

State of Nevada
Department of Transportation
Materials Division

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

SCOPE

This test method describes the equipment and procedures used for determining the air content of freshly mixed concrete. This method is to be used with dense aggregate and normal weight concrete. This test method shall not be used with lightweight aggregates, air cooled blast furnace slag, or aggregates with high porosity. Test Method Nev. T431 shall be used for Air Content of Freshly Mixed Concrete by Volumetric Method with lightweight aggregates.

APPARATUS

1. Air Meter - Type B (See Figure 1).
 - a. Measuring bowl, flanged or otherwise constructed cylindrical bowl made of hard metal resistant to corrosion by the cement paste. The diameter of the bowl shall be equal to 0.75 to 1.25 times the height and a capacity of at least 0.0057m^3 (0.20 ft^3).
 - b. Cover assembly, shall be made of hard metal resistant to corrosion by the cement paste, smoothly machined interior surfaces contoured to provide an air space above the level of the top of the bowl and flanged or otherwise constructed such that the cover and the measuring bowl can be fitted together into a pressure-tight assembly. The cover shall be fitted with a gauge for obtaining a direct reading of air content. The graduations for a suitable range in air content shall be within 0.1%. The cover shall be fitted with an air bleeder valve for venting of the air chamber, a main air valve, and petcocks for bleeding off water as required. Suitable means of clamping the cover to the bowl shall be provided to make a pressure-tight seal without entrapping air at the joint between the flanges of the cover and bowl. A suitable hand pump shall be provided with the cover.
2. Scoop, large enough to obtain a representative sample of concrete.
3. Tamping rod, round, straight steel rod, 16 mm (5/8 in.) in diameter and not less than 400 mm (16 in.) in length, having the tamping end rounded to a hemispherical tip.
4. Internal vibrators, may have rigid or flexible shaft. The frequency of vibration shall be 7000 vibrations per minute or greater while in use. The outside diameter or the side dimensions of the vibrating element shall be at least 19 mm (3/4 in.) and not greater than 38 mm (1 1/2 in.). The length of the shaft shall be at least 600 mm (24 in.).

5. Rubber mallet, weighing approximately 0.60 ± 0.25 kg (1.25 ± 0.50 lb) for use with measuring bowl of 0.0142 m³ (0.5 ft³) or less, and a mallet weighing approximately 1.0 ± 0.25 kg (2.25 ± 0.50 lb) for use with measuring bowl larger than 0.0142 m³ (0.5 ft³).
6. Strike-off bar, flat, straight steel bar or other suitable material which is at least 300 mm (12 in.) in length.
7. Strike-off plate, flat, rectangular metal plate at least 6 mm (1/4 in.) thick glass or acrylic plate at least 13 mm (1/2 in.) thick with a length and width at least 50 mm (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 1.5 mm (1/16 in.)
8. Syringe, small rubber bulb type.
9. Sponge or towel.
10. Calibration vessel, which represents 5% air by volume.
11. Calibration tubes, one bent tube and one straight tube.

CALIBRATION OF AIR METER

1. Calibrate the Air Meter - Type B daily prior to use.
2. Fill the measuring bowl with water at $25 \pm 3^{\circ}\text{C}$ ($77 \pm 5^{\circ}\text{F}$).
3. Strike the sides of the measuring bowl with a rubber mallet to remove excessive air bubbles from the water.
4. Thread the short piece of straight tubing into the threaded petcock opening on the underside of the cover assembly. Clamp the cover assembly on the measuring bowl with the tube extending down into the water.
5. Using the syringe provided, add water at $25 \pm 3^{\circ}\text{C}$ ($77 \pm 5^{\circ}\text{F}$) to the measuring bowl through the petcock with the threaded tube until all air is expelled through the opposite petcock.
6. Pump up the air pressure to just beyond the predetermined initial pressure line (I/P). Wait a few seconds for the gauge hand to stabilize, then add or release air as necessary to stabilize the gauge hand at the initial pressure line (I/P).
7. Close both petcocks and immediately press the main air valve to release air into the base. Tap the gauge lightly with your fingers while holding down the main air valve lever. The gauge hand should read zero. If two or more tests show a variation greater than 0.1% from zero, follow specification protocol to reestablish initial pressure line (I/P).

