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## **METHOD OF TEST FOR AIR CONTENT OF FRESHLY MIXED CONCRETE BY THE VOLUMETRIC METHOD**

### **A. SCOPE**

This test describes the procedure for determining the air content of freshly mixed concrete containing any type of aggregate, whether it be dense, cellular, or lightweight.

### **B. REFERENCES**

ASTM C 173/C 173M - Air Content of Freshly Mixed Concrete by the Volumetric Method  
California Test 539 - Sampling Fresh Concrete

### **C. APPARATUS**

1. Air Meter: Commercially available air meter, of the volumetric type, consisting of a base and top section.
2. Tamping Rod: A round, straight steel rod with a diameter of  $\frac{5}{8}$  in.  $\pm \frac{1}{16}$  in. and length of at least 4 in. greater than the depth of the measure in which rodding is to be performed, but not more than 24 in. One or both ends of the tamping rod must be rounded to a hemispherical tip of the same diameter as the rod.
3. Strike-off Bar: A flat, straight bar of steel or other suitable material.
4. Scoop: A small metal scoop.
5. Syringe: A small rubber bulb syringe having a capacity at least that of the measuring cup. (An accessory furnished with the meter.)
6. Funnel: A special funnel for adding water to the container with minimum disturbance of the concrete. (An accessory furnished with the meter.)
7. Measuring Cup: A metal cup having a capacity equal to 1.0 % of the volume of the base of the air meter. (An accessory furnished with the meter.)

### **D. CALIBRATION OF APPARATUS**

1. Determine the volume of the base of the air meter to an accuracy of 0.1 %, by determining the weight of water at 70°F required to fill it at room temperature, and dividing this weight by the unit weight of water at same temperature. Use a glass plate to cover the base to remove excess water and to ensure that the container is full. There should be no air bubbles under the glass.
2. Determine the accuracy of the graduations on the neck of the top section of the air meter by filling the assembled measuring base and top section with water to the level of the mark for highest air content graduation. Add water, at 70°F, in increments of 1.0 % of the volume of the base to check accuracy throughout the

graduated range of air content. The error at any point shall not exceed 0.1 % of air.

**E. SAMPLE**

Obtain the sample of freshly mixed concrete in accordance with California Test 539.

**F. PROCEDURE**

1. **Rodding and Tapping:** Using the scoop, fill the base with freshly mixed concrete in two layers of equal depth. Rod each layer 25 times with the tamping rod, distributing the strokes evenly over the surface of the layer. Tap the sides of the base 10 to 15 times with the hand or a rubber mallet (having a weight of 1.25 lb  $\pm$  0.5 lb) after rodding each layer to displace entrapped air along the sides of the base. In rodding the first layer, penetrate nearly full depth into the layer, but avoid striking the bottom of the base. In rodding the second layer, penetrate slightly into the underlying layer with each stroke.
2. **Striking Off:** After placement of the second layer of concrete in accordance with F.1., strike off the excess concrete with the strike-off bar until the surface is flush with the top of the base. Wipe the flange of the base unit clean.
3. **Adding Water:** Clamp the top section into position on the base. Insert the funnel and add water until it appears in the neck. Remove the funnel and adjust the water level, using the syringe, until the bottom of the meniscus is level with the zero mark. Attach and hand-tighten the screw cap.
4. **Inverting and Agitating:** After completing the inverting and agitating procedure, tilt the meter approximately 45 degrees and vigorously roll and rock the unit for approximately 1 min keeping the neck elevated at all times. Set the unit upright and allow it to stand while the air rises to the top until the liquid level stabilizes. The liquid level is considered stable when it does not change more than 0.1 % within a 1 min period. Set the apparatus upright, jar it lightly, and allow it to stand until all of the air rises to the top (about 5 min when testing lightweight concrete). Repeat the operation until two consecutive readings do not change more than 0.25 % air.
5. **Dispelling Air Bubbles:** When all of the air has been removed from the concrete and allowed to rise to the top of the water in the neck, remove the screw top. Add, in one measuring cup increments using the syringe, sufficient isopropyl alcohol to dispel the foamy mass on the surface of the water. One measuring cup is equivalent to 1.0 % air, and is usually all that is required.
6. **Reading:** Read the level of the liquid in the neck by reading at the bottom of the meniscus. Estimate to the nearest 0.25 % air. Calculate the air content of the concrete in the measuring base in percent, by adding to the above reading the amount of alcohol used in accordance with F.5.

**G. PRECAUTIONS**

1. Avoid striking the top edge of the base when rodding the fresh concrete.
2. Wipe the flange of the base clean to ensure an airtight seal when the meter is assembled.

3. In testing lightweight concrete, every effort must be made to prevent the lightweight particles from filling the neck of the top section of the meter after the concrete is agitated. Take care to not break the glass in the neck section when dislodging any of these particles that may enter the neck.
4. Disassemble the apparatus and examine the contents to be sure that there are no portions of undisturbed, tightly packed concrete in the base. If portions of undisturbed concrete are found, the test is invalid.

**H. HEALTH AND SAFETY**

It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Prior to handling, testing or disposing of any materials, testers must be knowledgeable about safe laboratory practices, hazards and exposure, chemical procurement and storage, and personal protective apparel and equipment.

Caltrans Laboratory Safety Manual is available at:

[http://www.dot.ca.gov/hq/esc/ctms/pdf/lab\\_safety\\_manual.pdf](http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf)

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(California Test 543 contains 3 pages)**