

Tentative Method

For

DETERMINATION OF LINEAR CHANGE OF MAGNESIUM OXYCHLORIDE CEMENTS

(OCA 300-16-50)

Revised June 29, 1950

SCOPE

1. This method of test describes equipment and procedures for the laboratory determination of linear changes occurring in oxychloride cements subsequent to final set.

ALTERNATE METHODS

2. Either of two types of equipment and procedures may be used for molding and measurement of specimens. Method I involves the use of molds and length comparator as specified in the Standard Method of Test for Autoclave Expansion of Portland Cement (A.S.T.M. Designation C 151-49)¹ of the American Society for Testing Materials. Method II specifies the equipment and procedure currently in use by the oxychloride cement industry.²

METHOD I

APPARATUS

3. (a) Molds. - The molds shall conform to requirements specified in Section 2 (c) of A.S.T.M. Standard Method, Designation C 151-49.

(b) Length Comparator. - The length comparator shall conform to requirements specified in Section 2 (f) of A.S.T.M. Standard Method, Designation C 151-49.

TEMPERATURE AND HUMIDITY

4. (a) The preparation of test specimens and the subsequent testing 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 F to 60.5 F). All materials and equipment 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.

1. A.S.T.M. Book of Standards, 1949, p. 35.

2. It is anticipated that comparison of the two different types of equipment and procedures by several laboratories may result in the selection of one method as standard.

PREPARATION OF TEST SPECIMENS

5. (a) Preparation of Molds. - Molds shall be coated with a saturated solution of stearic acid in trichloroethylene sufficiently in advance of the molding of the specimens to permit complete evaporation of the solvent. The stainless steel or noncorroding metal reference points shall then be set, care being taken to keep them free from the parting compound.

(b) Molding Specimens. - The mold shall be filled with the plastic mix of oxychloride cement prepared as provided in the Tentative Method for Mixing Oxychloride Cement Compositions with Gauging Solution (OCA Designation 300-20) of the Oxychloride Cement Association. The cement shall not have aged more than 20 min. from completion of the mixing. The corners of the mold shall be completely filled and the entrapped air removed by applying the spatula with a cutting motion. Strike off the excess cement flush with the top of the mold.

STORAGE AND MEASUREMENT OF TEST SPECIMENS

6. (a) After the mold has been filled it shall immediately be placed in the curing cabinet. At 30 ± 5 min. after final set of the cement, as determined in conformity with the Tentative Method of Determination of Setting Time of Oxychloride Cements (OCA Designation 300-15) of the Oxychloride Cement Association, the specimen shall be carefully removed from the mold and measured for length to the nearest 0.0001 in. It shall then be placed on a rack or grating in the storage area in such a position that the standard atmosphere (Section 4 (b)) shall have access to all faces. The specimen shall then be measured for length at $\frac{1}{2}$ hr. intervals until maximum contraction is reached. Maximum contraction is the point of minimum length of the specimen after which two consecutive measurements at $\frac{1}{2}$ hr. intervals show either a decrease in length of not more than 0.0001 in. or an actual expansion. The specimens from some types of oxychloride cement mixes 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, the specimen shall be measured for length 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 specified in the following Section, 6 (b).

(b) In determining linear change a suitable 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, in inches times ten (retaining all figures), is reported as per cent 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 one 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 one, three, seven, or twenty-eight days.

(c) If the test specimen increases in length between the initial and final reference points, the change is referred to as expansion (this expansion may be indicated by a plus (+) sign); if it decreases in length, the change is referred to as contraction (may be indicated by a minus (-) sign).

REPORT

7. The report of the results of the test shall include:
- (a) Designation of method used (Method I or Method II)
 - (b) Initial and final reference points
 - (c) Value found for per cent expansion or contraction, rounded off to nearest 0.001 per cent in accordance with method A.S.T.M. E 29.

Typical forms for reporting linear change are: "Expansion, one to seven days \pm 0.xyz%" or "Linear change, one to seven days = -0.xyz%".

METHOD II

APPARATUS

8. (a) Measuring Apparatus. - (1). - A cradle similar to that illustrated in Fig. 1, suitable for holding the test specimen at an angle of 45° to the vertical, shall be provided.

(2) Length Comparator. - Changes in length of the test specimen shall be measured by a dial gauge or a micrometer comparator with ratchet stop. The measuring instrument shall be fitted to the cradle (Section 8 (a) (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 0.0002 in., and when tested at any point throughout its range, the error shall not be greater than \pm 0.002 in. The difference between repeated measurements shall not be greater than 0.001 in. The calibrations on dial or micrometer shall be such that length changes of 0.0001 in. may be estimated. A standard invar reference bar 10 \pm 0.1 in. long shall be provided and the instrument shall be checked frequently with this reference bar.

(b) Molds. - A collapsible brass mold with internal dimensions of 1 in. by 1 in. by 10 in. (tolerance of all dimensions \pm 0.1 in.) shall be employed for forming the test specimen with its longitudinal axis in the horizontal position. The details of a suitable mold are shown in Fig. 2.

(c) Ground Glass Inserts. - Pieces of glass microscope slides which 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.

TEMPERATURE AND HUMIDITY

9. (a) The preparation of test specimens and the subsequent testing shall be conducted in an atmosphere maintained at a temperature of $70 \pm 1^\circ \text{F}$ and at a relative humidity of 50 ± 5 per cent (corresponding to a wet bulb temperature range of 56.5°F to 60.5°F). All materials and equipment shall be equilibrated to these conditions at time of use.

(b) The temperature of the storage cabinet or storage room shall be maintained at $70 \pm 1^\circ \text{F}$ 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.

PROCEDURE

10. (a) The clean mold shall be coated with a saturated solution of stearic acid in trichloroethylene sufficiently in advance of molding the specimen to permit complete evaporation of the trichloroethylene. Place the ground glass inserts at each end of the mold so that their smooth surfaces are next to the mold. Fill the mold with the oxychloride cement prepared as provided in the Tentative Method for Mixing Magnesium Oxychloride Cement Compositions with Gauging Solution (OQA Designation 300-20) of the Oxychloride Cement Association. 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 cutting motion with spatula. Strike off the excess cement level with the top of the mold. At 30 ± 5 min. after final set of the cement, as determined in accordance with the Tentative Method for Determination of Setting Time of Magnesium Oxychloride Cements (OCA Designation 300-12) of the Oxychloride Cement Association, 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 indicated in the following section. After removal from the mold the test specimen shall be placed on a rack or grating so that the standard atmosphere shall have access to all four sides at all times.

(b) The specimen, immediately on removal from the mold, shall be placed in the cradle (Fig. 1) so that the faces of the anvil and spindle of the micrometer or dial gauge 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, subsequent readings shall be made 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 gauge against the standard invar bar and correct the measurement of the specimen accordingly if deviations greater than ± 0.0001 in. from the length of the standard invar bar are noted.

(c) Repeat the measurements at $\frac{1}{2}$ hr. intervals until maximum contraction is reached. Maximum contraction is the point of minimum length of the specimen after which two consecutive measurements at $\frac{1}{2}$ hr. intervals show either a decrease in length of not more than 0.0001 in. or an actual expansion. With some types of mixes the test specimen 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 specified in the following paragraph.

(d) In determining linear change, a suitable 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, in inches times 10 (retaining all figures), is reported as per cent 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 one 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 one, three, seven, or twenty-eight days.

(e) If the test specimen increases in length between the initial and final reference points, the change is referred to as expansion, (this expansion may be indicated by a plus (+) sign); if it decreases in length, the change is referred to as contraction (may be indicated by a minus (-) sign).

REPORT

11. The report of the results of the test shall include:
 - (a) Designation of method used (Method I or Method II)
 - (b) Initial and final reference points
 - (c) Value found for per cent expansion or contraction, rounded off to nearest 0.001 per cent in accordance with method A.S.T.M. E 29.

Typical forms for reporting linear change are: "Expansion, one to seven days = 0.xyz%", or "Linear change, one to seven days = - 0.xyz%".

