molds shall be coated with a saturated solution of stearic acid in trichlorethylene.

(*b*) *Testing Machine.*—The testing machine may be of either the hydraulic or the screw type, with sufficient opening between the upper bearing surface and the lower bearing surface of the machine to permit the use of verifying apparatus. The load applied to the test specimen shall be indicated with an accuracy of plus or minus 1.0 per cent. The upper bearing shall be a spherically seated, hardened metal block firmly attached at the center of the upper head of the machine. The center of the sphere shall lie at the center of the surface of the block

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1950 to 1952.

in contact with the specimen. The block shall be closely held in its spherical seat, but shall be free to turn in any direction. The diagonal or diameter of the bearing surface shall be only slightly greater than the diagonal of the face of the 2-in. cube, in order to facilitate accurate centering of the specimens. A hardened metal bearing block shall be used beneath the specimen to minimize wear of the lower plate of the machine. The bearing block surfaces intended for contact with the specimen should have a hardness not less than Rockwell number C 60 (Brinell number 620). These surfaces shall not depart from plane surfaces by more than 0.0005 in. when the blocks are new, and shall be maintained within a permissible variation of 0.001 in.

Storage and Test Conditions

3. The complete preparation of test specimens, including storage of solutions and materials and the curing, shall be carried out in an atmosphere maintained at 70 ± 1 F. and at a relative humidity of 50 ± 5 per cent (corresponding to a wet bulb temperature range of 56.5 to 60.5 F.). After removal from the molds, the test specimens shall be stored, for the designated duration of the test, on a rack or grating that will permit access of the standard atmosphere at a velocity of not less than 20 nor more than 500 ft. per min. to all sides of the test specimen.

Test Specimens

4. (*a*) *Molding Test Specimens.*—Prepare the plastic cement in accordance with the Standard Method for Mixing Magnesium Oxychloride Cement Compositions with Gauging Solution (ASTM Designation: C 251).[3] Immediately after mixing the plastic cement, place the cement in the cube molds, resting on plane nonabsorbent plates. Fill the molds heaping full. Remove the entrapped air and completely fill the corners of the molds by using a cutting and stabbing motion with a small spatula for a period of 15 sec. Heap additional wet mix above the molds and strike off level and smooth with a trowel. Three strokes of the trowel shall be all the troweling permitted to level and smooth the cubes. The preparation of the last specimen shall be completed not more than 20 min. after completion of mixing of the cement.

(*b*) *Storage of Test Specimens.*—All test specimens shall be retained in the molds on the plane plates for not less than 12 hr. and not more than 24 hr. after final set, when they shall be freed from the forms and stored under standard conditions.

Procedure

5. (*a*) At the end of the designated curing period, remove the cubes from the constant temperature, constant humidity storage, and break them on the compression testing machine. Apply the load to the faces of the cubes that were in contact with the true plane surfaces of the mold. Check these faces by application of an accurate straightedge. If appreciable curvature is present, grind the face or faces to a plane surface before loading, or discard the specimens.

(*b*) Remove loose sand grains or incrustations from the contact faces, and carefully place the cubes in the testing machine below the center of the upper bearing block. No cushioning or bedding materials shall be used. Apply the loading up to 25 per cent of the expected maximum load at any convenient rate, after which load the specimens continuously to failure at a rate or rates which shall at no time be less than 1000 or more than 6000 psi. per min. (Note).

[3] Appears in this publication.

NOTE.—This is the rate of loading specified in the Standard Method of Test for Compressive Strength of Hydraulic Cement Mortars (ASTM Designation: C 109).[3]

(*c*) Test nine cubes as directed in Paragraphs (*a*) and (*b*).

Calculations

6. (*a*) The total maximum load indicated by the testing machine shall be recorded, and the compressive strength calculated in pounds per square inch from the cross-sectional area of the cube tested. Cubes that are manifestly faulty or that give strengths differing by more than 10 per cent from the average value of all test specimens made from the same sample and tested at the same period shall not be considered in determining the compressive strength. Calculate the average compressive strength of the nine cubes tested.

(*b*) The average compressive strength value for the average of nine cubes shall be rounded off to the nearest 100 psi. in accordance with the rounding-off method given in Section 3 (*d*) to (*h*) of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29).[4]

Report

7. The report shall include the following:

(*1*) Identification of test sample,

(*2*) Age of specimen,

(*3*) Applied load in pounds for each cube, and

(*4*) Average compressive strength calculated to nearest 100 psi.

[4] 1964 Book of ASTM Standards, Part 30.

