

Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method

1. Scope:

This test is for determining entrained air in fresh concrete by the pressure method.

2. Apparatus:

- 2.1 Air meter conforming to AASHTO T 152. (Type A or B)
- 2.2 Tamping rod. A round smooth 5/8" steel rod with the tamping end rounded to a hemispherical tip of 5/8" diameter. The minimum length shall be 18".
- 2.3 Trowel, rubber mallet, small scoop or shovel, and a metal straight edge a minimum of 12" long.
- 2.4 Cover plate. A flat rectangular metal plate at least 1/4 in. thick or a glass or acrylic plate at least 1/2 in. thick with a length and width at least 2 in. greater than the diameter of the measure with which it is to be used. The edges of the plate shall be straight and smooth within a tolerance of 1/16 in. The corners and edges may be beveled.

3. Procedure:

- 3.1 Meter calibration: Type A meter.
 - A. Place clean, dry, brass standardizing vessel in 1/4 ft³ bucket, open end down.
 - B. Fill the container with water.
 - C. Place lid on container and clamp securely.
 - D. Add water until slightly above "0" mark on plastic tube. The valve in filler tube must be open.
 - E. Open valve on lid to adjust water to exactly "0".
 - F. Close all valves except air inlet and apply pressure until the reading on the plastic tube is 5%. Mark the gauge pressure. (Some meters have tire valves in air inlet line instead of manual valve.)
 - G. Repeat D., E., and F. until the reading is constant.
 - H. Record the air pressure determined in paragraph G.
 - I. A change in elevation of more than 600' from the location the meter was last calibrated will require re-calibration.

3.2 Air test: Type A meter.

- A. Obtain a sample of concrete in accordance with SD 402.

NOTE: Samples of volumetric mixed low slump dense concrete shall be placed in a covered container for 5 minutes prior to testing.

- B. Before making an air test, moisten the meter bucket and the inside of the lid. There shall be no free water in the bucket. If there is, wipe it out with a paper towel or rag. Place the meter on a flat, level and firm surface.
- C. Fill the meter bucket with concrete in 3 approximately equal layers. Rod each layer 25 times. Distribute the strokes uniformly over the cross section of the layer being rodded.

Rod the lower layer its total depth, but the rod shall not forcibly strike the bottom of the bucket so as to cause excessive vibration. Rod the second and third layers with the rod penetrating slightly (Approximately 1 inch) into the layer below.

After each layer is rodded, tap the outside of the bucket sharply 10 to 15 times with the mallet. Tap with enough force to close any holes left by rodding and to release any large air bubbles that may have been trapped. For concrete with a slump of less than 2" the number of taps can be increased to achieve consolidation.

Heap the concrete above the top of the measure for the final layer, adding additional concrete, as required, to keep the surface above the measure as it is rodded.

- D. Use a straightedge or cover plate to strike off the concrete flush with the top of the bucket. Removal of 1/8" of material during strike off with a straight edge is optimum. Use the following procedure for striking off the measure with a cover plate.

Press the cover plate on top of the measure to cover approximately 2/3 of the measure. Withdraw the cover plate with a sawing motion. Place the cover plate on the measure in the original position to cover the same 2/3 of the measure. Advance the cover plate with downward pressure and a sawing motion until it slides completely off the measure. Finish the surface with several strokes of the plate at an inclined angle.

Thoroughly clean the rim of the bucket.

NOTE: Cover plate shall be used for strike off on all unit weight determinations for low slump dense concrete.

NOTE: The internal surface of the cover assembly must be clean and should be wet prior to placing on the meter bucket.

- E. Attach the lid and add water to “0”. Gently tap the bucket at the same time with the mallet to release trapped air.
- F. Adjust water column to the “0” mark and close valves.
- G. Apply air pressure with pump until the gauge reading determined during calibration is reached.
- H. Read the percent of air on the plastic tube.
- I. Release the air pressure and check the water level in the tube, if it is not within 0.2 of 0 on the tube scale, repeat steps E., F., and G., as a check.
- J. Clean and dry the air meter after each use.

3.3 Meter calibration: Type B meter – Method A.

- A. Fill the base with water.
- B. Screw the short piece of straight tubing into the threaded petcock hole on the underside of the cover. Clamp the cover onto the base with the tube extending down into the water.
- C. With both petcocks open, add water with a syringe through the petcock having the pipe extension below, until all the air is forced out the opposite petcock. Leave both petcocks open.
- D. Pump the pressure to a little beyond the pre-determined calibration pressure. This pre-determined calibration pressure is read on the scale below “% air” in the lower right hand corner of the gauge. A good starting point for this pre-determined calibration pressure is 3.0%. Wait a few seconds for compressed air to cool to normal temperature and then stabilize the gauge needle at the pre-determined calibration pressure by pumping or bleeding off as needed. It will be necessary to tap the gauge lightly several times with your finger to stabilize the needle.
- E. Close both petcocks and immediately press down on the thumb lever exhausting the air into the base. Wait a few seconds until the hand is stabilized. Lightly tap the gauge with your finger to stabilize the needle. If all the air was eliminated and the pre-determined calibration pressure was correctly selected, the gauge should read zero. If two or more tests show a consistent variation of $\pm 0.1\%$ in the result, then change the pre-determined calibration pressure to compensate for the

variation. Use the newly established pre-determined calibration pressure for subsequent tests.