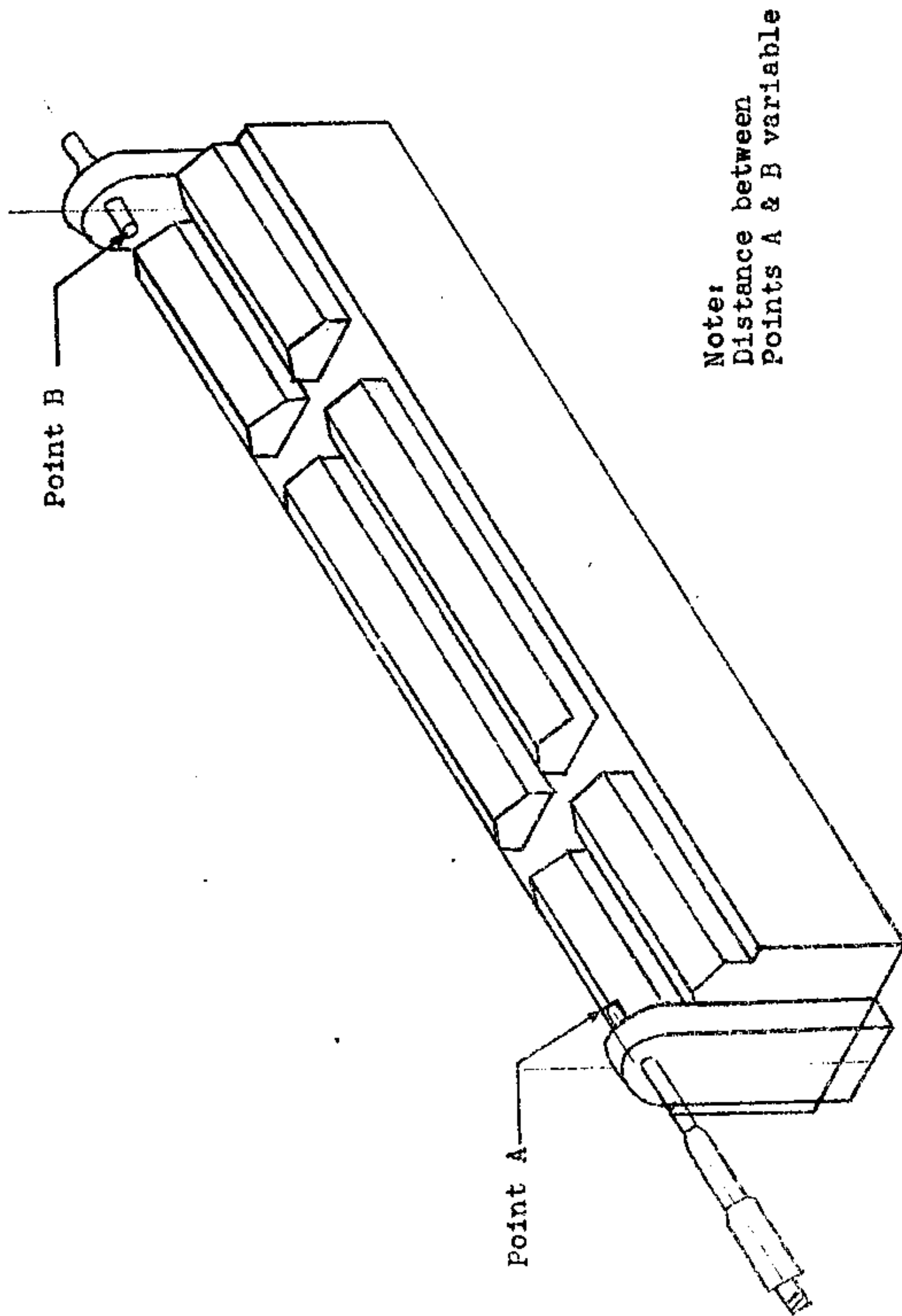
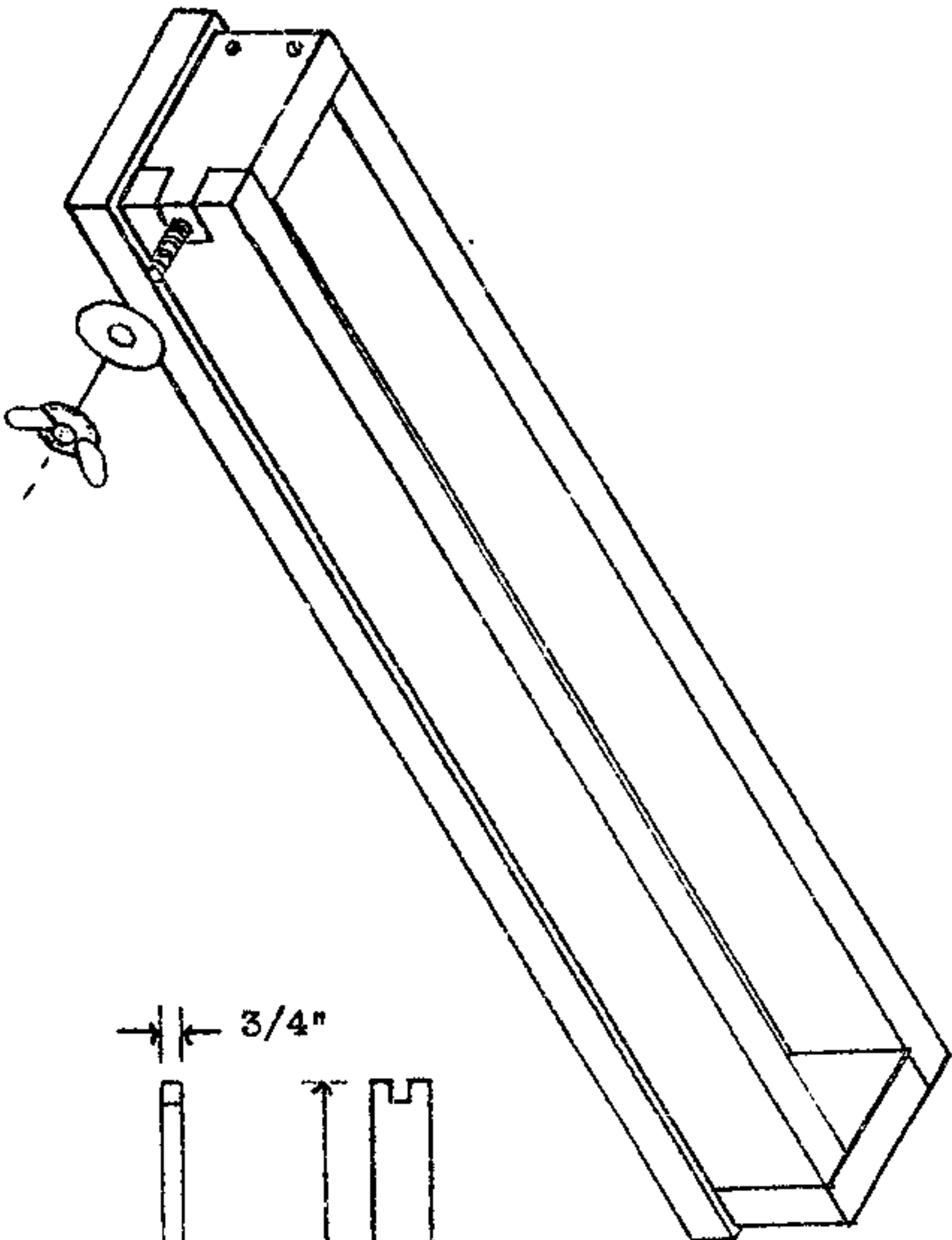
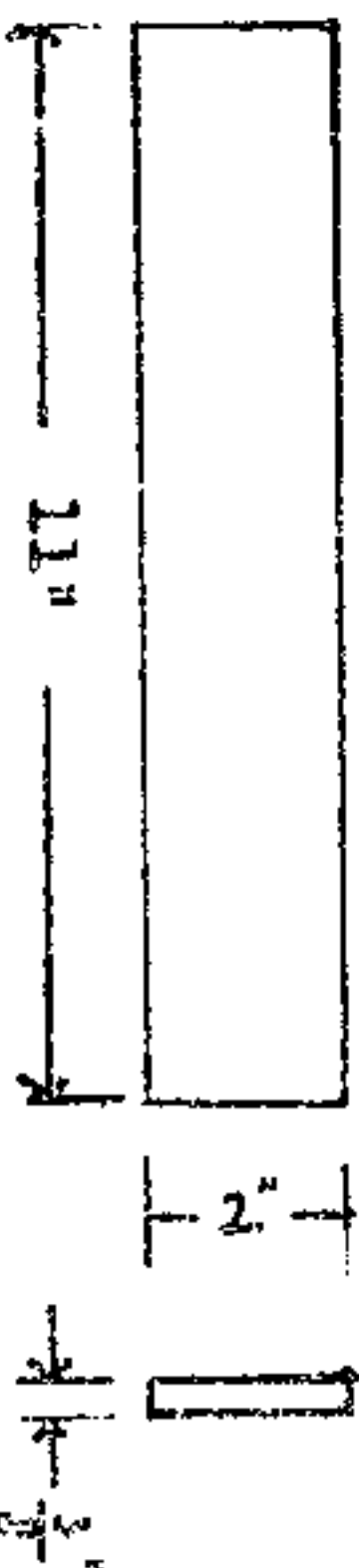
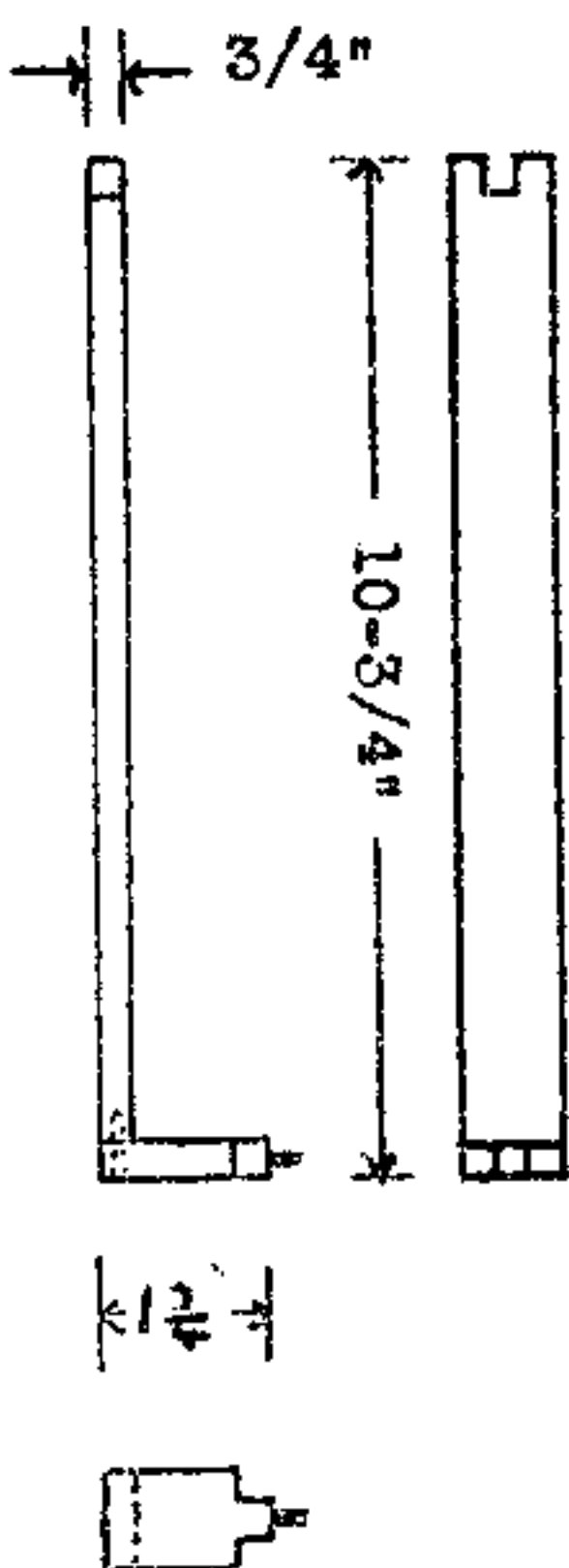