8. Screw the curved tube provided into the threaded outside opening of the petcock. By pressing on the main air valve lever and controlling the flow with the petcock lever, carefully fill the plastic calibration vessel exactly full of water.
9. Release air pressure by opening the petcock without the tubing. Open the other petcock and allow water from the tube to run back into the measuring bowl. There is now 5% air in the measuring bowl.
10. With both petcocks open, follow the procedure in step six to pressurize the gauge to the initial pressure line (I/P). Close the petcocks and immediately press the main air valve lever. Stabilize the gauge hand as before. The gauge should read 5.0%.
11. If two or more tests indicate a variation of more than 0.1%, reset the gauge hand to 5.0%. Retest to ensure settings are correct by following steps two through nine.

SAMPLING

Sample fresh concrete in accordance with Test Method Nev. T425.

PROCEDURE

1. Referee or dispute testing shall be performed using Test Method Nev. T431.
2. Dampen all equipment and place the measuring bowl on a rigid surface that is level and stable. There shall be no excessive water left standing inside the measuring bowl before testing.
3. Filling the measure and consolidating.
 - a. Method of consolidation should be determined per the results of the slump test, unless the method is stated in the specifications under which the work is being performed. The methods of consolidation are rodding and internal vibration. Rod concrete with a slump greater than 75 mm (3 in.). Rod or vibrate concrete with a slump of 25 to 75 mm (1 to 3 in.). Vibrate concrete with a slump less than 25 mm (1 in.).
 - b. Rodding - Place the concrete in the measure in three layers of approximately equal volume. Rod each layer with 25 strokes of the tamping rod. Rod the bottom layer throughout its depth but the rod shall not forcibly strike the bottom of the measure. Distribute the strokes uniformly over the cross section of the measure and for the top two layers, penetrate about 25 mm (1 in.) into the underlying layer. After each layer is rodded, lightly tap the sides of the measure 10 to 15 times with the appropriate mallet to close any voids left by the tamping rod and to release any larger air bubbles that may have been trapped. Add the final layer so as to avoid overfilling.

- c. Internal Vibration - Fill and vibrate the measure in three layers of approximately equal volume. Place all of the concrete for each layer in the measure before starting vibration of that layer. Insert the vibrator at three different points for each layer. Throughout the consolidation process, do not allow the vibrator to rest on or touch the bottom or sides of the measure. The vibrator shall penetrate into the previous layer approximately 25 mm (1 in.). When withdrawing vibrator, take care to avoid any air pockets being left in the specimen. The duration of vibration required will depend upon the workability of the concrete and the effectiveness of the vibrator. Continue vibration just long enough to achieve proper consolidation of the concrete. Usually, sufficient vibration has been applied as soon as the surface of the concrete becomes relatively smooth. Over vibration may cause segregation and loss of appreciable quantities of entrained air.
4. After consolidating the concrete, strike off the excess concrete with the strike-off bar or the strike-off plate until the surface is flush with the top of the bowl. Clean the top flange of the measuring bowl to ensure a proper seal.
5. Clamp the top section onto the measuring bowl. Open both petcocks. Using the rubber bulb syringe, gently inject water through one petcock while jarring the air meter until water emerges from the opposite petcock and visible air bubbles have been expelled.
6. Close the air bleeder valve on the air chamber and pump air into the air chamber until the gauge hand is on the initial pressure line (I/P). Allow a few seconds for the compressed air to cool to normal temperature. Gently tap the gauge with one hand while slowly opening the air bleeder valve until the needle rests exactly on the initial starting point. If too much air is released, then add air again and repeat this step. Close both petcocks and open the main air valve while simultaneously hitting the measuring bowl with the mallet. Lightly tap the gauge to settle the needle. After the needle has stabilized, read the air content to the nearest 0.1 percent. After this reading has been obtained, release the main air valve.

Note: Failure to close the main air valve before releasing the pressure from either the container or the air chamber will result in water being drawn into the air chamber. Open both petcocks to release the pressure in the measuring bowl, remove the cover and thoroughly clean the bowl and the cover. Release the remaining air in the pressure chamber only after cleaning the cover.

