GDT 32

A. Scope

For a complete list of GDTs, see the Table of Contents.

Use this test method to determine the air content of freshly mixed concrete containing highly porous, cellular, or lightweight aggregate.

B. Apparatus

The apparatus consists of the following:

1. Air Meter: Use an air meter consisting of a bowl and a top section (see Figure 32-1) conforming to the following requirements:
   a. Bowl: The bowl must be machined metal, thick and rigid enough to withstand normal field use, and be material not readily corroded by cement paste.

      The bowl must have a diameter equal to 1 to 1.25 times the height and be constructed with a flange at or near the top surface. Use bowls of not less than 0.20 ft^3 (0.0056 m^3) for general use with structural or pavement concrete containing aggregate with maximum size of 2 in (50 mm) or less.

NOTE: You may use a bowl of not less than 0.075 ft^3 (0.002 m^3) capacity for routine work, but check the results against those obtained with the 0.20 ft^3 (0.0056 m^3) bowl if the results are questionable.

   b. Top Section: The top section must of the same machined metal as the bowl.

      The top section must have a capacity similar to the bowl. It must be equipped with a flexible gasket and hooks or lugs to attach to the flange on the bowl to make a watertight connection.

      The top section must have a glass-lined or transparent plastic neck, graduated in increments not greater than 0.5 percent, from 0 at the top to 9 percent or more of the volume of the bowl. The upper end of the neck must be threaded and equipped with a screw cap having a gasket to make a watertight fit.
2. Funnel: Use a metal funnel with a spout that can be inserted through the neck of the top section and long enough to extend to just above the bottom of the top section. The discharge end of the spout must be able to add water to the container without disturbing the concrete.
3. Tamping Rod: Use a round, straight, steel rod, 5/8 in (16 mm) diameter and approximately 24 in (600 mm) long, with one end rounded to a hemispherical tip with a 5/8 in (16 mm) diameter (WR-7).
4. Strike-Off Bar: Use a steel bar approximately 1/4 (6 mm) x 1 (25 mm) x 24 in (600 mm) long (WS-13-1).
5. Measuring Cup: Use a metal cup having a capacity equal to 1.0 percent of the volume of the air meter bowl.
6. Syringe: Use a small rubber bulb syringe with a capacity at least that of the measuring cup.
7. Pouring Vessel: Use a metal or glass container of approximately 1 qt (1 L) capacity.
8. Trowel: Use a blunt-nosed brick mason's trowel (WT-7).
9. Scoop: Use a small metal scoop (WS-03).
10. Calibration of Apparatus
    a. Determine the volume of the air meter bowl, in cubic feet (meters), by weighing the amount of water at 70 °F (21 °C) required to fill it.
    b. Divide this weight by 62.40 lb/ft^3 (1000 kg/m^3), the unit weight of water at 70 °F (21 °C).
    c. Cover the bowl with a glass plate. The plate will help remove excess water and ensure that the container remains full.
    d. Determine the accuracy of the graduations on the neck of the air meter's top section.

       Fill the assembled measuring bowl and top section with water to the level of the mark for any air content.
    e. Add more 70 °F (21 °C) water equal to 1.0 percent of the volume of the bowl to the water already in the neck. The height of the water column must increase by an amount equivalent to 1.0 percent of air.

f. Check the volume of the measuring cup by adding one cupful of water to the assembled apparatus in the manner described in Apparatus steps 10.d and 10.e. The addition must increase the height of the water column equivalent to 1.0 percent of indicated air.

C. Sample Size and Preparation

Obtain the sample of freshly mixed concrete according to GSP-17.

