BS EN 1024:2012

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Clay roofing tiles for discontinuous laying — Determination of geometric characteristics

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National foreword

This British Standard is the UK implementation of EN 1024:2012. It supersedes BS EN 1024:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/542/3, Clay roofing tiles.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Clay roofing tiles for discontinuous laying - Determination of geometric characteristics

Tuiles de terre cuite pour pose en discontinu - Détermination des caractéristiques géométriques

Tondachziegle für überlappende Verlegung - Bestimmung der geometrischen Kennwerte

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Foreword

This document (EN 1024:2012) has been prepared by Technical Committee CEN/TC 128 “Roof covering products for discontinuous laying and products for wall cladding”, the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2012, and conflicting national standards shall be withdrawn at the latest by September 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1024:1997.

This European Standard is one of the series of standards dealing with clay roofing tiles as listed below:

— EN 1304, *Clay roofing tiles and fittings — Products definitions and specifications*

— EN 538, *Clay roofing tiles for discontinuous laying — Flexural strength test*

— EN 539, *Clay roofing tiles for discontinuous laying — Determination of physical characteristic*

This European Standard includes:

— an informative annex

Figure A.1 – Example of twist measurement device for tiles with sidelock and headlock, tiles with sidelock only and overlapping tiles.

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1 Scope

This European standard specifies the methods for determining the geometric characteristics of clay tiles as defined in EN 1304, *Clay roofing tiles and fittings — Product definitions and specifications.*

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1304, *Clay tiles and fittings — Product definitions and specifications*

3 Symbols

L_1 maximum distance when measuring covering dimensions (length) in millimetres (mm);

L_2 minimum distance when measuring covering dimensions (length) in millimetres (mm);

l_1 maximum distance when measuring covering dimensions (width) in millimetres (mm);

l_2 minimum distance when measuring covering dimensions (width) in millimetres (mm);

L mean cover length in millimetres (mm);

L_M maximum cover length in millimetres (mm);

l mean cover width in millimetres (mm);

l_M maximum cover width in millimetres (mm);

H difference in height from the measuring point at the support bar or height in relation to a reference plane in millimetres (mm);

C twist coefficient in percent;

A tile length as declared by the manufacturer in millimetres (mm);

B tile width as declared by the manufacturer in millimetres (mm);

h_d height of camber as declared by the manufacturer in millimetres (mm);

h_m measured height of camber in millimetres (mm);

R camber in percentage;

Δh $|h_m - h_d|$ absolute value in millimetres (mm);

L_T total length of the tile in millimetres (mm);

l_T total width of the tile in millimetres (mm);

L_A measurement base in longitudinal direction in millimetres (mm);

L_B measurement base in transverse direction in millimetres (mm);

E_1 distance between the internal edges of an over - and under- tile at one of its extremities in millimetres (mm);

E_2 distance between the internal edges of an over - and under- tile at the other extremity in millimetres (mm).

4 Test pieces

The measurement of geometric characteristics are carried out on 10 test pieces, each of which constitutes a whole tile, except for the measurement of cover dimensions, which requires 24 tiles.

5 Tests methods

5.1 Determination of dimensional characteristics

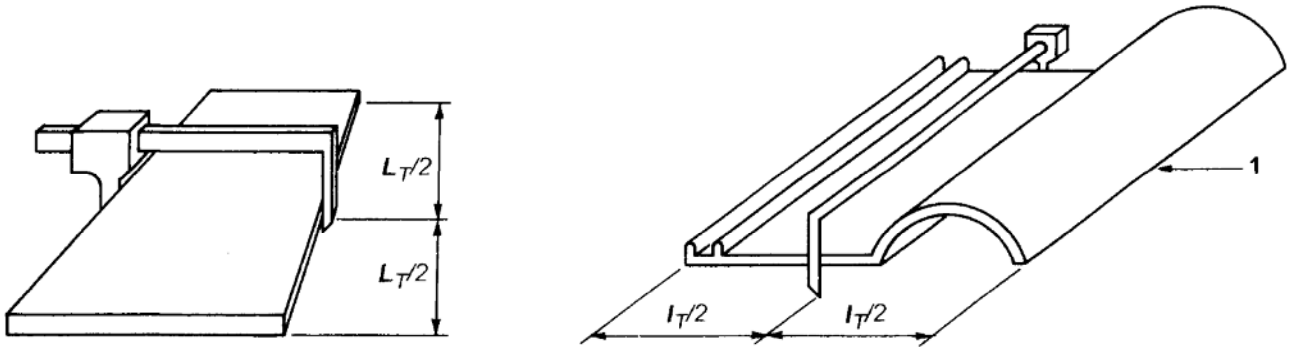
5.1.1 Individual dimensions[1)]

5.1.1.1 Apparatus

The tests are made with a measuring apparatus with a precision of at least one millimetre.