Figure 1
Micrometer Cradle



Scale: 6" = 1'0"

Note:
Material 3/8" Brass



Scale: 3" = 1'0"

Figure 2
Linear Change Mold

Tentative Method

for

DETERMINATION OF LINEAR CONTRACTION OF MAGNESIUM OXYCHLORIDE CEMENTS

(00A-300-16A-50)

Revised June 30, 1950

SCOPE

1. This method of test describes the procedures for the laboratory determination of linear changes occurring in oxychloride cements prior to point of maximum contraction.

APPARATUS

2. (a) Measuring Apparatus. - The measuring apparatus shown in detail in Fig. 1 consists essentially of a base on which is rigidly mounted a section of angle brass 1-1/2 in. by 1-1/2 in. in dimensions and approximately 11 in. long, which serves as a cradle for the specimen. A rigidly mounted tail piece at one end of the cradle is provided with a bolt for anchoring the test specimen. At the opposite end of the cradle is 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 gauge. 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 grams or more than 120 grams. 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 1/2 in. above the apex of the cradle.

(b) Brass Face Plates. - Pieces of light gauge, but rigid brass cut in the form of a right triangle with the two adjacent sides each 1-1/2 in. long shall be used to confine the ends of the specimen. Shim stock approximately 0.010 in. 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 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 7/16 in. from the apex of the face plate and on a line bisecting the right angle. Three 3/32 in. holes shall be punched in each end plate for keying to the specimen.

TEMPERATURE AND HUMIDITY

3. The preparation of the test specimens and subsequent testing of the 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 F to 60.5 F). All dry materials, equipment and solutions shall be at this same temperature at time of use.

AIR VELOCITY

4. 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

5. (a) Cut four pieces of thin, nonsticky, 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 oxychloride cement which has been prepared as provided in the Tentative Method of Mixing Magnesium Oxychloride Cement Compositions with Gauging Solution (OCA Designation 300-20) of the Oxychloride Cement Association. 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 the stem of the indicating device. Adjust the end plate so that it is vertical, does not bind on the sides of the mold, and so that the test specimen is 10 ± 0.05 in. long. The test specimen shall remain undisturbed in the apparatus until the completion of the determination.

(b) At 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 five min. prior to this base-point reading. Record the length of the test specimen at $\frac{1}{2}$ 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 $\frac{1}{2}$ hr. intervals show either a decrease in length of not more than 0.0001 in. or an actual expansion.

(c) The linear change measurements, expressed as percentage change from the base-point, shall be plotted against time on suitable coordinates in order to make it possible to interpolate linear change values corresponding to the independently measured setting times.

(d) Non-plastic contraction shall be reported as the percentage change in length of the test specimen between the time of final set as provided in the Tentative Method for Determination of the Setting Time of Magnesium Oxychloride Cements (OCA Designation 300-15) of the Oxychloride Cement Association and the time at which maximum contraction occurs. The setting times and the contractions shall be determined concurrently on test specimens prepared from the same batch of cement.

(e) Net contraction shall be recorded as the decrease in length of the test specimen between the initial base-point (at $\frac{1}{2}$ hr. age) and the point of maximum contraction, expressed as percentage. 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.

(f) Final values reported shall be rounded off to the nearest 0.001 per cent in accordance with practice recommended by A.S.T.M. Method E-29.

REPORT

6. The report of results shall include:

- (a) Value found for per cent non-plastic contraction
- (b) Value found for per cent net contraction or
- (c) Value found for per cent gross contraction

Tentative Method of Test For
BULK DENSITY OF MAGNESIUM OXYCHLORIDE CEMENT COMPOSITIONS

(OCA 300-19-50)

Revised June 30, 1950

SCOPE

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

APPARATUS

2. The apparatus shall consist of the following:

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

(b) Beaker of 1000 milliliter capacity.

(c) 22 gage copper wire.

PREPARATION OF SAMPLES

3. (a) The samples shall consist of at least five pieces or fragments of the composition being tested each weighing not less than 100 g. nor more than 200 g. These pieces or fragments shall be broken from the specimens molded and tested for transverse strength after the seven day test has been completed as specified in the Tentative Method of Test for Transverse Strength of Oxychloride Compositions (OCA Designation 300-13) of the Oxychloride Cement Association.

(b) Each specimen shall be free of all loosely adhering particles.

(c) Visibly defective specimens such as those containing cracks or bubbles, shall not be used.

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

PROCEDURE

4. (a) Dry Weight "D". - The weight, D, of each specimen cured as described in Section 3 (d) shall be determined by weighing on a suitable balance, in air, to the nearest 0.05 g. at seven 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 one hour. During this one hour 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 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 hanger of 22 gage copper wire hung from one arm of the balance. The balance shall be previously counter-balanced 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, determined immediately in grams 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 an error by withdrawing water from the pores of the specimen.

CALCULATION

5. (a) Exterior Volume "V". - The 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:

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

$$\text{Weight per cubic foot at 70 F.} = B \times 62.2$$

(c) Rounding off. - The value for bulk density shall be rounded off to the nearest pound per cubic foot in accordance with A.S.T.M. E 29.

REPORT

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

Tentative Method

For

MIXING OXYCHLORIDE CEMENT COMPOSITIONS WITH GAUGING SOLUTION For Preparation of Specimens for Laboratory Tests

(ODA 300-20-50)

Revised June 30, 1950

SCOPE

1. This method describes the procedures to be employed in mixing dry pre-mixed 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 grams shall be employed.

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. For a complete definition of sensibility reciprocal, see "Specifications, Tolerances and Regulations for Commercial Weighing and Measuring Devices", Handbook H29, Nat. Bur. Standards, Sept. 1942, pp. 87-88.

(b) Weights. - The permissible variation in weights employed shall be as prescribed in Table I.