D. Procedures

1. Use the scoop and trowel to fill the bowl with freshly mixed concrete in three layers of equal depth.
2. Rod each layer 25 times with the tamping rod.
3. Tap the sides of the bowl 10 to 15 times after each rodding, as outlined in Section D of GDT 28.
4. After placing the third layer of concrete, strike off the excess concrete with the strike-off bar until the surface is flush with the top of the bowl.
5. Wipe the flange of the bowl clean.
6. Clamp the top section into position on the bowl, insert the funnel, and add at least 1 pint (473 ml) of water followed by the selected amount (NOTE 1) of alcohol. Record the amount of alcohol added. Continue adding water until it appears in the neck of the top section. Remove the funnel and adjust the water level, using the rubber syringe, until the bottom of the meniscus is level with the zero mark. Attach and tighten the screw cap.
7. Invert and agitate the unit until the concrete settles free from the base; and then, with the neck elevated, roll and rock the unit until the air appears to have been removed from the concrete. Set the apparatus upright, jar it lightly, and allow it to stand until the air rises to the top. Repeat the operation until no further drop in the water column is observed.
8. Make a direct reading of the liquid in the neck, reading to the bottom of the meniscus, and estimating to the nearest 0.1 percent.

NOTE 1: The amount of isopropyl alcohol necessary to obtain a stable reading and a minimum of foam at the top of the water column will depend on concrete air content, the amount and type of air-entraining admixture, the cement content and perhaps other factors. Many concretes made with less than 500 lb/yd^3 (296 kg/m^3) of cement and air contents less than 4% may require less than 0.5 pint (237 ml) of alcohol. Generally, the amount of alcohol necessary can be established for given mixture proportions and should not change greatly during the course of a job.

E. Calculations

The final meter reading tends to be slightly higher than the actual air content of the sample when 2.5 pints (1.18 L) or more of alcohol is used.

1. When less than 2.5 pints (1.18 L) of alcohol is used, the final meter reading is the air content of the sample of concrete tested.
2. When 2.5 pints (1.18 L) or more alcohol is used, subtract the correction from Table 1 from the final meter reading to obtain the air content of the concrete sample tested.

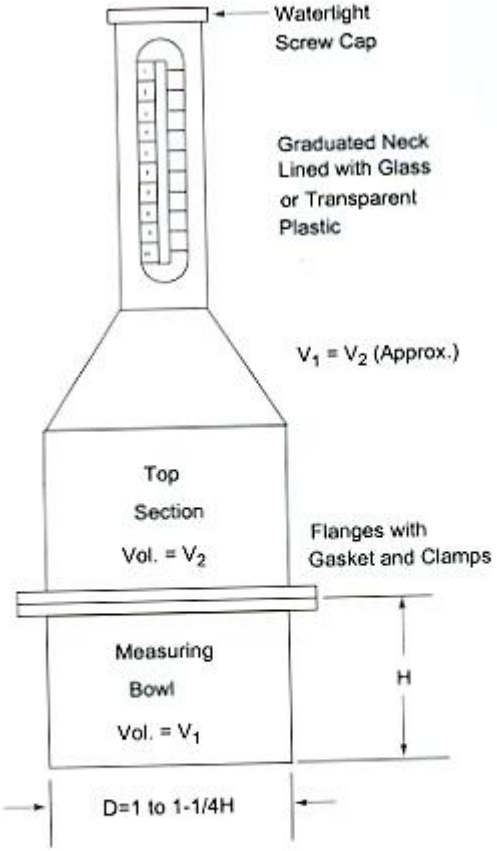
Table 1 – Correction for the Effect of Alcohol on Air Meter Reading

70% Isopropyl Alcohol Used		Correction (Subtract)
Pints	Ounces (ml)	
0.5	8 (237)	0.0
1.0	16 (473)	0.0
1.5	24 (710)	0.0
2.0	32 (946)	0.0
3.0	48 (1420)	0.3
4.0	64 (1893)	0.6
5.0	80 (2366)	0.9

NOTE: Read the calibrated marks on the glass directly in percent.

F. Report

Report the final air content of the concrete on Form 319 and Form 525.



Apparatus for Measuring Air Content of Fresh Concrete
by Volumetric Method

Figure 32-1