5.1.1.2 Procedure

After removing any surplus clay from the edges, the measurements shall be taken, both transversely and longitudinally along the centre of the tile unless another measuring position has been specified by the manufacturer (see Figure 1). The dimensions are expressed to the nearest whole millimetre.



Key

1 tile

Figure 1 – Principle for measuring individual dimensions

5.1.1.3 Expression of results

The arithmetic means of the lengths and widths of the 10 tested tiles and the differences expressed as a percentage of these mean values in relation to the values A and B declared by the manufacturer shall be calculated and noted in the test report.

1) EN 1304 specifies to which type of tiles these measurements apply.

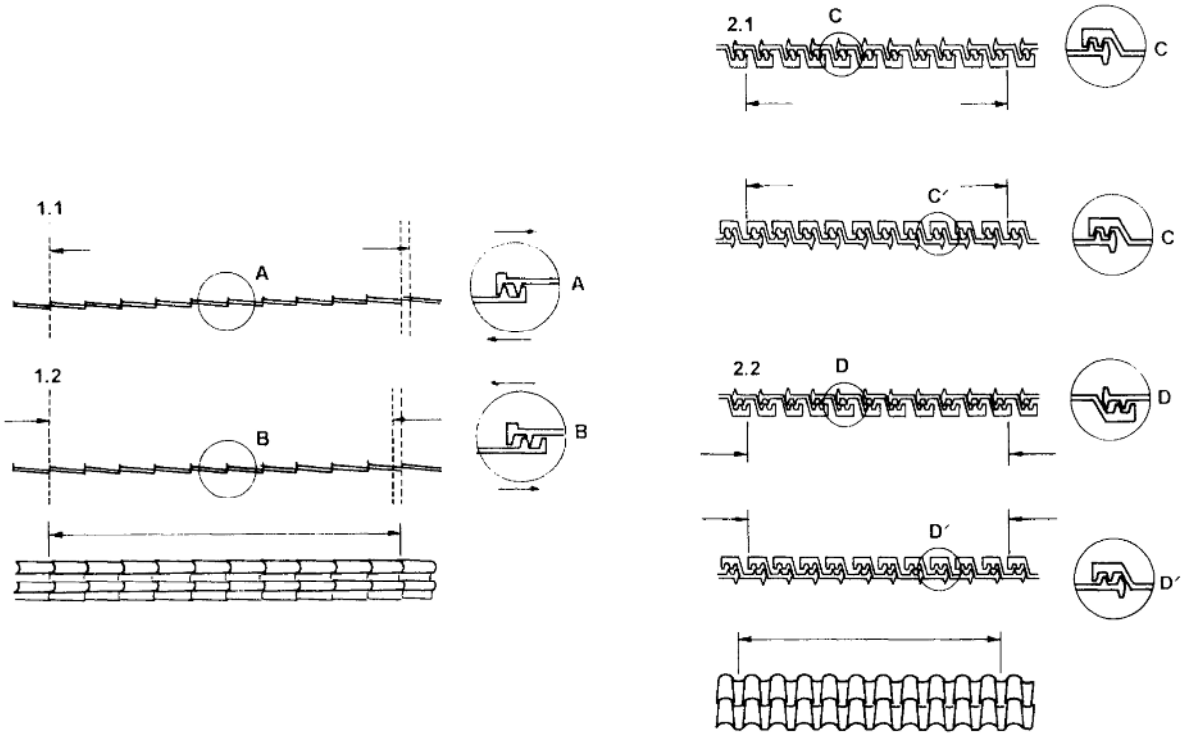
5.1.2 Overlap dimensions (margins)[1)]

5.1.2.1 Principle

The mean overlap dimensions are determined longitudinally and transversely.

They are measured as indicated in Figure 2.

NOTE Certain tile models can only be measured in one direction.



Key

1 mean cover length
1.1 open position
1.2 closed position
2 mean cover width
2.1 open position
2.2 closed position

Figure 2 – Principle for measuring cover dimensions

5.1.2.2 Number of test pieces

24 tiles are required for the measurements.

5.1.2.3 Apparatus

The tests are carried out with a measuring apparatus with a precision of at least 1 mm.

5.1.2.4 Procedure

The tiles are laid upside down in two rows on a flat surface, and interlocked with one another so as to form a stable unit. Certain types of tiles may require laying the right way up.