Table I

<u>Weight, g.</u>	<u>Permissible Variations on Weights in Use</u> <u>Grams. \pm</u>
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 so as 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 $1\frac{1}{2}$ in. wide, and thick enough for good mechanical strength and symmetrically mounted in an assembly so that in operating position the longitudinal axis of the blades are parallel to each other and to the axis of the mixing can. The broad side of the blades is 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 (r.p.m.) 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 $\frac{1}{8}$ in. or more than $\frac{1}{4}$ 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 one inch. 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 loading edge of the fixed blade shall be located approximately 60° , 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 $\frac{1}{8}$ in. and not more than $\frac{3}{8}$ in.

(d) Volumetric Equipment. - The dispensing burettes 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.

TEMPERATURE AND HUMIDITY

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 F to 60.5 F). All test materials and equipment shall be equilibrated to these standard 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 specific gravity units, and shall be prepared from materials meeting requirements of Tentative Specifications for Magnesium Chloride (OCA Designation 500-11) of the Oxychloride Cement Association.

PROCEDURE

5. (a) 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.) shall be weighed to $\pm 1\%$ and the weight recorded. Transfer the material to a clean, dry mixing can and mix mechanically for 4 minutes. 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 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 prescribed by Tentative Method for Determination of the Consistency of Magnesium Oxychloride Cements by Means of a Flow Table (OCA Designation 300-12) of the Oxychloride Cement Association and simultaneously start the timing device. The addition of the solution, including drainage of the containers, should be completed within 20 sec. The mixing shall continue without interruption or interference for 12 min. ± 5 sec. measured from the time of first addition of gauging solution.

(b) - (1). At completion of mixing, check the consistency as per cent flow of a portion of the cement according to Tentative Method for Determination of the Consistency of Magnesium Oxychloride Cements by Means of a Flow Table (OCA Designation 300-12). In the testing of oxychloride grade magnesia for flooring composition as described by Tentative Method for Testing Magnesia (MgO) for Magnesium Oxychloride Cements (OCA Designation 400-4) of the Oxychloride Cement Association normal consistency shall be considered to be 98-108% flow. 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 Tentative Method for Determination of the Setting Times of Magnesium Oxychloride Cements by Means of an Automatic Setting Time Machine (OCA 300-15). 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 shall fall in the range 98-108% flow when the magnesia is tested in accordance with the method mentioned above.

(b) - (2). In the testing of oxychloride cement compositions, the consistency as measured by per cent 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, and adjust 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. Not more than twenty minutes should elapse between completion of mixing and preparation of the last test specimen, except in the case of Tentative Method for Determination of Linear Contraction of Magnesium Oxychloride Cement Compositions (OCA Designation OCA 300-16 A), the specimen of which should be prepared within 10 min. of completion of mixing.

(d) In the event of disagreement between testing laboratories, confirmation of the identity of mixing procedures and of conformity to the methods to which reference is made in Section 5 (a) and 5 (b) shall be required and

shall be considered to have been certified when the two laboratories, employing a single standard ratio of gauging solution to magnesia and equivalent representative portions of a single magnesia sample and testing according to the two methods mentioned, obtain consistency values agreeing to within 5% flow as measured by the method to which reference is made in Section 5 (b). In so checking the test procedures, the per cent flow values compared shall be taken as the average of three consistencies measured at the end of three independent mixings.

REPORT

6. 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.
- (3) Consistency of the cement as per cent flow.

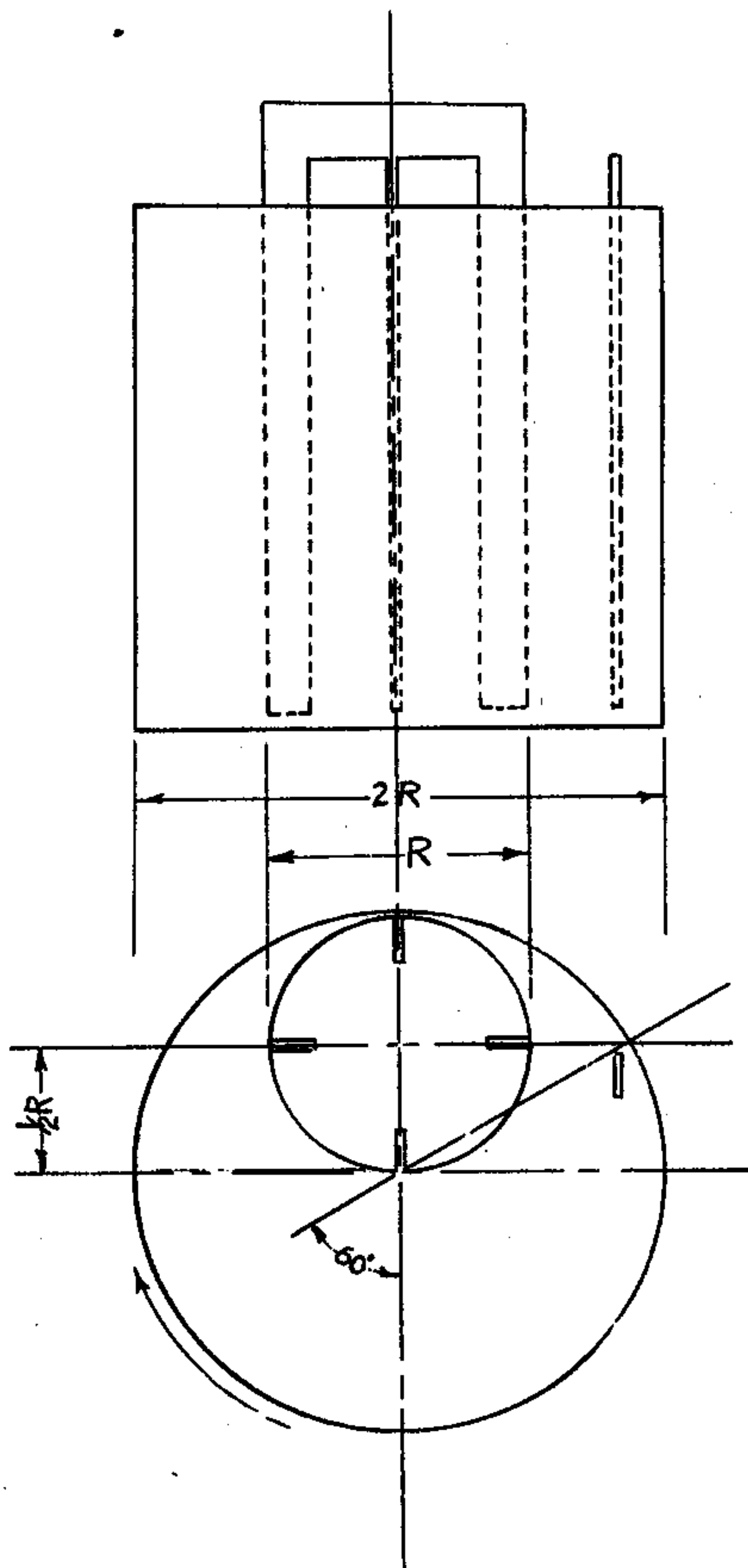


Figure 1 - Schematic Diagram of Mixing Equipment

OXYCHLORIDE CEMENT ASSOCIATION

TENTATIVE METHOD

FOR

TENSILE BOND STRENGTH OF BONDING MEDIUMS

Designation OCA 300-30-47-T

December 15, 1947

SCOPE:

1. This method of test is intended for determining the tensile properties of bonding mediums when tested between Oxychloride Cements and materials representative of subfloors, such as oxychloride compositions, new and old concrete, wood, steel, brick, stone and ceramic.

DESCRIPTION:

2. Tensile bond strength is the maximum tensile load per unit bonding area carried by a test specimen of the type herein described during a tension test. It is expressed in pounds per square inch.

APPARATUS:

3. (a) Testing Machine. The testing machine for determination of the bonding strength may be any type with sufficient opening between the upper bearing surface and the lower bearing surface of the machine to permit the use of verifying apparatus and to accommodate various test specimens. The tension applied to the test specimen shall be indicated with an accuracy of plus or minus 1.0 per cent.
(b) Grips. Grips for holding a test specimen between the fixed members and the movable member shall be the self-aligning type. That is, they shall be attached to the fixed and movable member, respectively, in such a way that they will move into alignment as soon as any load is applied.
(c) Molds. Two-inch cube molds as specified in OCA Specification 300-14-47-T, Section 2b, shall be employed.
(d) Attachment Bolt. The contact between the movable grip and the test specimen shall be made by means of a $3/8$ " x 6" cold roll steel bolt with $1\frac{1}{2}$ " standard thread and with nut. See Figure 1. The bolt shall have a 1-inch O. D. washer placed on the bolt spindle and spot welded to the bolt head.

