

Standard Method of Test for

SETTING TIME OF MAGNESIUM OXYCHLORIDE CEMENTS¹



3,328 (C 254-52).

Take the following editorial change in Standard Method C 254-52:
Section 5 (a).—In line 13 change "corresponding initial" to read "corresponding to in-
ial."

ADOPTED, 1932.

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

Final setting time needle:

Weight.....	4 lb. \pm 16 grains (1814.4 \pm 1.0 g.)
Tip diameter.....	0.083 \pm 0.002 in. (2.12 \pm 0.05 mm.)

¹ Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee C-2 on Magnesium Oxysulfate and Magnesium Oxysulfate Cements.
² Prior to adoption as standard, this method was published as tentative from 1950 to 1952.

Tip length.....	0.015 \pm 0.001 in. (0.38 \pm 0.03 mm.)
Shoulder diameter	0.167 \pm 0.002 in. (4.24 \pm 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

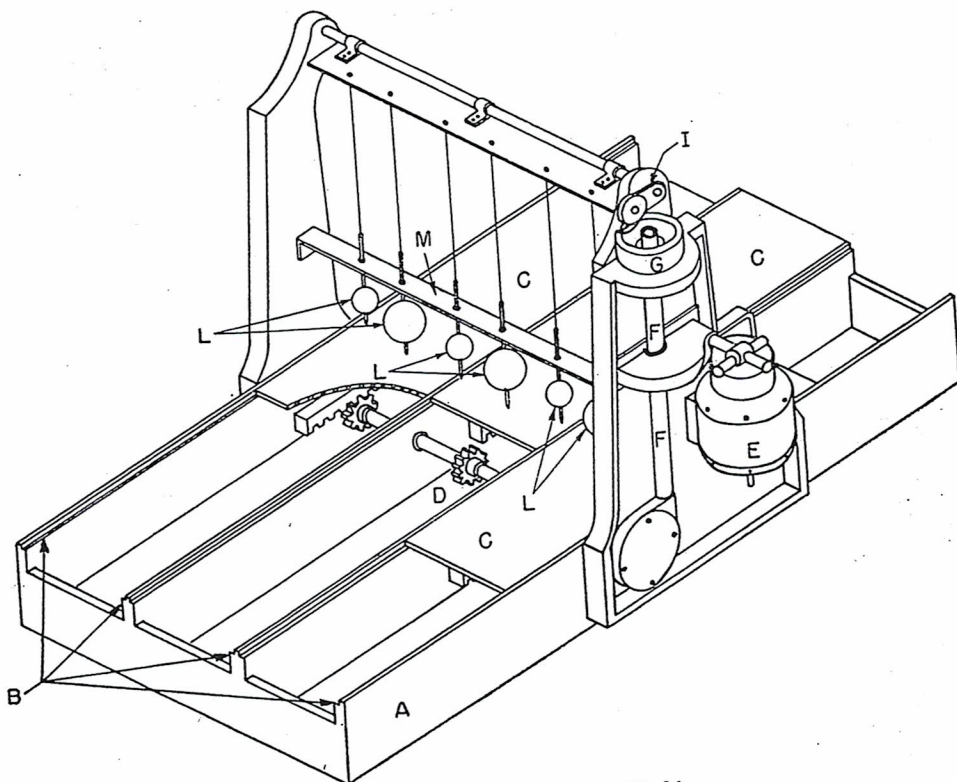


FIG. 2.—Automatic Setting Time Machine.

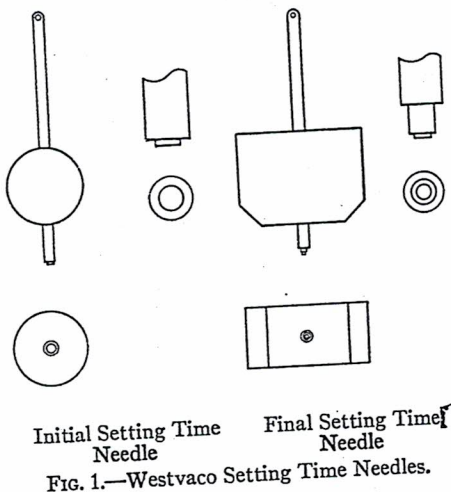


FIG. 1.—Westvaco Setting Time Needles.

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 punchmarks made by the needles do not overlap. The cam actuates a rocker arm, *I*,

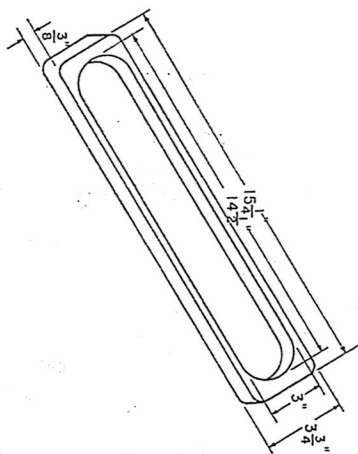


FIG. 3.—Mold for Setting Time Test Specimens.

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, see Contents in Numeric Sequence of ASTM Designations at front of book.

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 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).³

Report

6. The report shall include the following:

- (1) Initial setting time in minutes, and
- (2) Final setting time in minutes.