The tiles are interlocked longitudinally and pulled apart individually to measure the maximum distance between two corresponding points on the first and the eleventh tile, i.e. L_1, the maximum length.

Following this, the tiles are taken up, then relaid and interlocked. They are pushed together individually as closely as possible to carry out the measurement of the minimum distance (L_2) following the procedure described above.

Take again the same measurements, but this time, transversely in order to obtain the values l_1 and l_2.

With regard to tiles with a variable overlap, determine only the measurement of cover in the open position, L_1 (longitudinally), l_1 (transversely).

NOTE This method is not relevant to some types of tiles designed to be laid broken jointed.

5.1.2.5 Expression of results

The mean cover length (L) is obtained from the following formula:

$$L = (L_1+L_2) / 20 \quad (1)$$

The maximum cover length (L_M) (tiles with a variable overlap) is obtained from the following formula:

$$L_M = L_1 / 10 \quad (2)$$

The mean cover width (l) is calculated from the following formula:

$$l = (l_1 + l_2) / 20 \quad (3)$$

The maximum cover width (l_M) (of tiles with a variable overlap) is calculated from the following formula:

$$l_M = l_1 / 10 \quad (4)$$

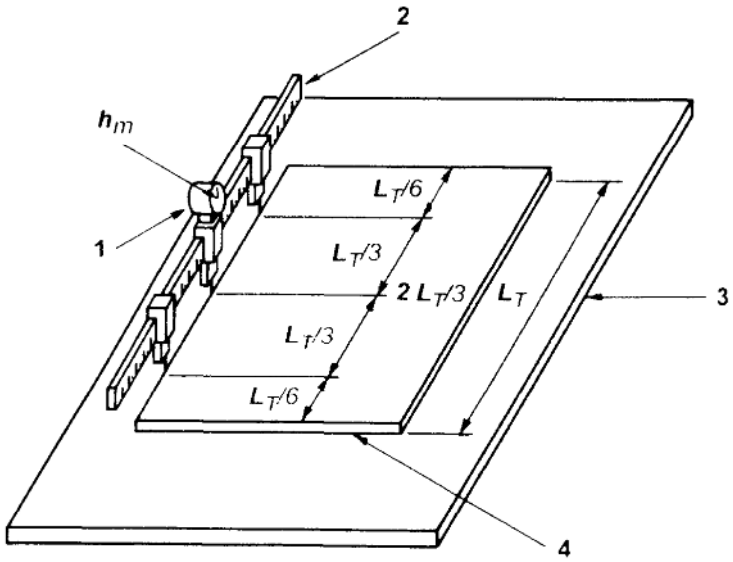
The calculated values as recorded are rounded to the nearest whole millimetre.

The percentage difference of these cover dimensions compared with those declared by the manufacturer are calculated and stated in the test report.

5.2 Cambers

5.2.1 Principle

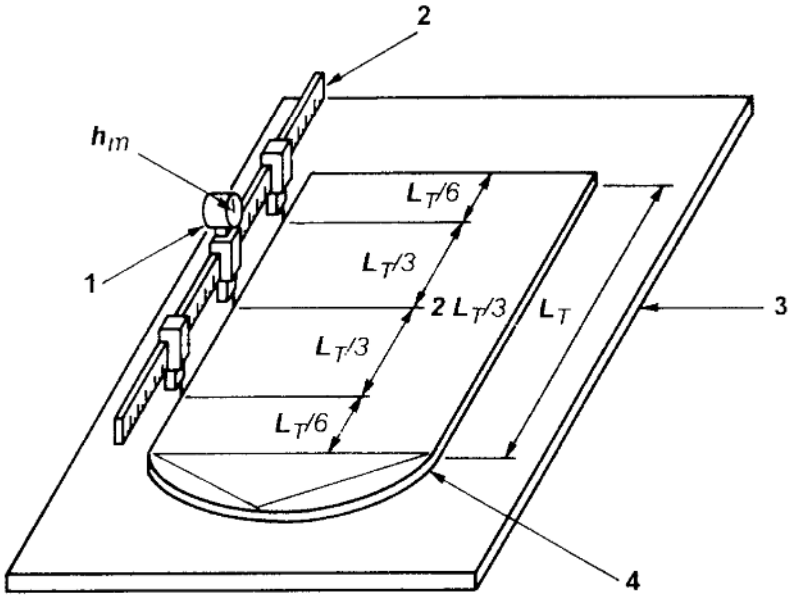
Measure height of camber longitudinally and transversely for plain tiles (see Figures 3, 4 and 5) and longitudinally only for all other types of tile (see Figures 6, 7 and 8). The height of camber for a curvature whose concavity is located on the outer surface of the tile are given a minus sign and a plus sign is given in the opposite case. The measurement is taken to a precision of at least 0,5 mm on each outside edge of the tile, with the most unfavourable value being selected. Take as measurement bases L_A and L_B equal to 2/3 of the total length (L_T) and width (l_T) of the tile. Where this is not possible, the measurement base may be reduced to the largest dimension that is compatible with the shape of the tile.



