Australian Standard®

Methods of testing concrete

Method 13: Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory

METHOD

1 SCOPE

This Standard sets out a method for curing concrete shrinkage specimens in the laboratory, and for determining the length changes of these specimens due to drying in air. It provides for testing of specimens prepared in the laboratory or in the field in accordance with AS 1012.8.4, in which the nominal size of aggregate in the concrete, in accordance with AS 2758.1, does not exceed 40 mm.

The precision statement in Clause 9 does not apply to specimens which have had non-standard initial curing (normally field-prepared specimens). In addition, this Standard requires that field-prepared specimens are marked, recorded and reported as such.

NOTES:

1 This test method is not always suitable for very low slump concrete (less than 20 mm), primarily due to the difficulties in obtaining adequate compaction. Provided adequate compaction is obtained, the method is applicable.

2 The method is specifically designed for measurement of drying shrinkage of concrete, but it is capable of adaptation for measurement of length changes of specimens subjected to a variety of environmental conditions.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1012	Methods of testing concrete
1012.8.1	Method 8.1: Method for making and curing concrete—Compression and indirect tensile test specimens
1012.8.4	Method 8.4: Making and curing concrete—Drying shrinkage specimens prepared in the field or in the laboratory
2758	Aggregates and rock for engineering purposes
2758.1	Part 1: Concrete aggregates

3 DEFINITIONS

For the purpose of this Standard, the definitions below apply:

3.1 Measuring laboratory

The laboratory responsible for completion of initial moist curing, storage in drying room, and measurement of specimens.

NOTE: In some instances the preparing and measuring laboratories will be the same.

3.2 Micrometer

A linear measuring system.

NOTE: Typical examples include dial gauges and digital readout systems.

3.3 Preparing laboratory

The laboratory responsible for sampling of concrete, moulding of specimens, initial curing in moulds, demoulding, initial moist curing, and transport to measuring laboratory (if required).

3.4 Standard moist curing conditions

As required by AS 1012.8.1 for lime-saturated water.

NOTE: Standard temperate conditions are required for a minimum of 24 h prior to initial measurement (see Clause 6.3.3 of AS 1012.8.4).

4 PRINCIPLE

Specimens are cured and air dried for a specified time and the change in length is measured.

5 EQUIPMENT

The following apparatus shall be used.

5.1 Drying chamber

A drying chamber with suitably controlled temperature, humidity and air circulation shall be provided for storing specimens in air and in which they can be measured in accordance with the following requirements:

(a) Air shall be circulated through the chamber in a uniform manner so that the specified conditions are attained adjacent to all specimens under test.

(b) The temperature in the chamber shall be maintained at 23 ±1°C for 90% of each 24 h period, at all times remaining within the range 23 ±2°C.

(c) The relative humidity in the drying chamber shall be maintained at 50 ±5% at all times.

(d) The temperatures and relative humidities shall be recorded at all times by a recording device which is capable of rapid response to changes in chamber conditions.

The recording detectors shall be calibrated annually against a standardized Assmann hygrometer or reference device.

NOTES:

1 A suitable rapid response device for recording temperature and humidity uses a combined detector with a thin-film capacitor for humidity and a platinum resistance thermocouple for temperature measurement. Response time for this type of detector is measured in seconds, and is virtually instantaneous within the narrow range required for this test method.

The detector is used in conjunction with a suitably matched chart recorder or data logger.

2 Most thermohygrographs are unsuitable for the purpose as the response is too slow to detect the full extent of fluctuations, particularly with the hair type of humidity detector.

(e) The rate of air movement in the chamber shall be such that the rate of evaporation is 12 ±5 mL per 24 h, with a minimum value of 7 mL per 24 h. The evaporation rates shall be determined by measuring the loss in weight of water in 400 mL low-form beakers of internal diameter 78 ±5 mm, initially containing approximately 375 g of water at a temperature of 23 ±2°C. The weight of water in the beaker shall not fall below 325 g. Each beaker shall be placed midway between test specimens on the storage racks with the water level at approximately the same height as the top of the specimens. Systematic checks on the evaporation rates shall be carried out by varying the location of the beakers within the chamber at least monthly or where conditions have changed and the results duly recorded.

NOTE: The rate of evaporation should be maintained as close to 12 mL per 24 h as possible.

(f) The requirements for temperature, humidity and evaporation rate apply to each storage position.

Positions which do not comply shall not be used for storage of test specimens.

(g) The chamber shall be fitted with suitable racks for storing specimens. The racks shall provide free circulation of air around specimens, except for necessary supports, and shall be so situated with respect to the nearest wall or other obstruction that air circulation is not restricted in the intervening space. The horizontal supports shall consist of non-absorptive members having a total bearing width supporting the specimen of not more than 25 mm. All storage positions shall be kept occupied at all times, with dummy specimens if necessary.

NOTE: It is recommended that dummy specimens be concrete prisms with the same dimensions as the test specimens.

5.2 Length comparator

5.2.1 *General*

The comparator for measuring length changes shall be capable of measuring the length of specimens over a range of 290 mm to 300 mm, with a precision of 0.001 mm.

NOTES:

1 It is recommended that where a horizontal comparator is used, micro meters be of the digital read-out type.

2 Details of a suitable horizontal comparator are provided in Appendix A.

5.2.2 *Check of precision*

The precision of the length comparator and the performance of the operator shall be checked by recording the difference in length between the reference bar and a typical specimen 20 times, replacing each in the comparator for each reading. The standard deviation of these 20 length differences shall not exceed 0.002 mm. When a check of precision fails to meet this requirement, further checks shall be made with another specimen or with another operator, to ascertain whether the lack of precision is associated with the comparator or with the operator.

5.2.3 *Reference bar*

A specific reference bar shall be used with each comparator and shall consist of a material characterized by an extremely low coefficient of thermal expansion (e.g. Invar), not less than 6 mm in diameter with an overall length of 295 ±1.5 mm.

Each end shall be reduced in diameter and the end 5 mm shall be approximately the same diameter and have the same end radius as the projecting end of the gauge stud being used in the specimen (see Clause 4.2 of AS 1012.8.4). Each end of the reference bar shall be polished.