TEST SPECIMENS:

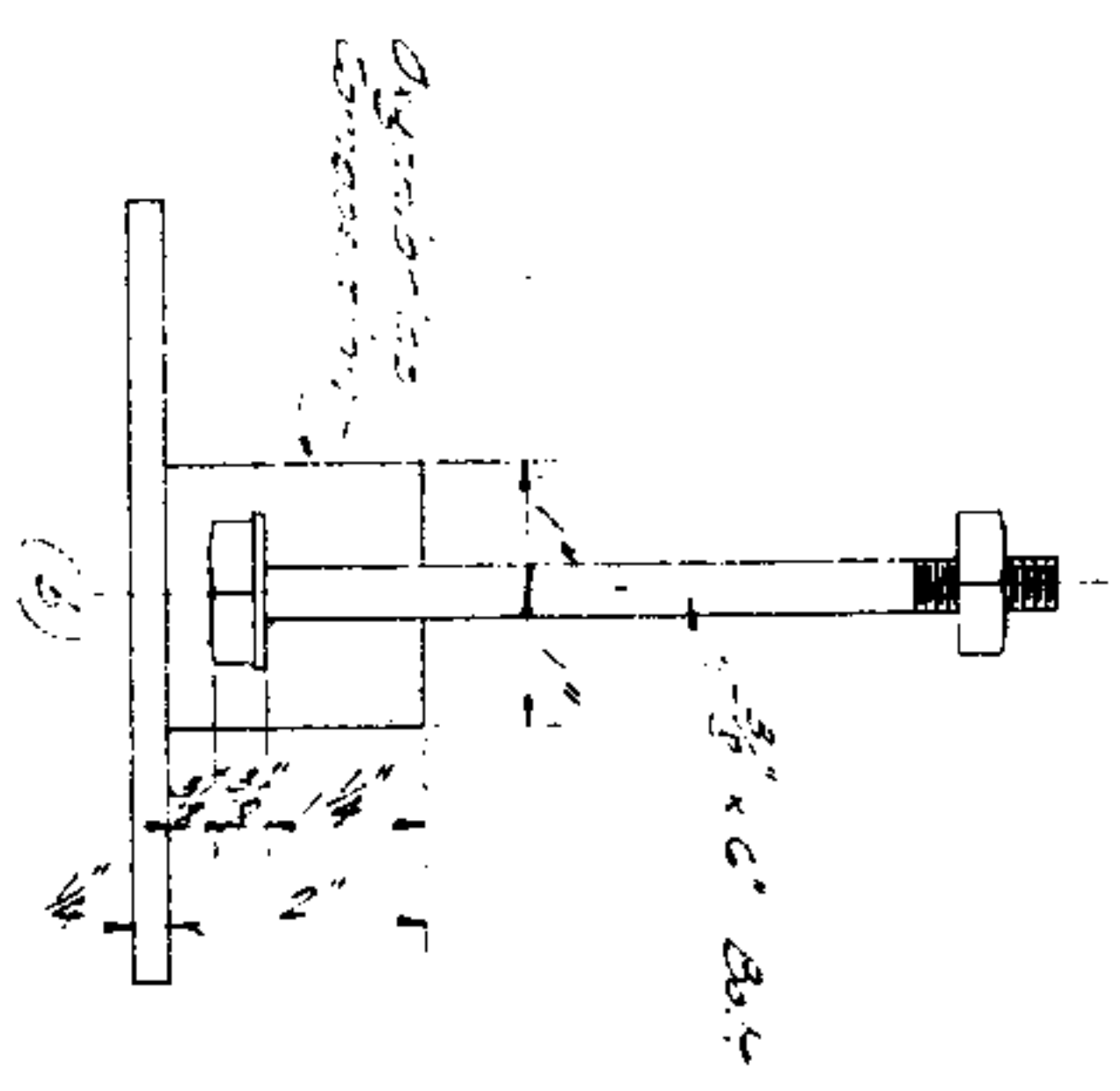
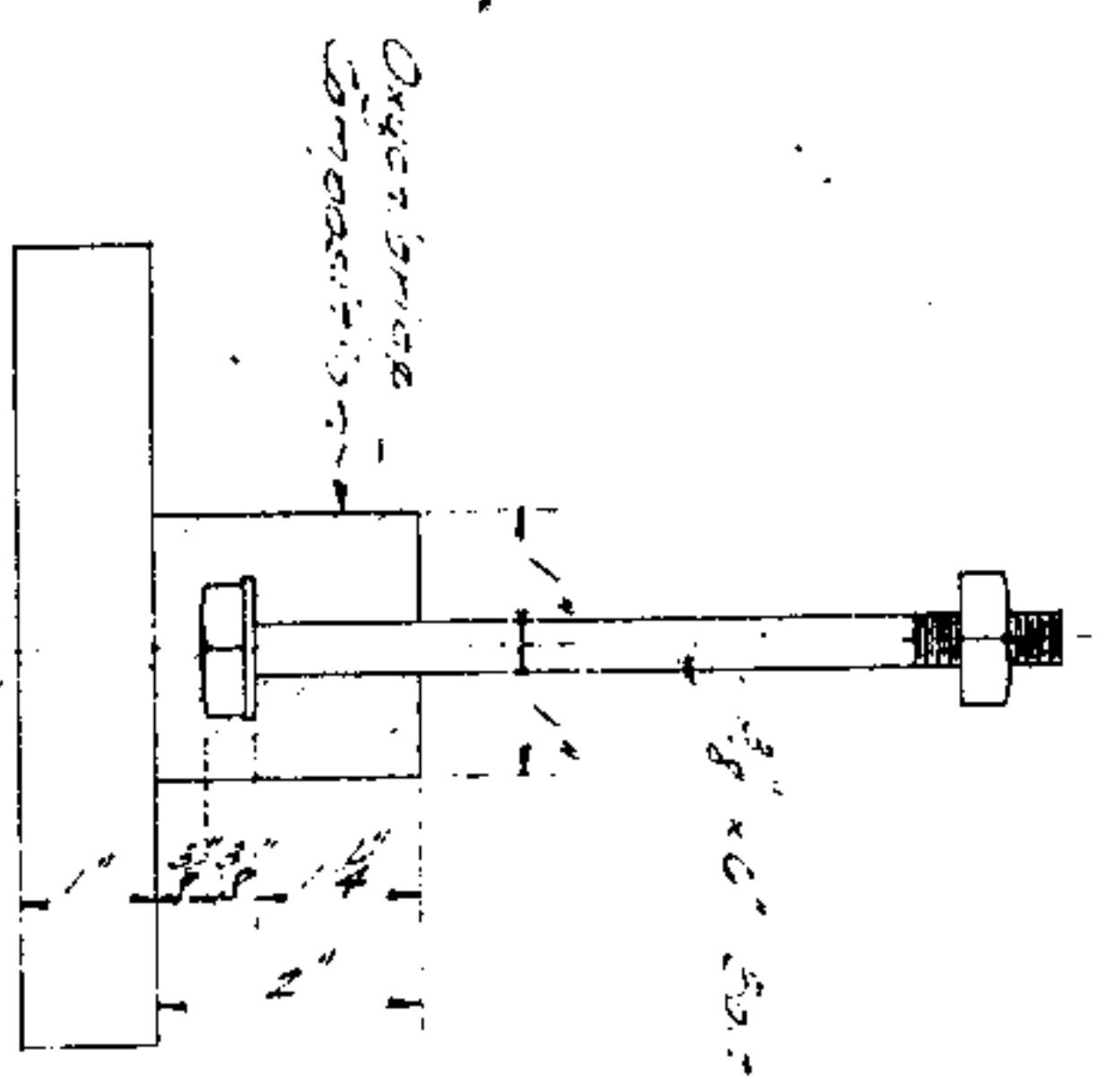
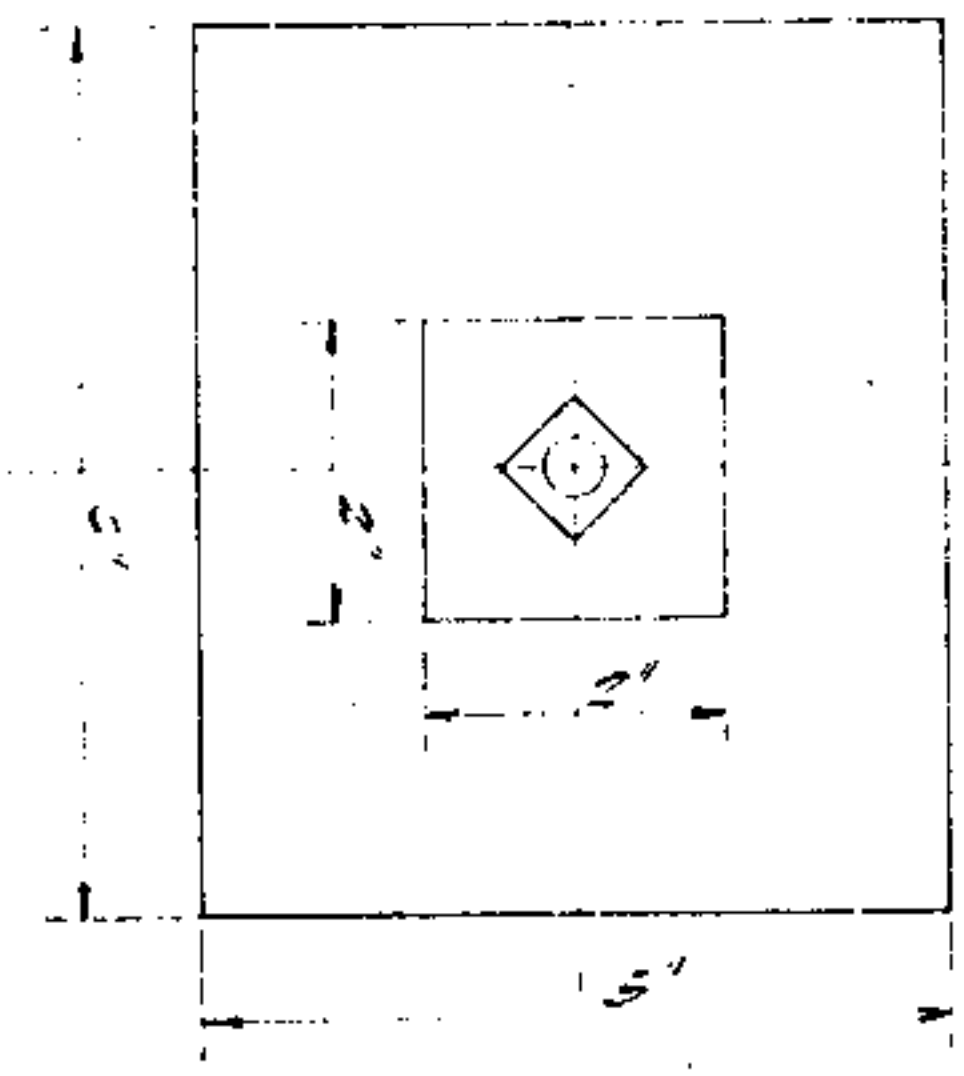
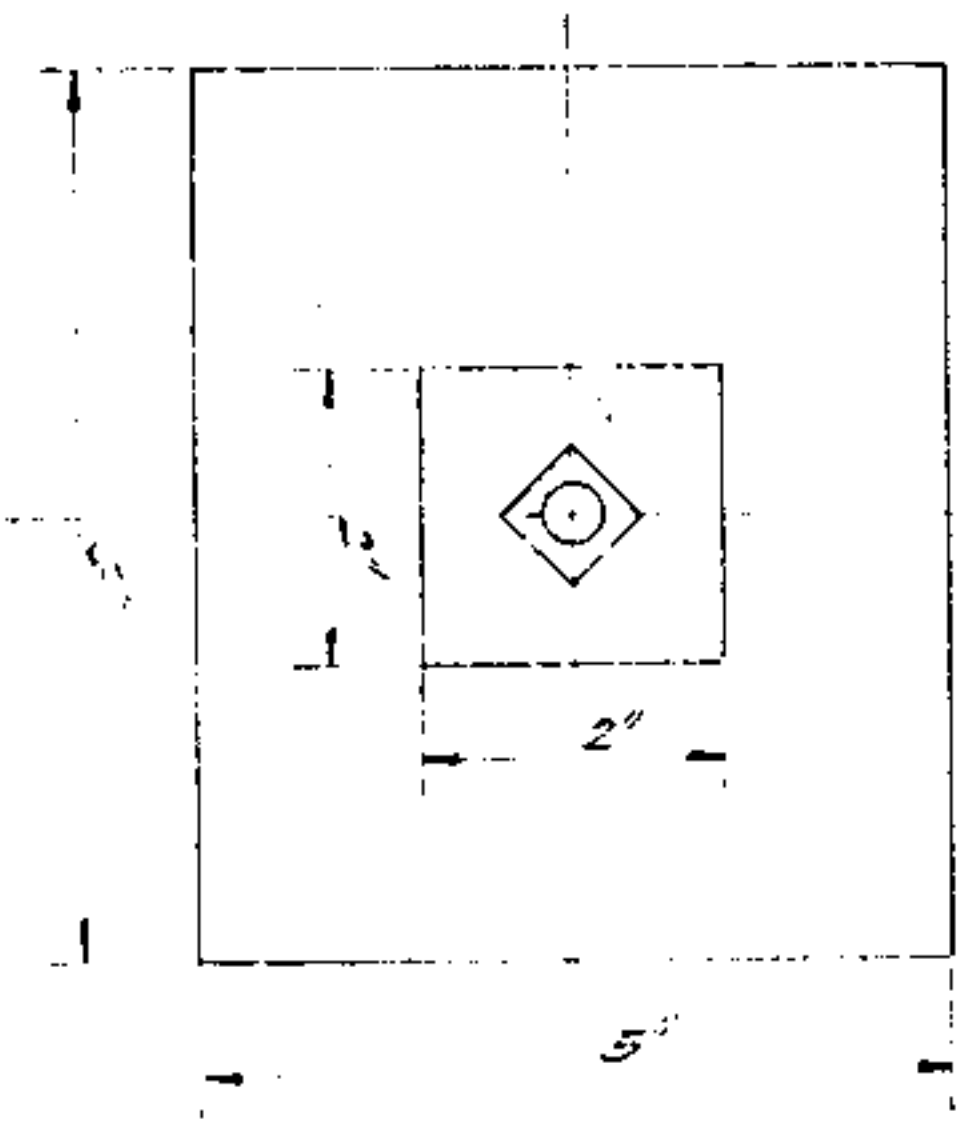
4. (a) The base of the bond test specimen shall consist of a base plate, approximately 5 x 6 inches, of composition similar in nature and surface to that of the subfloor.