Key

1 dial gauge
2 rule
3 metal plate
4 tile

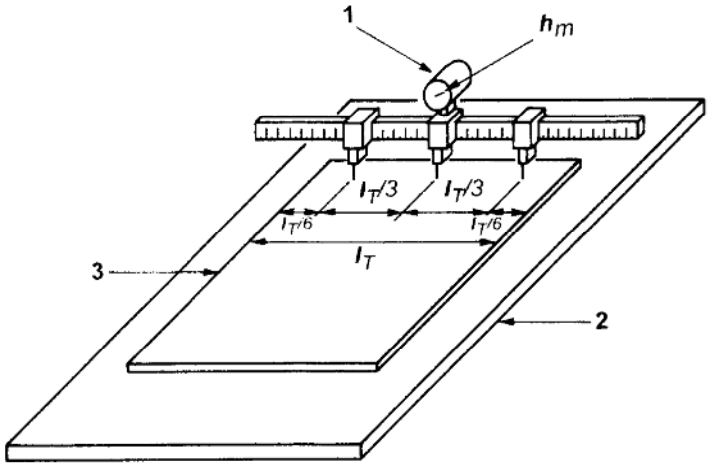
Figure 3 – Measurement of longitudinal camber on a plain tile



Key

1 dial gauge
2 rule
3 metal plate
4 tile

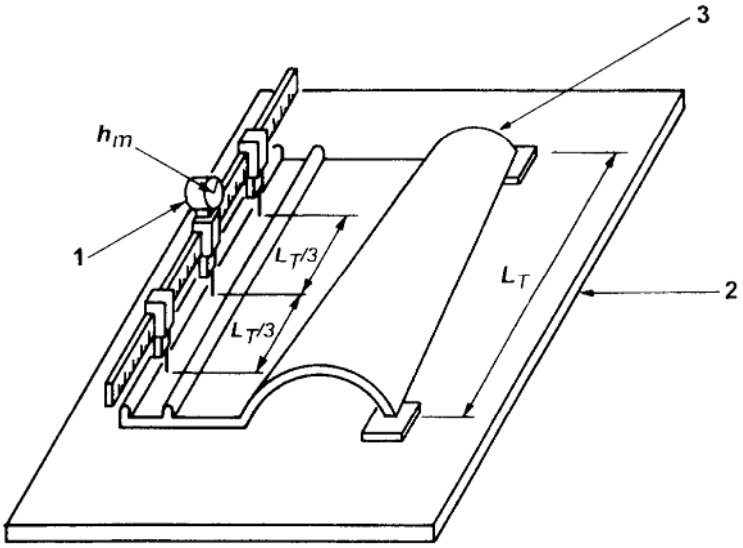
Figure 4 – Measurement of longitudinal camber on an ornamental plain tile



Key

1 dial gauge
2 metal plate
3 tile

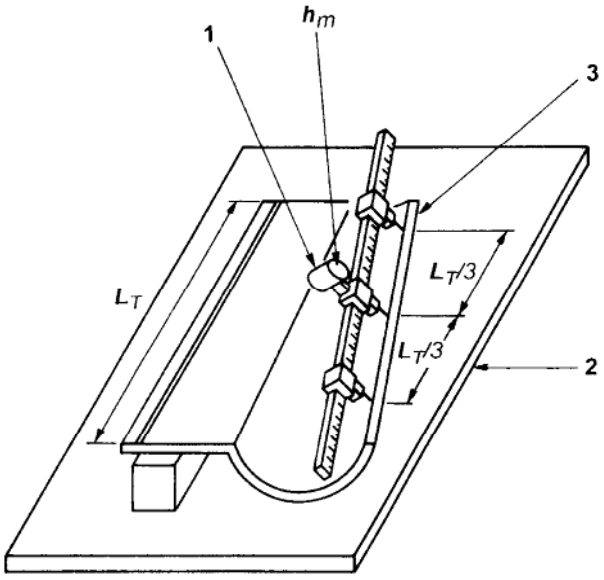
Figure 5 – Measurement of transverse camber on a plain tile