7. Subtract the aggregate correction factor percentage obtained from the Mix Design from the gauge reading. This will give you the corrected air content percentage. Report this to the nearest 0.1 percent.

Example: Apparent Air Content - Aggregate Correction Factor = Air Content

$$5.2\% - 0.2\% = 5.0\%$$

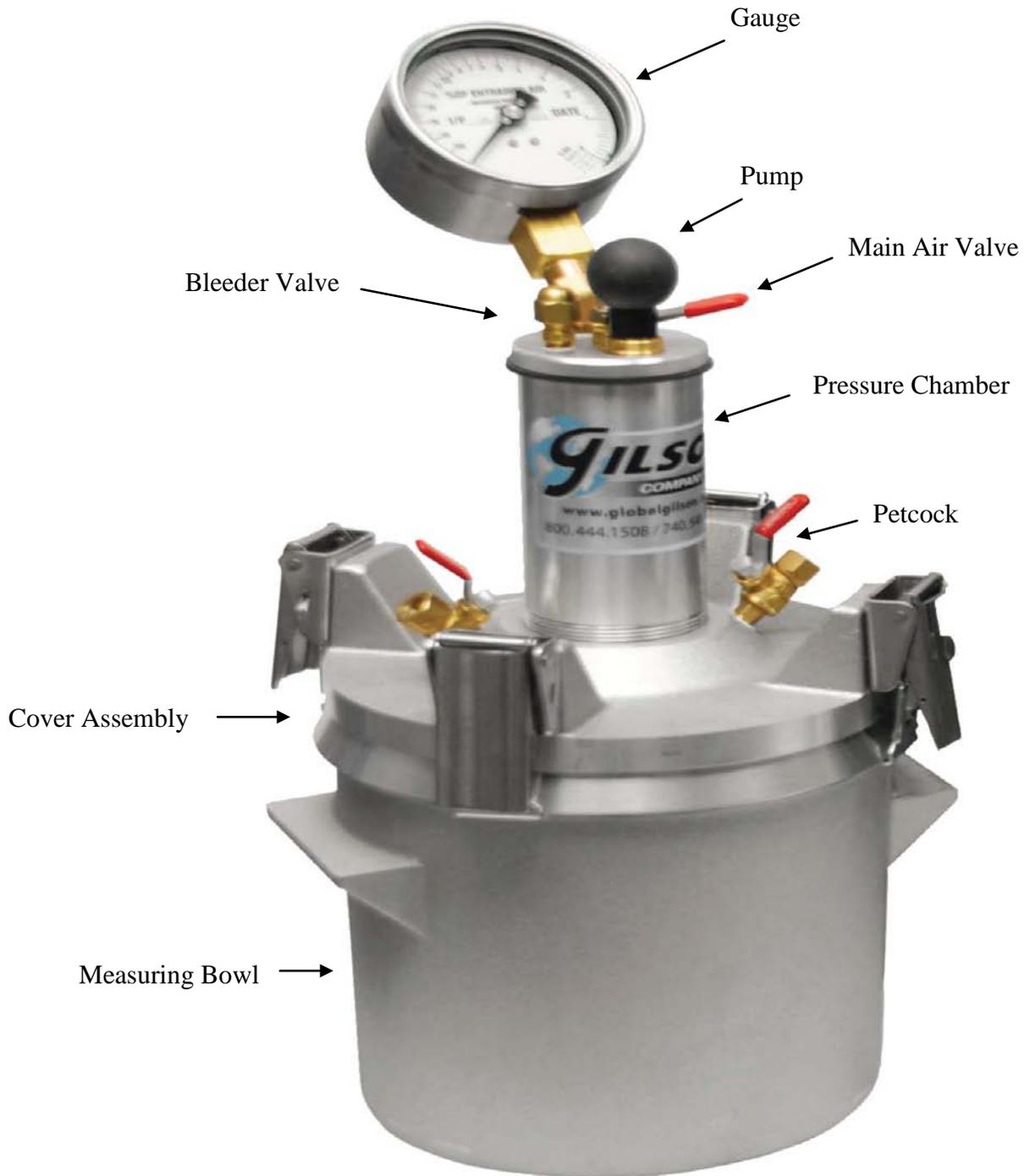


Figure 1