



de-ionized water. Force water<sup>2</sup> into the atmometer until the filter paper is saturated and there are no air bubbles in the system. Adjust the level of water in the graduate to approximately the 100 mL mark. Permit evaporation of water from the filter paper for one hour before recording the time and initial reading of the graduate. (This waiting period may be omitted during subsequent use of the atmometer provided the filter paper does not become dry.) Change the filter paper whenever it shows signs of contamination, but not less frequently than once each two weeks.

### C. MATERIALS

Graded Ottawa sand conforming to the requirements of ASTM Designation: C 778.

### D. TEMPERATURE AND HUMIDITY REQUIREMENTS

1. The temperature of the air in the vicinity of the mixing slab, the dry materials, molds, base plates, and mixing bowl shall be maintained between 20°C and 27.5°C. The temperature of the mixing water, the moist closet or moist room, and the water in the storage pans shall not vary from 23°C by more than plus or minus 1.7°C.
2. The relative humidity of the workroom in which mortars are mixed and specimens are molded shall not be less than 50 %. The moist room or moist closet shall be so constructed as to provide storage facilities for test specimens at a relative humidity of not less than 90 %.

### E. PREPARATION OF SPECIMEN MOLDS

Coat the interior surface of the mold with a thin film of automotive crankcase oil, grade SAE 30. The oil shall not be of the multi-grade type. After this operation, set the gauge studs, being careful to keep them free of oil.

### F. PREPARATION OF MORTAR

1. The batch of mortar shall consist of 750 g of cement, 1,500 g of graded Ottawa sand and water as follows:

<u>Cement Type</u>	<u>W/C Ratio</u>
II Mod, II PS, V	.375 ± .005
III	.390 ± .010

Mix the mortar in accordance with ASTM Designation: C 305.

2. Upon completion of the mixing procedure outlined in ASTM Designation: C 305, the mixing paddle shall be shaken to remove excess mortar into the mixing bowl, and any mortar adhering to the sides of the bowl shall be quickly scraped down into the batch. Allow the mortar to stand in the mixing bowl 90 seconds, and then remix the entire batch 15 seconds at medium speed before starting the molding of the specimens.

### G. MOLDING, STORING AND MEASURING SPECIMENS

1. Start molding 25.4 x 25.4 x 285.8 mm specimens within 2 minutes and 15 seconds after completion of the original mixing of the mortar batch. Mold four specimens. Fill the mold in two layers and compact each layer with the tamper. Work the mortar into the corners, around the gauge studs, and along the surfaces of the mold until a homogeneous specimen is obtained. After the top layer has been compacted, cut the mortar off flush with the top of the mold and smooth the surface with a few strokes of the trowel.
2. Store the specimens in their molds in the moist closet or moist room for 22 to 23 1/2 hours. Then remove them from the molds. Remove the specimens without striking or jarring them, using particular care not to exert pressure against the gauge studs. Use a device that will permit disengagement of the specimen from the molds without injury. Identify the specimens, using a soft carbon pencil or ink brush that deposits a mark that is essentially carbon without binder. Place them in water at 23°C ± 1.7°C for a minimum of 30 minutes prior to making the initial length measurement. Make the initial length measurement at the age of 24 h ± 15 min from the time cement and water were mixed together. Remove the specimens from the water storage one at a time, wipe them with a damp cloth and then measure them for length as provided in ASTM Designation: C 151.

---

<sup>2</sup> A working drawing of a device for supplying water to the filter paper is available upon request.

3. Store the specimens in water at  $23^{\circ} \pm 1.7^{\circ}\text{C}$  to the age of  $72\text{ h} \pm 15\text{ min}$  computed from the time cement and water were mixed together. Remove the specimens from water and measure for length as provided above in paragraph 2.
4. Place the specimens on racks in the drying room with at least 25.4 mm clear space between specimens. Remove the specimens at the age of  $168\text{ h}$  (7 days)  $\pm 15\text{ min}$  computed from the time cement and water were mixed together. Measure promptly for length in accordance with ASTM Designation C-151.

## H. COMPUTATIONS

1. Compute the expansion in water of each specimen as the length upon removal from water storage less the initial length measurement and express it as a percentage of 254 mm.
2. Compute the contraction in air of each specimen as the length upon removal from the water storage less the length upon removal from the drying room and express it as a percentage of 254 mm.
3. Report the average change in length of four specimens from the same batch of mortar as the percent expansion in water or the percent contraction in air provided the variability between specimens does not exceed the limits of acceptability as described below. If the results of four specimens do not meet the criterion for acceptability, but the results of any three of the specimens do meet the criterion, report the average of the measured length changes of the three specimens as the percent expansion in water or the percent contraction in air.

If the length changes of at least three specimens do not meet the criterion for acceptability, the results shall not be reported and the test shall be repeated.

4. Test results shall be considered acceptable if the standard deviation of the measured length changes of specimens does not exceed 0.050 mm in expansion or contraction. The standard deviation shall be computed by the following formula:

$$\sigma = \frac{\sqrt{\sum (x_i - \bar{X})^2}}{n - 1}$$

Where:

$\sigma$  = the standard deviation

$X_i$  = a single observation

$\bar{X}$  = the arithmetic mean of all observations under consideration

$n$  = the number of observations under consideration

$\Sigma$  = the sign of summation

## I. PRECAUTIONS

Exercise care to avoid use of an excessive amount of oil on the specimen molds. Apply the oil in the least amount that will prevent undue adherence of the hardened mortar to the mold.

Observe faithfully the time intervals between measurements and the protection of specimens against loss or gain of water.

Exercise care to avoid striking the gauge studs during handling. Do *not* change adjustments of the torque handle on the atmometer when the filter paper is wet, as this may reduce the rate of evaporation from the graduate.

## J. REPORTING RESULTS

Report the results of this test on Form TL 528.

## K. SAFETY AND HEALTH

Prior to handling, testing or disposing of any waste materials, testers are required to read: Part A (Section 5.0), Part B (Sections: 5.0, 6.0 and 10.0) and Part C (Section 1.0) of Caltrans Laboratory Safety Manual. Users of this method do so at their own risk.

### REFERENCES:

ASTM Designations: C 109, C 151, C 157 and C 305  
AASHTO Designation: T160

End of Text (California Test 527 contains 3 pages)