Key

1 dial gauge
2 metal plate
3 tile

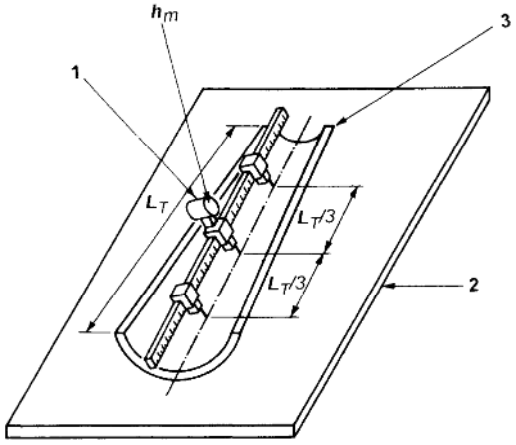
Figure 6 – Measurement of longitudinal camber on a tile with sidelock and headlock or a tile with sidelock only



Key

1 dial gauge
2 metal plate
3 tile

Figure 7 – Measurement of longitudinal camber on a tile with sidelock and headlock or a tile with sidelock only (reverse side of tile)



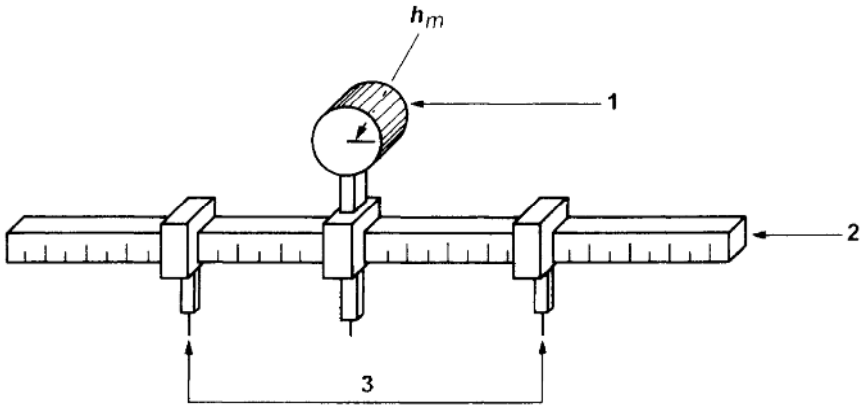
Key

1 dial gauge
2 metal plate
3 tile

Figure 8 – Measurement of longitudinal camber on an under-and-over tile

5.2.2 Apparatus (Figure 9)

The measurement is taken using a rule with three contact points, combined with a device to measure the height of camber accurately to a precision of at least 0,5 mm.



Key

1 dial gauge
2 rule
3 contact points

Figure 9 – Apparatus for measuring cambers

The two outer contact points on the rule shall be able to slide so as to adjust to different measurement lengths.

Any suitable apparatus may be used to obtain these measurements provided the prescribed requirements are met.

5.2.3 Procedure

5.2.3.1 Longitudinal measurement

5.2.3.1.1 Plain tiles and overlapping tiles

The measurement is taken on the exterior face of the tile along the two longitudinal outer edges.

5.2.3.1.2 Tiles with sidelock and headlock, and tiles with sidelock only

The measurement is taken on the outer surface of the tile in the bottom of the interlock groove, as well as on the lower edge of the flange which locks into this groove.

5.2.3.1.3 Over-and-under tiles

This measurement is taken along the axis in the bottom of the concavity of the tile, or for tiles with a flat bottom, along the centre line.

5.2.3.2 Transverse measurement - Plain tiles

The measurement is taken on the exterior face of the tile along the two transverse - upper and lower - outer edges. (For tiles whose lower edge is not a straight line, take the measurement at the widest point of the tile, as far as possible towards the lower edge).

5.2.4 Expression of results

Cambers are obtained from the following formulas:

$R = \Delta h \times 100 / L_A$ in percentage, longitudinally (5)

$R = \Delta h \times 100 / L_B$ in percentage, transversely (6)

where

$h = |h_m - h_d|$ in absolute value;

h_m is the measured height of camber in millimetres;

h_d is the nominal height of camber declared by the manufacturer in millimetres;

L_A and L_B are the base lengths defined above in millimetres.

Note the individual measurement values and the mean values of the results in the test report.