- (b) Approximately six square inches of the center of the base plate shall be coated with the bonding medium in accordance with the procedure as outlined by the manufacturer of the bonding medium.
- (c) The oxychloride cement mortar shall be proportioned and mixed with the gauging solution in accordance with the methods outlined in OCA Specification 400-4-47-T. Immediately after mixing the oxychloride cement mortar, the 2" cube mold, resting on the center of the coated base plate, shall be filled half full and the entrapped air removed and the corners of the mold completely filled by using a cutting and stabbing motion with a small spatula for a period of fifteen seconds. The attachment bolt shall then be rigidly suspended in the center of the mold and perpendicular to the face of the base plate by means of a single or gang rack with clearances as shown in Figure 1. The mold shall be filled heaping full, entrapped air removed as with the first portion, and the excess oxychloride mortar smoothed off with a spatula.
- (d) Conditioning. All specimens shall be molded and cured by exposure to a relative humidity of 50 ± 5 per cent and a temperature of $70 \pm 2^\circ \text{F}$. All test specimens shall remain in the same position as molded for 24 hours after which the molds shall be removed and the specimens tested at seven days age.

PROCEDURE:

5. (a) The specimen shall be anchored to the base plate of the testing machine by 4 "C" clamps, or special attachment clamps or shoe, care being taken to align the specimen with the adjusting grips for the bolt so that the load will be applied in a direction perpendicular to the plane of the bonded area.
- (b) Speed of testing:- Tension tests for all materials shall be made by applying a load to the specimen at a rate of 600-700 pounds per minute, or the crosshead speed of the testing machine shall be such that the load can be accurately weighed but shall not exceed 0.050 inches per minute when the machine is running idle.
- (c) Bonding strength of the specimens shall be the breaking load and shall be reported in pounds per square inch based on contact area of each specimen tested. The value reported shall be the average of tests of not less than three specimens. Any value for an individual specimen varying more than 15 per cent from the mean shall not be included in calculation of the average.

