



Air Content of Plastic Concrete by the Pressure Method

CSA A23.2-4C

Concrete exposed to freezing and thawing environments and chlorides must be air entrained to provide resistance to the damage caused by freeze-thaw cycles as well as the chemical attack from de-icing salts. To measure the air content within the concrete, the pressure method is used which is valid for all concrete types except concretes containing low-density or other porous aggregates. Before beginning the procedure for testing, calibration of the air meter as per the manufacturer's instructions shall be ensured.

Apparatus

1. A measuring bowl of sufficiently rigid construction and accurate volume to make a pressure-tight container and a cover designed to be attached to the measuring bowl so as to make an adequately rigid, pressure-tight assembly.
2. A round straight steel tamping rod 16 mm \pm 1 mm in diameter and between 450 mm and 600 mm in length, having at least one end rounded to a hemispherical tip.
3. A rubber or rawhide head mallet weighing approximately 0.6 kg \pm 0.3 kg.
4. A steel strike-off bar approximately 6 mm \times 25 mm \times 450 mm long.
5. Miscellaneous equipment, including trowel, syringes, funnel, and other equipment that is necessary to conduct the test.



Procedure for testing

1. **Time constraint** – Complete the test for air content within 10 minutes after obtaining the sample, including transportation and remixing.
2. **Sampling** – Obtain a representative grab sample from between the 10% and 90% points of discharge as per CSA A23.2-1C.
3. **Rodding** – When the specified slump is > 40 mm, place the representative sample of concrete in the measuring bowl in three equal layers, consolidating each layer by rodding 25 times. The rod must not forcibly strike the bottom of the bowl when rodding the first layer and for the second and final layers shall penetrate approximately 25 mm into the underlying layer. The sides of the bowl must be tapped smartly 10 or more times after rodding each layer to remove voids left by the tamping rod and any large air bubbles.
4. **Consolidation and Strike-off** – The final layer shall be slightly overfilled by approximately 3 mm. After consolidation, the top surface shall be struck off and finished smoothly with a strike-off bar or rod with great care being taken to leave the measure level.



5. **Cover Assembly** – Thoroughly clean the flanges of the container and the cover. Clamp the cover in place ensuring a pressure-tight seal with the operating valve closed and the petcocks open.
6. **Operation of air meter** – Add water through one petcock until all air trapped under the cover is forced out through the other petcock. To facilitate this operation, the side of the bowl should be slightly jarred until the flow of water coming from the second petcock is free of bubbles, and all entrapped air has been expelled. Pump air slightly beyond the initial calibrated pressure point and using the air bleed valve, stabilize the air back to the initial pressure while lightly tapping the pressure gauge. Close both petcocks and release the air into the chamber by

opening the main valve. The valve should be held in the open position while tapping the gauge lightly until the gauge needle stabilizes. Record the percentage of air to the nearest 0.1%.



Table 4
Requirements for air content categories
 (See Clauses 4.1.1.1.1, 4.1.1.3, 4.1.1.4, 4.1.1.5, 4.3.1, and 4.3.3.2, and Table 2.)

Air content category	Range in air content* for concretes with indicated nominal maximum sizes of course aggregate, %		
	10 mm	14-20 mm	28-40 mm
1†	6-9	5-8	4-7
2	5-8	4-7	3-7

* At the point of discharge from the delivery equipment, unless otherwise specified.

† For hardened concrete, see Clause 4.3.3.2.

Notes:

- 1) The above difference in air contents has been established based upon the difference in mortar fraction volume required for specific coarse aggregate sizes.
- 2) Air contents measured after pumping or slip forming can be significantly lower than those measured at the end of the chute.

Notes:

1. When testing air content of low slump concrete (≤ 40 mm) it shall be vibrated rather than rodded to consolidate the sample. Internal and external vibration is acceptable and for further information please consult CSA A23.2:19 Clause 10.3.

Source: Table 4, CSA A23.1:19/CSA A23.2:19 Concrete materials and methods of concrete construction/Test methods and standard practices for concrete. © 2019 Canadian Standards Association

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