- F. Screw the curved tube into the outer end of the petcock and by pressing on the thumb lever and controlling the flow with the petcock lever, fill the 5% calibration vessel level full of water from the meter.
- G. Release the air at the free petcock. Open the other petcock and let the water in the curved pipe run back into the base. There is now the equivalent of 5% air in the base.
- H. With the petcocks open, pump up the air pressure in the same manner as outlined in paragraph D. Close the petcocks and immediately press the thumb lever. Wait a few seconds for exhaust air to warm to normal temperature, and for the needle to stabilize.

Tap the gauge lightly again with your finger to aid in stabilizing the needle. The dial should read 5.0%.

- I. If two or more consecutive readings are more than 0.1% above or below 5%, remove the gauge glass and reset the needle to 5% by turning the re-calibration screw located on the needle assembly.
- J. Once you have calibrated the meter at 5%, you may calibrate for higher air contents, if deemed necessary. This is accomplished by withdrawing additional water at 5% increments and repeating the steps outlined in paragraphs G., H., and I. above.

3.4 Meter calibration: Type B meter – Method B.

- A. Fill the base with water.
- B. Place the calibration cylinder at the bottom of the filled meter base. (Keep the cylinder upright as you place it.)
- C. Place the cover on the base and latch.
- D. With both petcocks open, add water with a syringe through one petcock until all air is forced out and water emerges from the opposite petcock. Leave both petcocks open.
- E. Pump the pressure to a little beyond the pre-determined calibration pressure. Wait a few seconds for compressed air to cool to normal temperature and then stabilize the gauge needle at that pressure by pumping or bleeding off as necessary while tapping the gauge lightly with your finger.
- F. Close both petcocks and immediately press down on the thumb lever exhausting the air into the base. Lightly tap the gauge with your finger

and wait a few seconds until the hand is stabilized. If the pre-determined calibration pressure was correctly selected, the gauge should read 5.0%. If two or more tests show a consistent variation of $\pm 0.1\%$ in the result, change the pre-determined calibration pressure to compensate for the variation. Use the newly established pre-determined calibration pressure for subsequent tests.

- G. Keep the small hole at the bottom of the cylinder unobstructed. Usually a very slight amount of water may be left in the cylinder after a test. Shake this water out before making another test or putting the cylinder into storage. Use two cylinders if you wish to calibrate at 10%.

3.5 Air test: Type B meter.

- A. Obtain a sample of fresh concrete in accordance with SD 402.

NOTE: Samples of volumetric mixed low slump dense concrete shall be placed in a covered container for 5 minutes prior to testing.

- B. Before making an air test, moisten the meter bucket and the inside of the lid. There shall be no free water in the bucket. If there is, wipe it out with a paper towel or rag. Place the meter on a flat, level and firm surface.
- C. Fill the meter bucket with concrete in 3 approximately equal layers. Rod each layer 25 times. Distribute the strokes uniformly over the cross section of the layer being rodded.

Rod the lower layer throughout its depth, but the rod shall not forcibly strike the bottom of the bucket so as to cause excessive vibration. Rod the second and third layers with the rod penetrating slightly (Approximately 1 inch) into the layer below.

After each layer is rodded, tap the outside of the bucket sharply 10 to 15 times with the mallet. Tap with enough force to close any holes left by rodding and to release any large air bubbles that may have been trapped. For concrete with a slump of less than 2" the number of taps can be increased to achieve consolidation.

Heap the concrete above the top of the bucket for the final layer, adding additional concrete, as required to keep the surface above the measure as it is rodded.

- D. Use a straightedge or cover plate to strike off the concrete flush with the top of the bucket. Removal of 1/8" of material during strike off with a straight edge is optimum. Use the following procedure for striking off the measure with a cover plate.

Press the cover plate on top of the measure to cover approximately 2/3 of the measure. Withdraw the cover plate with a sawing motion. Place the cover plate on the measure in the original position to cover the same 2/3 of the measure. Advance the cover plate with downward pressure and a

sawing motion until it slides completely off the measure. Finish the surface with several strokes of the plate at an inclined angle.

Thoroughly clean the rim of the bucket.

NOTE: The internal surface of the cover assembly must be clean and should be wet prior to placing on the meter bucket.

NOTE: Cover plate shall be used for strike off on all unit weight determinations for low slump dense concrete.

- E. Clamp the cover on securely, leave the petcocks open.
- F. Using the syringe supplied, inject water through one petcock until all of the air is displaced and expelled through the opposite petcock. Leave both petcocks open at this time. Jar meter gently with the hand to expel trapped air.
- G. Apply air pressure with the pump until the gauge reading equals the pre-determined calibration pressure.
- H. Wait a few seconds and stabilize the needle at the pre-determined calibration pressure by pumping up or bleeding off with the air release valve, while tapping the gauge to insure the needle is stabilized.
- I. Close both petcocks then press down on the thumb lever to release the air into the base. While holding the thumb lever down smartly tap the bucket with a mallet to relieve local restraints and then lightly tap the gauge with your finger to stabilize the needle.
- J. Read the percent of air in the concrete on the dial and then release the thumb lever.
- K. After you release the pressure, clean the base, the cover and the petcock openings thoroughly with running water.

4. Report:

Report the percent of entrained air to the nearest 0.1% on a DOT-23.

5. References:

AASHTO T 152
SD 402
DOT-23