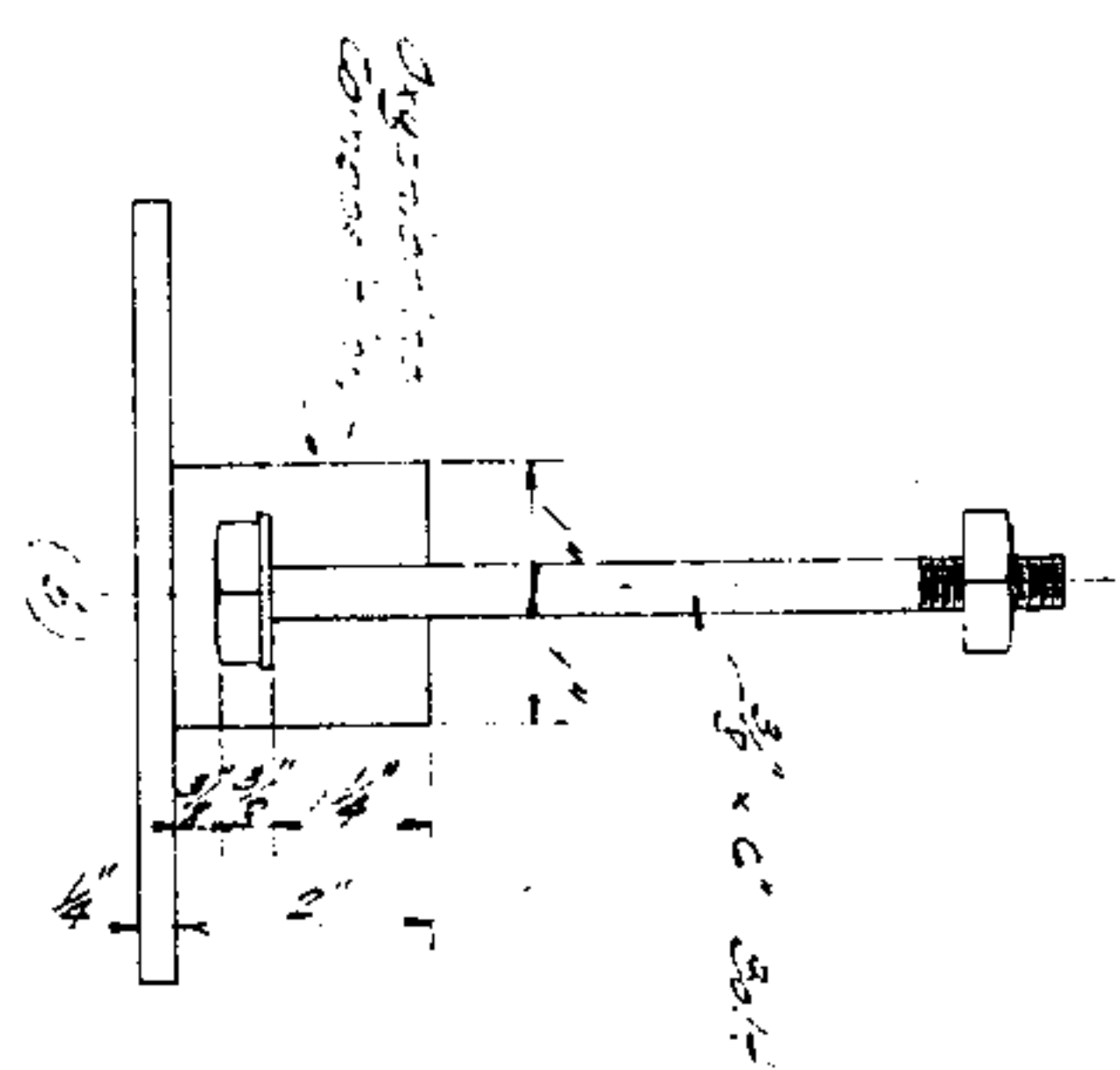
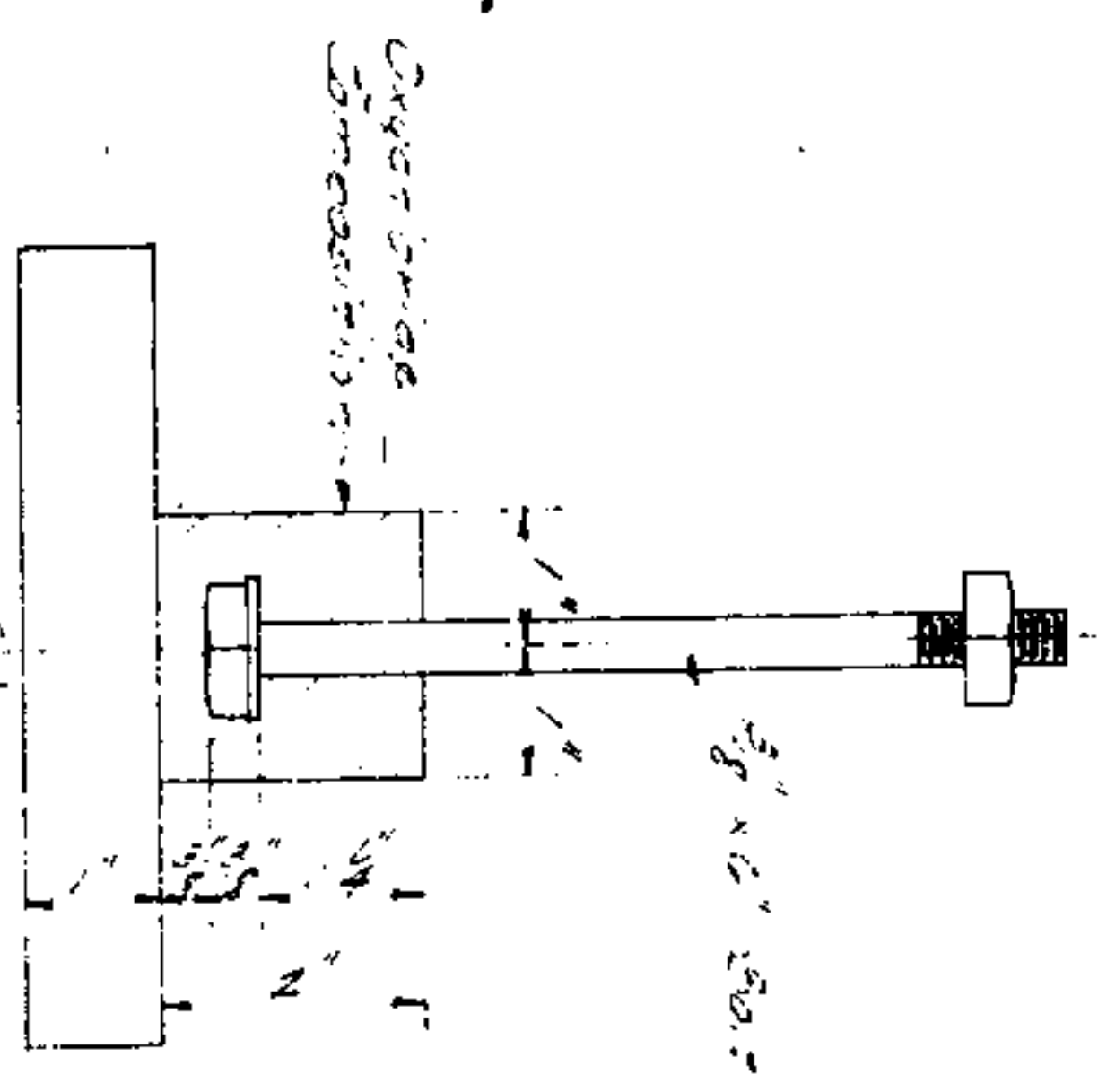
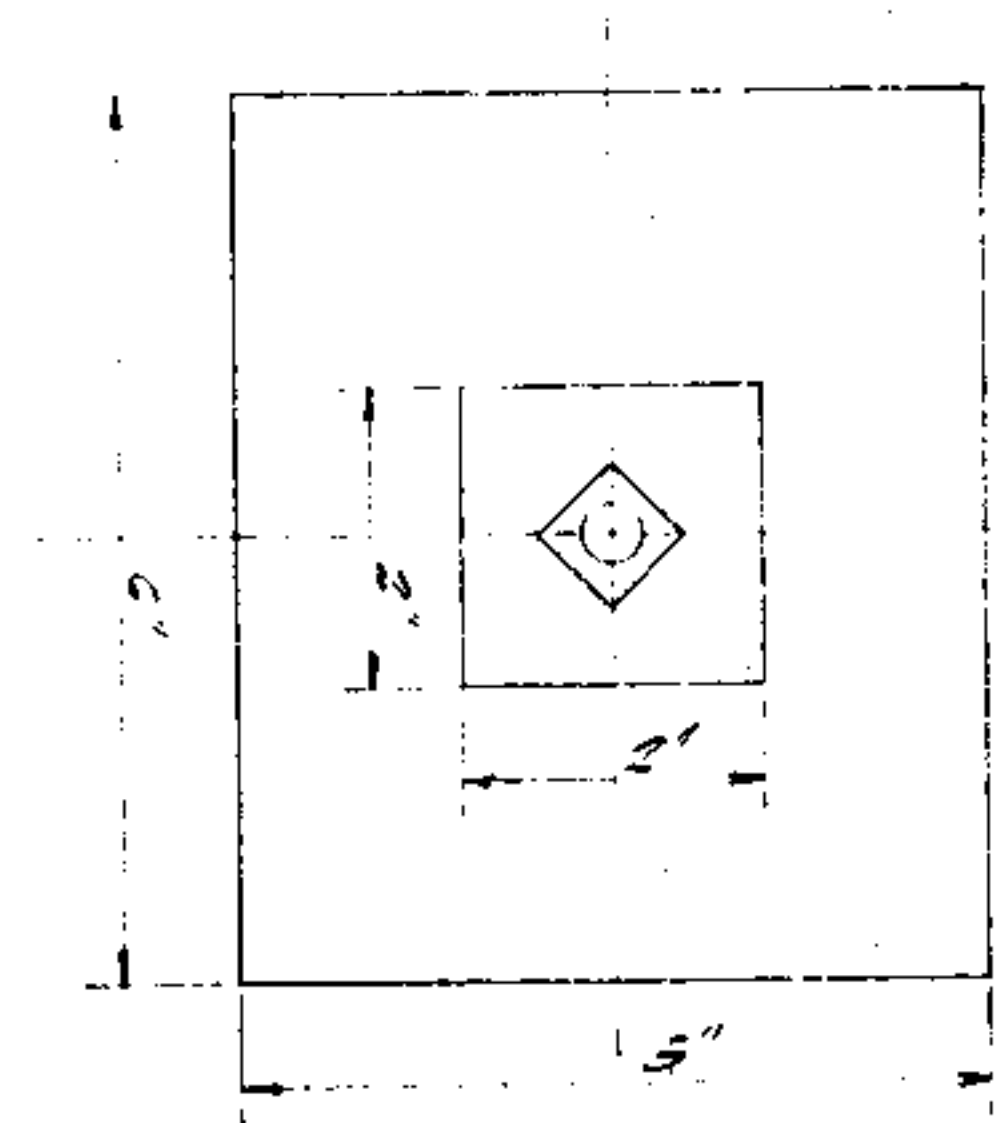
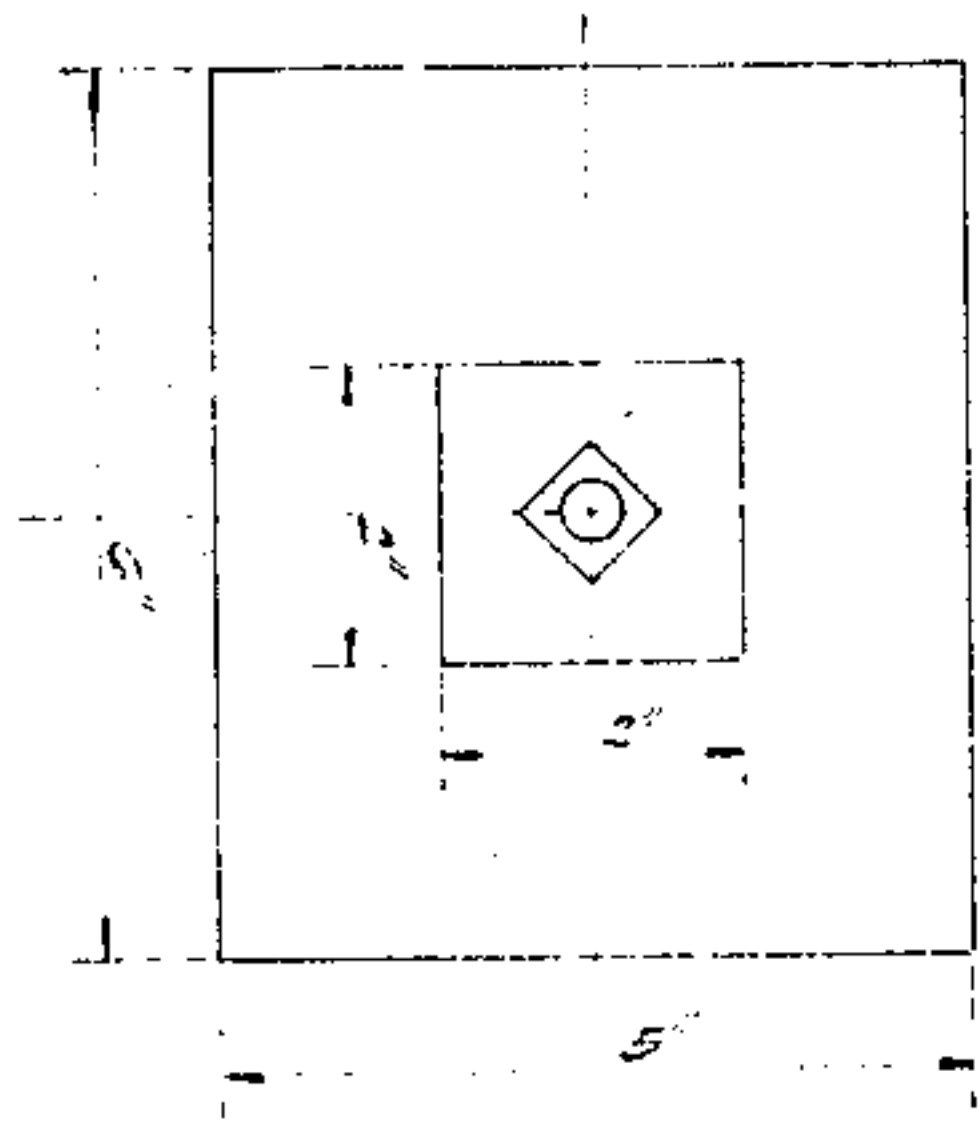
OXYCHLORIDE CEMENT ASSN., INC.
1028 Connecticut Avenue
Washington 6, D. C.



