

Australian Standard®

AS 1012.23:2015

Methods of testing concrete

Method 23: Water content of freshly mixed concrete—Microwave oven method

1 SCOPE

This Standard provides a method of estimation of the free water content of fresh concrete using a relatively high-powered microwave oven within a short period of time.

This method is applicable for concrete containing aggregates with absorption of less than 3% and with water/cementitious material ratio of 0.50 or less. Concrete with water/cementitious material ratio greater than 0.50 but less than or equal to 0.60 may also be tested with this method; however, the level of accuracy of the results is diminished.

NOTES:

- 1 It has been found that for water/cementitious material ratio 0.50 an accuracy of $\pm 5\%$ is obtained for drying of 11 minutes. For water/cementitious material ratios between 0.50 and 0.60 an accuracy $\pm 8\%$ is obtained for drying of 12 minutes. If the net water content of concrete is required from results of this test, the water absorption of coarse and fine aggregates used in the concrete must be determined.
- 2 It is the intention of this Standard not to fully dry the concrete during the test.
- 3 This Standard may involve hazardous materials, operations, and equipment. This Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this Standard to 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 |
| 1012.5 | Method 5: Mass per unit volume of freshly mixed concrete |

3 DEFINITION

For the purpose of this Standard the definition below applies.

3.1 Free water content

Water that is available in the concrete to hydrate the cementitious material. Additional water, which is absorbed in the aggregate, is not available for hydration.

4 APPARATUS

4.1 Microwave oven

Microwave oven with a power setting of 900 ± 50 W, a turntable and sufficient capacity to accept the specified tray and test specimen.

4.2 Tray

Heat-resistant tray approximately 0.05 m^2 and 50 mm deep.

4.3 Balance

Balance of sufficient capacity with a limit of performance not exceeding ± 0.5 g.

4.4 Metal scraper

Small metal scraper having a sharp edge and a blade approximately 25 mm wide.

4.5 Grinding pestle

Pestle having a porcelain grinding head with a diameter of approximately 50 mm.

4.6 Fibreglass cloth

Plain weave fibreglass cloth having a minimum mass of 0.3 kg/m^2 and a minimum thickness of 0.3 mm.

5 SAMPLING

5.1 Field sampling

For concrete sampled in the field, the test sample shall be obtained in accordance with the requirements of AS 1012.1.

5.2 Laboratory sampling

For concrete made in the laboratory, the test sample shall be prepared in accordance with AS 1012.2.

6 PROCEDURE

The procedure shall be as follows:

- Cut a piece of fibreglass cloth large enough to completely wrap a 1500 ± 50 g test specimen of freshly mixed concrete.
NOTE: The minimum size fibreglass cloth that has generally been found to be adequate is $0.5 \text{ m} \times 0.5 \text{ m}$.
- Place the fibreglass cloth on the heat resistant tray with the cloth uniformly overhanging the outside edges of the tray.
- Determine the mass of the tray and cloth together (m_s).
- Obtain a sample of freshly mixed concrete in accordance with AS 1012.1 or AS 1012.2 and scoop a test specimen of 1500 ± 50 g from the sample.
- Within 5 min of mixing the composite sample, place the test specimen on the fibreglass cloth and wrap it completely with the cloth.
- Determine the mass of the tray, cloth, and freshly mixed concrete test specimen (m_t).
- Place the tray with the completely wrapped test specimen on the turntable in the microwave oven. Dry the test specimen with the turntable rotating for a period of 5 min and 30 ± 10 s at the 900 W power setting.

For concretes with water/cementitious material ratio greater than 0.50 but less or equal to 0.60, test specimens shall be dried for a period of $6.0 \text{ min} \pm 10 \text{ s}$.

- (h) Immediately remove the tray and test specimen from the microwave oven and quickly unwrap the test specimen. With the edge of the scraper, break the mass of concrete until the coarse aggregate is separated from the mortar. Carefully grind the mortar with the pestle for no more than 1 min to expose a greater surface area. Ensure that no material is lost.
- (i) Rewrap the test specimen; place the tray with the completely wrapped test specimen on the turntable in the microwave oven, and dry it with the turntable rotating 5 min and 30 ± 10 s at the 900 W power setting.
For concretes with water/cementitious material ratio greater than 0.50 but less or equal to 0.60, dry the test specimens for a minimum of 6.0 min ± 10 s.
- (j) Remove the tray containing the test specimen from the microwave oven and immediately determine the mass of tray plus fibreglass cloth plus dry test specimen (m_d).
- (k) If required, determine the mass per unit volume of the freshly mixed concrete in accordance with AS 1012.5 from a separate test specimen obtained from the sample obtained in Step (d).

7 CALCULATION

Calculate the following:

- (a) The free water content percentage (W_c), as follows:

$$W_c = \frac{(m_f - m_d)}{m_f - m_s} \times 100$$

where

W_c = free water content, as a percentage

m_d = mass of the tray plus cloth plus dry test specimen, in grams

m_f = mass of the tray plus cloth plus fresh test specimen, in grams

m_s = mass of the tray plus cloth, in grams

- (b) If required, total free water content (W_t), as follows:

$$W_t = \frac{W_c \times U_w}{100}$$

where

W_t = total free water content, in kilograms per cubic metre

W_c = free water content, as a percentage

U_w = mass per unit volume of the fresh concrete, in kilograms per cubic metre

8 RECORDS

The following information shall be recorded:

- (a) Identification of the concrete.
- (b) Job site or laboratory, where tested.
- (c) Date and time of test.
- (d) Drying time.
- (e) Masses recorded.