

Australian/New Zealand StandardTM

AS/NZS 4456.12

**Masonry units, segmental pavers and flags—
Methods of test****Method 12: Determining coefficients of
contraction**

This Standard incorporates Amendment No. 1 (August 2004). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

1 SCOPE

This Standard sets out the methods for determining the coefficients of contraction of masonry units, pavers and flags. The coefficient of residual curing contraction is an indication of the potential shrinkage undergone by a masonry unit during its secondary curing process. The coefficient of drying contraction is an indication of the potential contraction undergone by a saturated masonry unit when it is allowed to dry over a long period at ambient conditions.

NOTE: For ease of use, the methods of determining residual curing contraction and drying contraction have been separated in this Standard, even though masonry units would most likely be tested for both properties consecutively.

2 REFERENCED DOCUMENTS

The following document is referred to in this Standard:

AS/NZS

4456	Masonry units, segmental pavers and flags—Methods of test
4456.0	Part 0: General introduction and list of methods
4456.1	Method 1: Sampling for testing
4456.2	Method 2: Assessment of mean and standard deviation

3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS/NZS 4456.0 apply.

4 NOTATION

The following notation is used in this Standard:

L	=	overall length of unit, in millimetres
Z_i	=	initial gauge reading of reference bar (average of two readings), in millimetres
	=	$(Z_1 + Z_2)/2$
Z_f	=	final gauge reading of reference bar (average of two readings), in millimetres
	=	$(Z_3 + Z_4)/2$
dZ	=	difference between final and initial gauge readings $(Z_f - Z_i)$ of the reference bar, in millimetres
Y_i	=	initial gauge reading of specimen, in millimetres

Y_f	=	final gauge reading of specimen, in millimetres
dl	=	change in length of the specimen, in millimetres
e_{cc}	=	the coefficient of residual curing contraction of the specimen, in millimetres per metre
$\bar{e}_{cc}$	=	mean coefficient of residual curing contraction of the sample, in millimetres per metre
e_{dc}	=	the coefficient of drying contraction of the specimen, in millimetres per metre
$\bar{e}_{dc}$	=	mean coefficient of drying contraction of the sample, in millimetres per metre

5 APPARATUS

The following is required:

- A temperature-controlled space whose temperature is controlled to $22 \pm 3^\circ\text{C}$.
- A measuring frame fitted with a micrometer or dial gauge that is capable of being read to the nearest 0.002 mm or better (see Figure 1).
- A flat-ended reference bar of invar steel rod fitted with an insulated grip and approximately equal in length to the test specimens.
- Two steel balls of 6.5 mm diameter.
- Two steel-ball adaptors that can be attached to the reference bar (see Figure 2).
- A calliper capable of being read to 0.5 mm over the length of the units being tested.
- A tungsten carbide drill of 6.5 mm diameter.
- An immersion tank capable of immersing all specimens on a grid without them touching each other.
- For AAC unit, a humidity chamber or container in which the specimens can be placed on racks to dry at $22 \pm 3^\circ\text{C}$ and $43 \pm 2\%$ relative humidity. This humidity corresponds to the equilibrium condition over a saturated solution of potassium carbonate in water. The trays containing the saturated solution shall contain sufficient solid salt that can be stirred thoroughly at least every 7 days to prevent the formation of lumps or a crust.
- A well-ventilated drying oven with a cubic capacity not less than 3 times the total volume of the specimens being dried, and capable of maintaining a temperature of $110 \pm 8^\circ\text{C}$.

6 COEFFICIENT OF RESIDUAL CURING CONTRACTION

6.1 Principle

A sample of 5 units is taken, each at 7 d of age or greater. The units are initially saturated then measured for length. They are then placed in water at laboratory temperature for 7 d, surface dried, and remeasured.

NOTE: Specimens tested at ages greater than 7 d are unlikely to give coefficients of curing contraction as great as those tested at age 7 d.

6.2 Preparation of test specimens

Specimens accumulated from continuous sampling shall be deemed to meet the requirements of this method, provided that the number of specimens accumulated is at least 5. For assessment of an individual lot, 5 units shall be selected in accordance with AS/NZS 4456.1.

Specimens may be cut from units. Where specimens are cut from units, they shall be taken in such a manner that they are representative of the lot under investigation and of the units used in practice. For autoclaved aerated concrete, cut specimens shall be taken so that they represent a uniform distribution across the sample in the direction of rise or compaction of the mass during manufacture. The specimens may be split or dry cut. They shall not contain any reinforcement, and the cut surfaces shall be clean and planar. The length axis of the prisms shall be parallel to the length of the unit. Cut test specimens shall be prisms with a length to suit the length of the measuring frame, but not less than 150 mm. The position of the specimen in the production unit shall be shown by a letter designation in the specimen number, i.e. U (upper), MU (middle upper), M (middle), ML (middle lower) or L (lower).

NOTE: Wet-sawn specimens should not be used because the introduction of water will invalidate the test.

By means of the tungsten carbide drill, a conical depression shall be formed in the centre of each end of each unit to provide reference point seats for the steel balls. All dust from the drilling shall be brushed from the conical depressions.

Where difficulty is encountered in making smooth conical depressions in coarse-textured or friable units, it shall be permissible, after initial drilling, to fill the depression with a moisture-stable, epoxy-based filler, for which the dimensional stability has been checked under the test conditions before it is adopted for used.

When the filler is cured, it shall be redrilled to re-expose the unit surface.

