Australian Standard®

Methods of testing concrete

Method 4.1: Determination of air content of freshly mixed concrete—Measuring reduction in concrete volume with increased air pressure

1 SCOPE

This Standard sets out the method for determining the air content of freshly mixed concrete from observations of the change in volume of the concrete when it is subjected to an increased air pressure (see Note 1). When performed for quality control purposes such as for plant production testing or for mixer uniformity tests, the apparent air content only may be sufficient.

The results obtained are dependent on the compaction method used. This Standard provides for compaction of the sample by rodding or by vibration or by using self compacting concrete (SCC) placed in the bowl.

NOTES:

1 This method is intended for use with concretes made with relatively dense natural aggregates for which the aggregate correction factor can be determined satisfactorily by the technique described in Clause 10. It is not recommended for use with concretes made with lightweight aggregates, or aggregates of high porosity (see AS 1012.4.3).

2 This Standard may involve hazardous materials, operations, and equipment. The Standard does not purport to address all of the safety problems associated with its use. The user of this Standard should establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS		
1012	Methods of testing concrete	
1012.1	Method 1:	Sampling of fresh concrete
1012.2	Method 2:	Preparation of concrete mixes in the laboratory
1012.3.1	Method 3.1:	Determination of properties related to the consistency of concrete—Slump test
1012.4.3	Method 4.3:	Determination of air content of freshly mixed concrete—Measuring air volume when concrete is dispersed in water

3 PRINCIPLE

The air content of freshly mixed concrete is determined by measuring the reduction in the volume of the concrete caused by the application of a specified pressure to the concrete.

4 APPARATUS

4.1 Pressure-type air meter with water level gauge

4.1.1 *General*

The air meter used shall comply with Clauses 4.1.2 to 4.1.4, inclusive, and shall consist of a measuring bowl and a pressure-tight conical cover assembly which is fitted with a pressure gauge and water level gauge, as shown diagrammatically in Figure 1. (See Appendix A for calibration.)