Standard Method of Test for

YIELD OF MAGNESIUM OXYCHLORIDE CEMENT (FIELD TEST)[1]

ASTM Designation: C 388 – 58

ADOPTED, 1958.[2]

This Standard of the American Society for Testing Materials is issued under the fixed designation C 388; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. This method of test covers a procedure for determining, under field conditions, the area that will be covered by a given weight of magnesium oxychloride composition.

Apparatus

2. The apparatus shall consist of the following:

(*a*) *Balance.*—A balance or scale sensitive to 0.5 per cent of the weight of the sample to be weighed.

(*b*) *Tamping Rod.*—A straight $\frac{5}{8}$-in. round metal rod, approximately 12 in. in length and tapered for a distance of 1 in. to a spherically shaped end having a radius of approximately $\frac{1}{4}$ inch.

(*c*) *Measure.*—A metal measure, cylindrical in form and preferably provided with handles. It shall be watertight, with the top and bottom true and even, preferably machined to accurate dimensions on the inside, and of sufficient rigidity to retain its form under rough usage. The measure required shall have a capacity of 0.1 cu ft and shall conform to the following dimensional requirements:

Capacity, cu ft	Inside Diameter, in.	Inside Height, in.	Thickness of Metal, U. S. Gage
0.1	6.00	6.10	No. 10 to No. 12

Calibration of Measure

3. The measure shall be calibrated by accurately determining the weight of water at 62 F (16.7 C) required to fill it. The factor, f, shall be obtained by dividing the unit weight of water at 62 F (16.7 C) (62.355 lb per cu ft) by the weight of water at 62 F (16.7 C) required to fill the measure.

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1956 to 1958.

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Sample

4. (*a*) Samples of oxychloride cement for test shall be taken at the mixer or mixing box immediately after completion of the mixing and shall be representative of the entire batch.

(*b*) Samples from a mechanical mixer shall be taken from the first discharge of the mixer.

(*c*) Samples of batches mixed by hand in a mixing box shall consist of approximately equal portions taken from not less than six points uniformly distributed over the entire batch. These portions shall be combined and mixed to form a single sample for test.

(*d*) The sample thus obtained shall be transported not more than a few feet from the working area to the place of performing the test and, to counteract segregation, shall be mixed in the container with a shovel or scoop until it is uniform in appearance before testing for yield.

Procedure

5. Fill the tared measure with the sample of oxychloride cement, rod thoroughly to eliminate air bubbles, and strike off the excess cement with a straightedge. Weigh the filled measure and determine the net weight of cement, W.

Calculation

6. Calculate the area covered, in square feet per 100 lb of dry mix, as follows:

$$A = \frac{1200f(1 + 8.35r\rho)}{TW}$$

where:

A = area covered, in square feet per 100 lb of dry mix,
f = volume factor for the measure used,
W = net weight of cement required to fill the measure,
T = thickness in inches to which the cement is to be placed,
r = gauging ratio in gallons per pound of dry mix, and
ρ = density of the gauging solution in grams per cubic centimeter.

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Standard Method of Test for

YIELD OF MAGNESIUM OXYCHLORIDE CEMENT (LABORATORY TEST)[1]

ASTM Designation: C 389 – 58

ADOPTED, 1958.[2]

This Standard of the American Society for Testing Materials is issued under the fixed designation C 389; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. This method of test covers a procedure for determining the area that will be covered by a given dry weight of magnesium oxychloride composition when placed in a thickness of ½ in.

Apparatus

2. (*a*) *Balance*, having a sensitivity of 0.1 g under a load of 2000 g.

(*b*) *Flow Table Mold*, as used in the Method of Test for Consistency of Magnesium Oxychloride Cements by the Flow Table (ASTM Designation: C 255).[3]

(*c*) *Glass Plate*, flat, ¼ in. thick and 4 in. square.

Preparation of Sample

3. The cement shall be mixed according to the Method for Mixing Magnesium Oxychloride Cement Compositions with Gauging Solution (for Preparation of Specimens for Laboratory Tests) (ASTM Designation: C 251).[3]

Procedure

4. (*a*) Weigh the flow table mold and the flat piece of glass to the nearest 0.5 g.

(*b*) Place the flow table mold in the inverted position (large end uppermost) on the glass plate, fill with cement, rod thoroughly to eliminate air bubbles, and strike off the excess cement with a straightedge.

(*c*) Weigh the mold, filled with cement, to the nearest 0.5 g.