5.3 Control of regularity of shape

5.3.1 Twist

5.3.1.1 Plain tiles

5.3.1.1.1 Apparatus

— Two 25 mm x 25 mm cross-section metal bars, longer than the width of the tile. These bars act as battens;

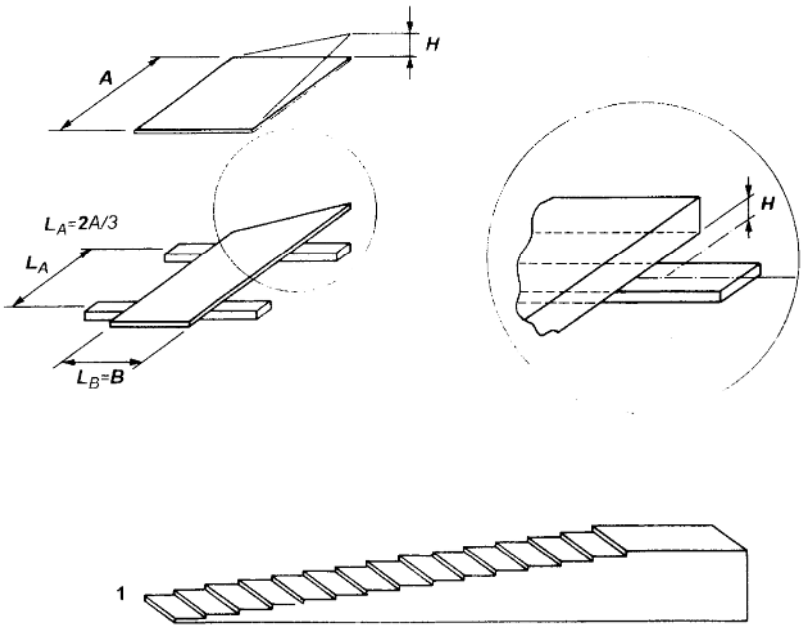
— a metal plate, level to a precision of 1/10 mm, with dimensions greater than those of the tile;

— a stepped metal thickness gauge (as shown in Figure 10) with 0,5 mm graduations, a maximum width of 8 mm and a maximum depth of 5 mm for each step to measure the gaps (vertical displacement).

Any suitable apparatus may be used to obtain these measurements, provided the prescribed requirements are met.

5.3.1.1.2 Procedure

Fix the bars, for instance, with adhesive tape and place them parallel to one another on the plate with a distance between their centres equal to 2/3 of the length of the tile. For the tiles that are not rectangular, the measurement base is equal to 2/3 of the length of the rectangular part of the tile. Place the tile on the metal bars so that its nib(s) rest on one of the two bars.



Key

1 thickness gauge

Figure 10 – Principle for assessing twist (plain tiles)

(Tiles without nibs are positioned on the metal bars as they would be in practice on battens).

The tile is then laid on the support bars to rest firmly on three corners. The height differential *(H)* in relation to the fourth corner is measured with the thickness gauge. Alternatively, the tiles can be placed with the upper surface against the metal rods, if their shape so demands.

5.3.1.1.3 Expression of results

The twist coefficient is calculated from the difference in height (H) and is obtained from the following formula:

$$C = H \times 100 / (L_A + L_B) \text{ in percentage} \quad (7)$$

(this coefficient is given to one decimal place)

where for plain tiles:

H is the difference in height in millimetres from the measurement point to the bar;

L_A is the measurement base in longitudinal direction, in millimetres (L_A = 2/3 of the rectangular per length);

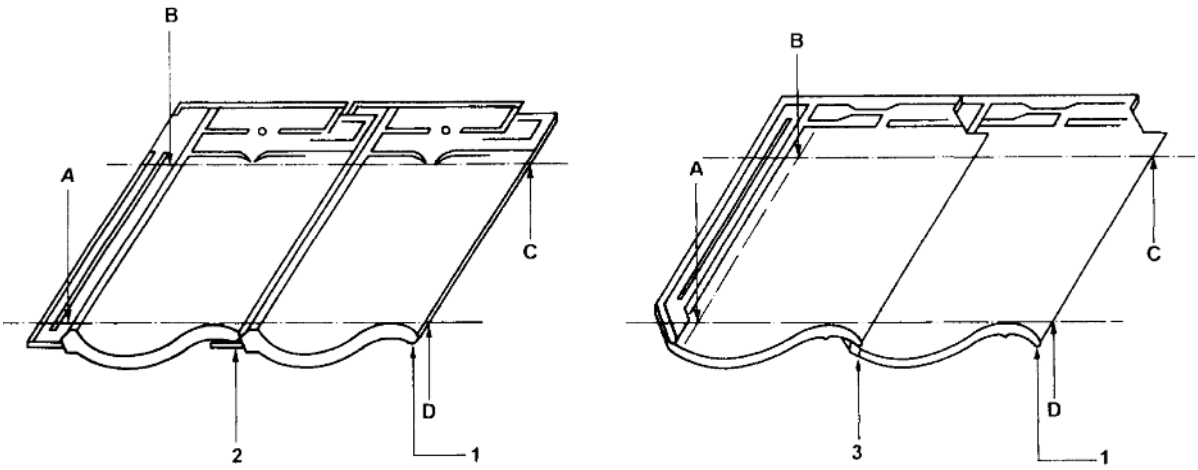
L_B is the measurement base in transverse direction, in millimetres (L_B = B = tile width declared by the manufacturer).