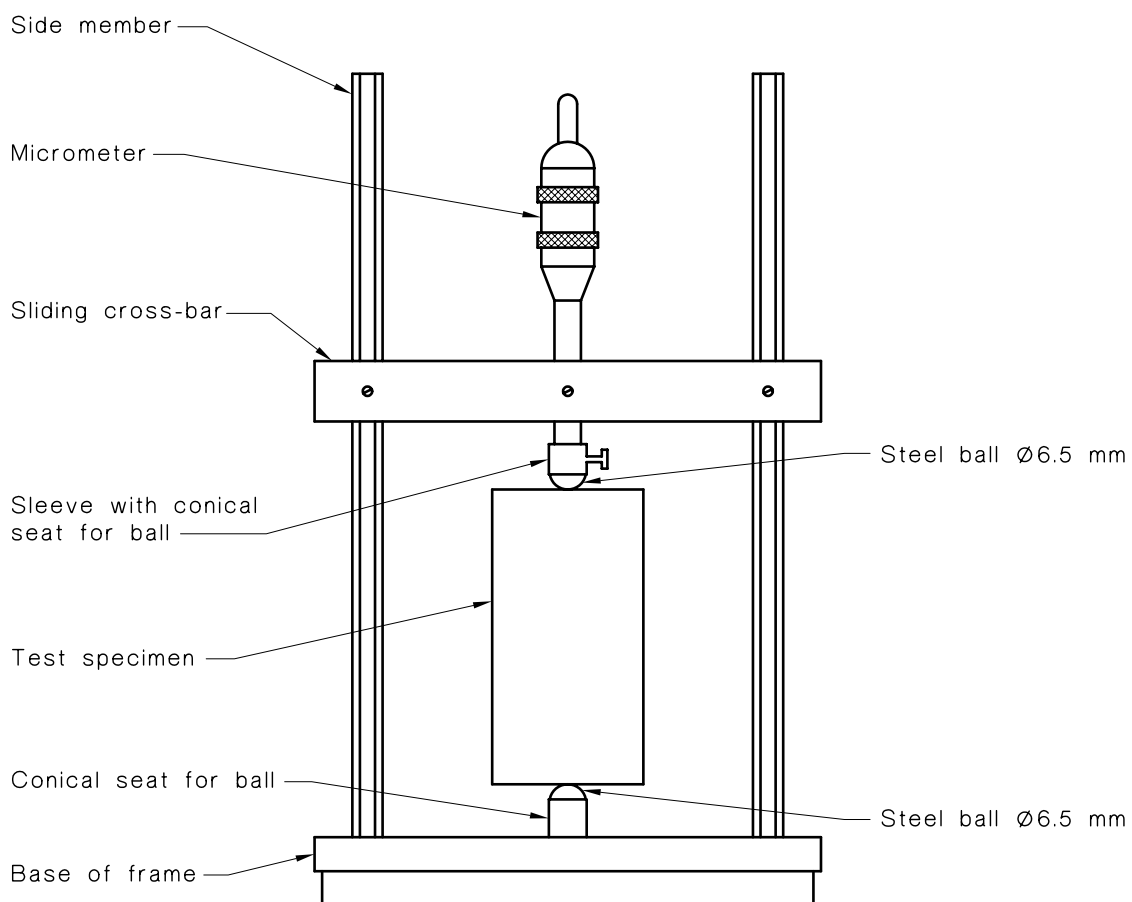


FIGURE 1 TYPICAL MEASURING FRAME

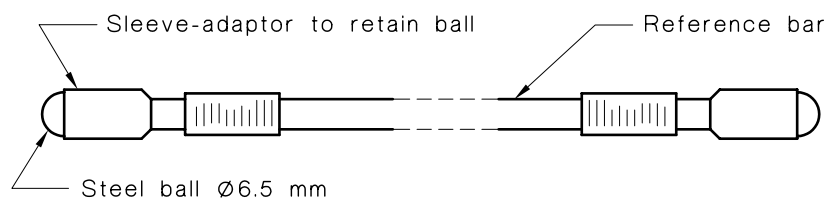


FIGURE 2 TYPICAL REFERENCE BAR WITH STEEL-BALL ADAPTORS

6.3 Procedure

The procedure shall be as follows:

- Immerse the specimens in potable water, at laboratory temperature, for 2 h.
- Using the calliper, measure the overall length of each specimen to the nearest 1 mm and record as L .
- Attach one steel ball adaptor to each end of the reference bar and with the balls in position measure the length of the reference bar supported vertically in the measuring frame with the micrometer to the nearest 0.002 mm. Record the result as Z_1 .
- Support the test specimen between the steel balls in the measuring frame. Take care that the unit is properly seated on the steel balls and read the micrometer to the nearest 0.002 mm. Record the result as Y_i . Repeat this procedure for all other test specimens.
- Remeasure the length of the reference bar as in Step (c) and record the result as Z_2 .
- Place the specimens in the immersion tank, inside the controlled temperature space, and leave them to soak for 7 days.
- Remove the specimens from the tank and surface dry them. Remeasure the reference bar and the specimens as in Steps (c) to (e) and record these results as Z_3 , Y_f and Z_4 .

6.4 Calculation of curing contraction

The following calculations shall be made:

- $Z_i = \frac{Z_1 + Z_2}{2}$ and $Z_f = \frac{Z_3 + Z_4}{2}$
- $dZ = Z_f - Z_i$
- $dL = Y_i - (Y_f + dZ)$
- $e_{cc} = \frac{dL}{L} \times 1000 \text{ mm/m}$
- Calculate mean coefficient of residual curing contraction in accordance with AS/NZS 4456.2 to one decimal place.

6.5 Recording

The following information shall be recorded:

- Reference to this test method, i.e., AS/NZS 4456.12.
- Description of the marking, location and identification of the lot.
- Sample and specimen identification.
- Date of sample and test.
- Work sizes for the lot.
- Age of the specimens at commencement of test.