Wood, Concrete, Stone,
Ceramic, other Materials

TEST SPECIMENS

1.500



WOOD, CONCRETE, STONE
CERAMIC, OTHER MATERIALS

TEST SPECIMENS

WOOD

Tentative Method of Test for

FIELD DETERMINATION OF THE SPECIFIC GRAVITY OF GAUGING SOLUTIONS OF MAGNESIUM CHLORIDE AND MAGNESIUM CHLORIDE-MAGNESIUM SULFATE FOR MAGNESIUM OXYCHLORIDE CEMENT COMPOSITIONS

Revised June 30, 1950

(OCA 350-11-50)

SCOPE

1. This method describes the procedure to be employed for field determination of the specific gravity of gauging solutions of magnesium chloride and magnesium chloride-magnesium sulfate used for the mixing of magnesium oxychloride compositions on the job.

APPARATUS

2. (a) Hydrometer. - A hydrometer approximately twelve inches in overall length and with a scale ranging from 20° to 30° Baume graduated in 0.1° Baume subdivisions shall be employed. 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 3 and in accordance with the procedure described in Section 4. 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 Table 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 inside diameter approximately twice that of the hydrometer shall be employed.

(c) Thermometer. - A Fahrenheit thermometer covering a temperature range of at least 40° to 160° graduated in 2° subdivisions shall be employed.

REFERENCE SOLUTION

3. (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.

(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 which is precise to ± 0.0005 specific gravity units.

(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 practice recommended in Section 4 of A.S.T.M. E 29.

PROCEDURE

4. The stock supply of gauging solution shall be either a solution of magnesium chloride or a mixture of magnesium chloride and magnesium sulfate, whichever is specified for the particular job. The solution shall be free of undissolved crystals and shall be thoroughly mixed. The clean, dry hydrometer jar shall be filled with a portion of the stock solution and its temperature in the jar determined by means of the thermometer which shall also be clean and dry. The clean, dry hydrometer shall be immersed and the reading at the intersection of the surface of the liquid and the hydrometer obtained. This reading should be made 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. The point where this line cuts the hydrometer scale should be read. The values for specific gravity shall be rounded off to the nearest 0.1° Be' and the temperature readings to the nearest 10° in accordance with A.S.T.M. method E 29. From these temperature and hydrometer readings conformance to specification requirements shall be determined by reference to Table I for magnesium chloride, or to Table II for the mixture of magnesium chloride and magnesium sulfate.

Table I

Permissible Range of Specific Gravity of Magnesium Chloride
Gauging Solution for Various Temperatures

<u>Permissible Hydrometer Reading, Degrees Baume'</u>		
<u>Temperature, F</u>	<u>Minimum</u>	<u>Maximum</u>
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

<u>Permissible Hydrometer Reading, Degrees Baume'</u>		
<u>Temperature, F</u>	<u>Minimum</u>	<u>Maximum</u>
40	24.0	25.0
70	23.5	24.5
100	23.0	24.0

REPORT

5. The report shall include:

- (a) Identification of solution as magnesium chloride or a mixture of magnesium chloride and magnesium sulfate.
- (b) Temperature and specific gravity of solution.