Note the individual measurement values and the mean value of the results in the test report.

5.3.1.2 Tiles with sidelock and headlock, tiles with sidelock only, and overlapping tiles

5.3.1.2.1 Principle

The twist of the tile is determined by measuring the parallel gap between the lower edge of the interlock or roll, and the contact line from this edge along the bottom of the corresponding interlock or tile surface (Figure 11).

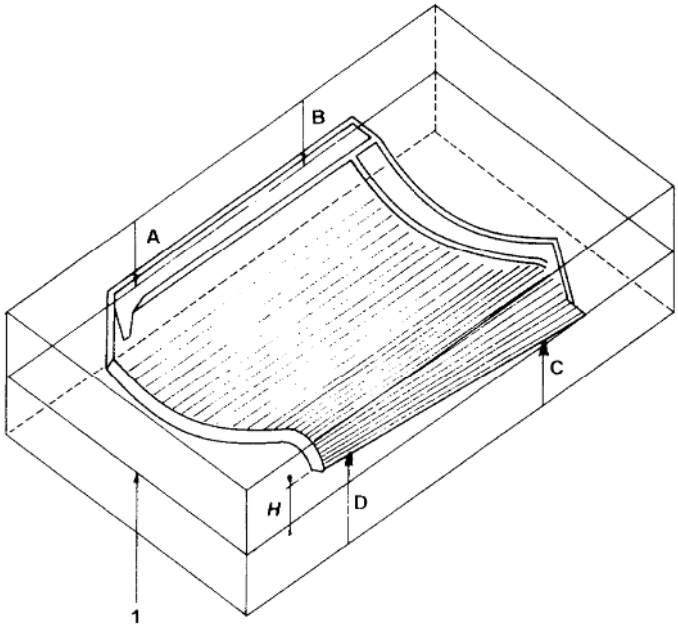


Key

1 lower edge of roll
2 contact point of lower edge of roll - bottom of interlock
3 contact point of lower edge of roll - tile surface

Figure 11 – Principle for measuring twist of tiles with sidelock and headlock, tiles with sidelock only and overlapping tiles

In practise, to measure this twist, assume that one of the contact edges (AB) (e.g. the lower edge of the roll) and one of the points (C) of the other contact line, form a plane, and measure the difference (*H)* from the other point of this contact line (D) in relation to this plane (Figure 12).



Key

1 reference plane

Figure 12 – reference plane

5.3.1.2.2 Apparatus

Any apparatus may be used which enables the measurement to be taken according to the method set out in 5.3.1.2.1 and the procedure laid down in 5.3.1.2.3. A model of these devices is shown in Annex A.

5.3.1.2.3 Procedure

Interlock two tiles and determine the contact line from the lower edge of the interlock or roll on the interlocked tile (either the bottom of the groove or interlock, or the surface of the tile as is the case with overlapping rolls).

Select on these contact lines a distance equal to 2/3 of the total length (L_T) of the tile so that the four measuring points (A, B, C, D) form a rectangle (or a parallelogram) on projection into the horizontal, (Figure 13). With certain types of tiles, it will be impracticable to deal with a dimension equal to 2/3 (L_T); in such cases, use the greatest length possible compatible with the shape of the tile. Measure the difference (H) in mm to the nearest 0,5 mm between the point D and the plane formed by A, B and C.