Calculations

5. (*a*) Calculate the yield in square feet of ½-in. thickness per 100 lb of dry mix as follows:

$$Y = \frac{11{,}400(1 + R\rho)}{W}$$

where:

Y = yield in square feet of ½-in. thickness per 100 lb of dry mix,

R = gauging ratio in milliliters of gauging solution per gram of dry mix,

ρ = specific gravity of the gauging solution, and

W = weight of the cement sample in grams.

(*b*) If desired, the amounts of dry mix and of magnesium chloride ($MgCl_2 \cdot 6H_2O$) in pounds per square foot may be calculated as follows:

$$\text{Dry mix, lb per sq ft} = \frac{0.0087W}{1 + \rho R}$$

$$MgCl_2 \cdot 6H_2O\text{, lb per sq ft} = \frac{0.233(\rho - 1.0124)\rho RW}{1 + \rho R}$$

where W, ρ, and R are defined as in Paragraph (*a*).

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, this method was published as tentative from 1956 to 1958.

[3] Appears in this publication.

Standard Definitions of

TERMS RELATING TO MAGNESIUM OXYCHLORIDE AND MAGNESIUM OXYSULFATE CEMENTS[1]

ASTM Designation: C 376 - 58

ADOPTED, 1958.

This Standard of the American Society for Testing Materials is issued under the fixed designation C 376; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Aggregate.—Any hard inert material in graduated sizes for mixing with a cementing material. (C 238)[3]

Compressive Strength.—A property of solid material that indicates its ability to withstand a compressive load. (C 246, C 257, C 275)

Consistency.—A degree of viscosity defined by the flow under specified force. (C 249, C 255)

Filler.—Nonfibrous inert materials such as silica, limerock, talc, etc., in particle sizes passing a No. 100 (149-micron) sieve. Fibrous materials such as sawdust, asbestos, and the like, in particle sizes passing a No. 20 (841-micron) sieve, for mixing with a cementing material. (C 238)

Flexural Strength.—A property of solid material that indicates its ability to withstand a flexural or transverse load. (Synonymous with Transverse Strength and Modulus of Rupture.) (C 246, C 256, C 275)

Gaging Ratio.—The ratio of oxychloride magnesia to gaging solution used in mixing a magnesium oxychloride cement and usually expressed as pounds of MgC per gallon of gaging solution. (C 251)

Gaging Solution.—A water solution of magnesium chloride, with or without $MgSO_4 \cdot 7H_2O$ equivalent to 10 per cent of the weight of $MgCl_2 \cdot 6H_2O$, of designated concentration or specific gravity for mixing with oxychloride cement composition. (C 250)

Linear Change.—The change in length of a specimen prepared and tested under standardized conditions, expressed as the percentage of the total length. (C 246, C 253, C 275)

Linear Contraction.—The decrease in length of a specimen prepared and tested under standardized conditions, expressed as the percentage of the total length. (C 246, C 252, C 275)

Magnesia.—The chemical compound magnesium oxide, MgO. (See Oxychloride Magnesia)

Magnesium Oxychloride.—The cementitious matrix formed by the reaction of oxychloride magnesia with gaging solution.

Magnesium Oxchloride Cement.—The conglomerated mass formed of various aggregates and fillers cemented in a matrix of magnesium oxychloride.

Magnesium Oxychloride Composition.—An intimate mixture of various dry ingredients, including oxychloride magnesia, which when mixed with gaging solution forms magnesium oxychloride cement.

Nonplastic Contraction.—The decrease in length from the time of final set to maximum contraction of a specimen prepared and tested under standardized conditions, expressed as the percentage of the total length. (C 246, C 252, C 275).

Oxychloride Magnesia.—Magnesia of a quality suitable for the preparation of magnesium oxychloride cement. (Synonymous with Plastic Calcined Magnesia, Caustic Calcined Magnesite, Oxychloride Magnesite, and Plastic Calcined Magnesite.) (C 275)

Setting Time.—The time in minutes required for a specimen prepared and tested under standardized conditions to attain a specified degree of rigidity. (C 246 C 254, C 275)

Standard Conditions.—Conditions of temperature, humidity, and air velocity for the preparation, storage, and testing of oxychloride specimens. (C 251)

Westvaco Needle.—A needle of specified dimensions and weight, which is used for the purpose of determining setting time. (C 254)

[1] Under the standardization procedure of the Society, these definitions are under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxychloride and Magnesium Oxysulfate Cements.

[2] Prior to adoption as standard, these definitions were published as tentative from 1955 to 1958.

[3] These designations refer to the ASTM specifications and methods to which the definition applies. Consult the Contents in Numeric Sequence for the latest editions of the specifications and methods.

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