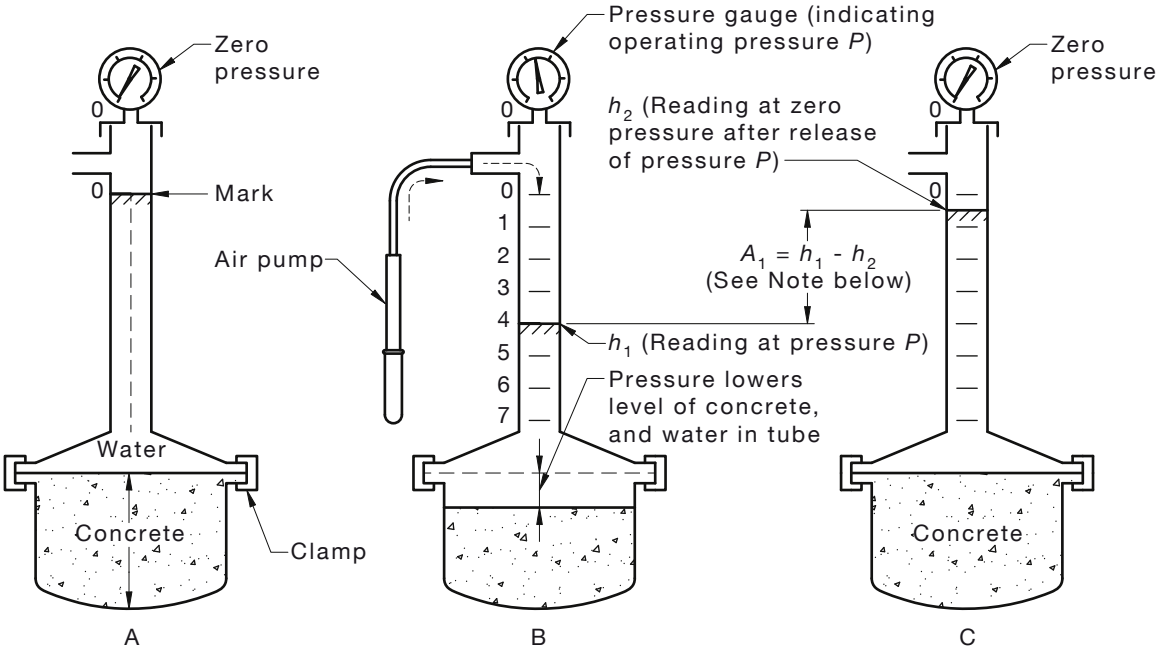
4.1.2 *Measuring bowl*

The bowl of the air meter shall be made from machined metal and shall have a flange at or near the top surface. The metal used shall be of such a thickness as to be sufficiently rigid to withstand normal field use and be of such composition as not to react with cement paste. The bowl shall also be sufficiently rigid to limit the expansion factor, D, of the apparatus assembly (see Appendix A, Paragraph A5) to not more than 0.1% of air content on the standpipe indicator scale when under the normal operating pressure.

The bowl diameter shall be between 0.75 and 1.25 times the height of the bowl.

For testing concrete with aggregates of nominal size not exceeding 40 mm, the capacity of the bowl shall be not less than 5 L.

For testing concrete with larger aggregate, a larger air meter shall be used; e.g. for concrete with maximum 75 mm nominal size aggregate, a bowl capacity not less than 10 L shall be used.



NOTE: $A_1 = h_1 - h_2$ when bowl contains concrete as shown in this Figure: when bowl contains only aggregate and water, $h_1 - h_2 = G$ (aggregate protection factor) $A_1 - G = A$ (air content of concrete).

FIGURE 1 TYPICAL ARRANGEMENT OF APPARATUS

4.1.3 *Conical cover assembly*

The cover, preferably composed of steel or hard metal that does not react with cement paste, shall be flanged and shall have internal surfaces inclined not less than 30° from the horizontal. It shall be pressure-tight and sufficiently rigid to limit the expansion factor of the apparatus assembly as prescribed in Clause 4.1.2.

The cover shall be fitted with a standpipe which may be a graduated precision bore glass tube or have a glass water gauge attached. The graduations on the standpipe or glass water gauge shall be in percent and tenths of a percent over a suitable range of air content as determined by the appropriate air pressure calibration test. The internal diameter of the standpipe shall be designed so that under the normal operating pressure, the water column will be lowered sufficiently to measure air contents to 0.1% (see Note 1).

The applied air pressure shall be indicated by a pressure gauge connected to the air chamber above the water column. The gauge shall have a range of twice the normal working pressure (see Note 2) and shall be suitably graduated.

The cover shall be fitted with a suitable device for venting at the top of the air chamber, an air valve, and a petcock for bleeding off water as required. Suitable means shall be provided for clamping the cover to the bowl and making a pressure-tight seal without trapping air at the joint between the flanges of the cover and bowl.

A suitable hand-pump shall be provided with the cover, either as an attachment or as an accessory.

NOTES:

1 A 25 mm lowering of the water column should represent approximately 1% of air.

2 Pressures of 50 kPa to 200 kPa have been used satisfactorily; however, each container should be calibrated for a stated normal working pressure.

4.1.4 *Tube*

A tube of appropriate diameter and arranged either as an integral part of the cover assembly or as a separate attachment shall be provided. The tube shall be constructed so that when water is added to the measuring bowl there will be a minimum of disturbance in the concrete.

4.2 Calibration cylinder

The calibration cylinder shall consist of a cylindrical measure having an internal volume of approximately 3% to 6% of the volume of the measuring bowl.

NOTE: A satisfactory measure may be machined from 1.6 mm brass tubing of the appropriate diameter to provide the volume desired. The bottom of the calibration cylinder can then be formed by soldering a brass disc to one end of the tube.

A coil spring or other means shall be provided for holding the calibration cylinder in place.

4.3 Rod

The rod used for the compacting of concrete shall comply with the relevant requirements of AS 1012.3.1.

4.4 Mallet

The mallet used in conjunction with the rod for the compacting of concrete shall be fitted with a hard rubber or hard plastics head of mass approximately 0.25 kg.