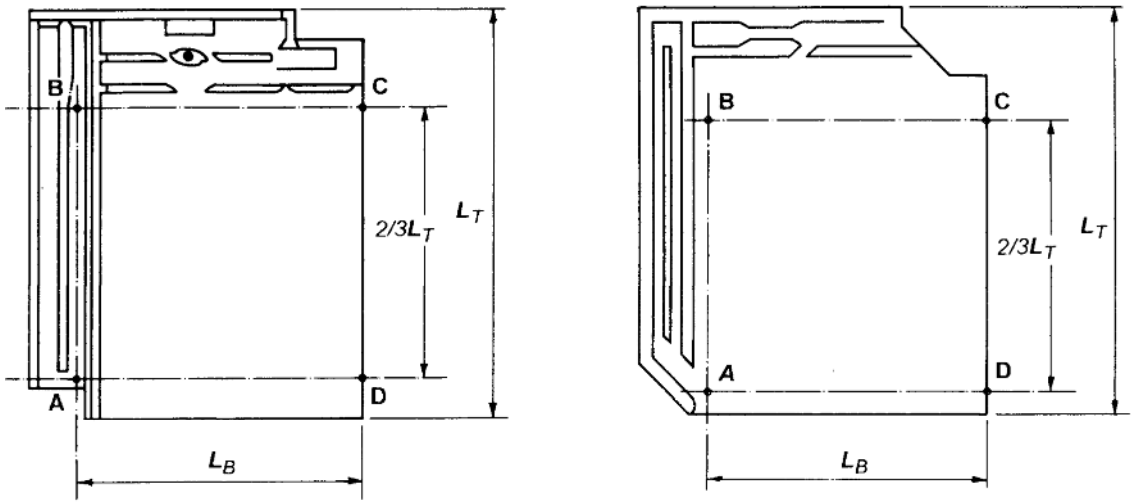


Figure 13

5.3.1.2.4 Expression of results

The twist coefficient is calculated as absolute value of the difference in height (I H I) and from the following formula:

$$C = \text{I } H \text{ I} \times 100 / (L_B + L_A) \text{ in percentage} \quad (8)$$

where for tiles with sidelock and headlock, tiles with headlock only and overlapping tiles.

with I H I as absolute value of the difference height of the measured point related to the reference level in mm

with L_A basis length, distance of the measuring points in length direction

with L_B basis length, distance of the measuring points in width direction

5.3.2 Uniformity of transverse profiles

NOTE This measurement only applies to over -and under- tiles.

5.3.2.1 Apparatus

A rule or measuring device graduated to the nearest 0,5 mm.

5.3.2.2 Procedure

Measure to the nearest 0,5 mm the distance between the inside edges of the tile at its two ends either E_1 or E_2.

5.3.2.3 Expression of results

Calculate the difference between the greatest and smallest values E_1 of the width measured at the narrow part of the tile, as well as the difference between the greatest and smallest values E_2 of the width of the tile measured at the wide part of the tile.

6 Test report

The test report shall state for each type of test:

a) number of this standard, EN 1024;

b) name of the test laboratory;

c) date on which the laboratory received the sample;

d) date of the test;

e) a description and identification of the tile, including the type, the manufacturer's name and, wherever possible, the production date;

f) results recorded or calculated according to each test (expression of results);

g) relevant manufacturer's specifications;

h) any remarks concerning the test;

i) signature of the person in charge of the test.

Annex A
(informative)

Example of twist measurement device for tiles with sidelock and headlock, tiles with sidelock only and overlapping tiles

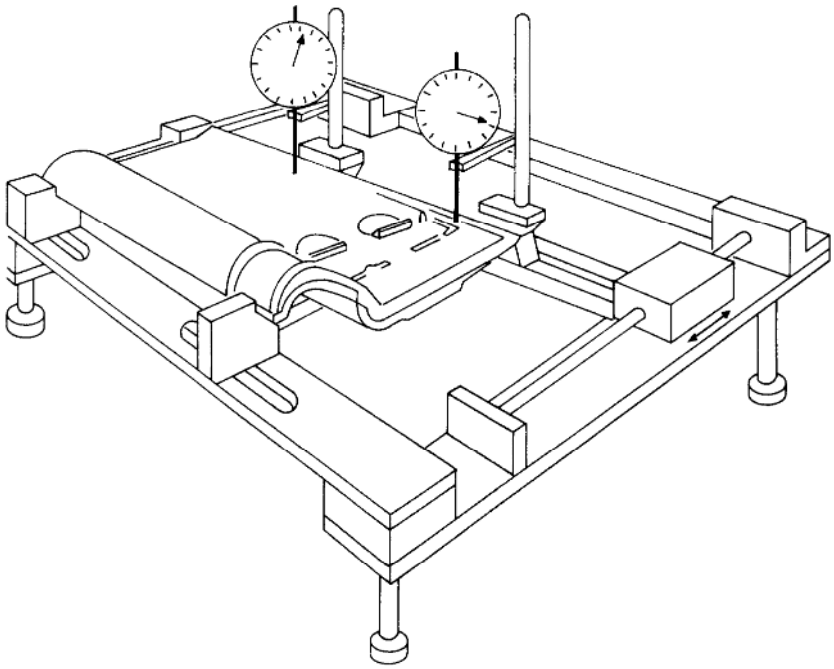


Figure A.1 – Example of twist measurement device for tiles with sidelock and headlock, tiles with sidelock only and overlapping tiles

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