INTERNATIONAL STANDARD

ISO 10545-2

Second edition
2018-09

Ceramic tiles —

Part 2:
Determination of dimensions and surface quality

Carreaux et dalles céramiques —

Partie 2: Détermination des caractéristiques dimensionnelles et de la qualité de surface

COPYRIGHT PROTECTED DOCUMENT

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso .org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 189, *Ceramic tile.*

This second edition cancels and replaces the first edition (ISO 10545-2:1995) which has been technically revised. It also incorporates the Technical Corrigendum ISO 10545-2:1995/Cor 1:1997.

The main changes compared to the previous edition are as follows:

— for the measurement of length and width, the deviation shall be reported as a percentage and in millimetres;

— for the measurement of thickness, the deviation shall be reported as a percentage and in millimetres;

— for the measurement of straightness of sides, the deviation shall be reported as a percentage and in millimetres;

— for the measurement of the centre curvature, edge curvature and warpage, the deviation shall be reported as a percentage and in millimetres;

— tests specimens sampling has been changed;

— for rectangularity measurements of oblong tiles with longer edge ≥60 cm, and ratio between longer edge and shorter edge ≥3, only δ_L and percent deviation shall be determined; as a consequence, the test report is modified accordingly.

A list of all parts in the ISO 10545 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Ceramic tiles —

Part 2:
Determination of dimensions and surface quality

1 Scope

This document specifies methods for determining the dimensional characteristics (length, width, thickness, straightness of sides, rectangularity, surface flatness) and the surface quality of ceramic tiles.

Tiles with areas less than 4 cm^2 are excluded from measurements of length, width, straightness of sides, rectangularity and surface flatness.

NOTE   Spacer lugs and glaze blobs and other irregularities of the sides are intended to be ignored when measuring length, width, straightness of sides, rectangularity, if these are subsequently hidden in the joints after fixing (installation).

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
straightness of sides
deviation from straightness of the centre of the side in the plane of the tile

Note 1 to entry: See Figure 1.

3.2
deviation from rectangularity
measurement of the departure from squareness of each corner of a tile

Note 1 to entry: It is expressed in millimetres.

Note 2 to entry: See Figures 3 a) and b).

3.3
surface flatness measurement
measurements in three positions on the surface of tiles

Note 1 to entry: Tiles that have relief on the proper surface preventing measurement on that surface shall, where possible, be measured on the back.

3.4
centre curvature
departure of the centre of a tile from the plane in which three of the four corners lie

Note 1 to entry: See Figure 4.

3.5
edge curvature
departure of the centre of one edge of a tile from the plane in which three of the four corners lie

Note 1 to entry: See Figure 5.

3.6
warpage
departure of the fourth corner of the tile from the plane in which the other corners lie

Note 1 to entry: See Figure 6.

3.7
crack
fracture in the body of the tile visible on the face or the back or both

3.8
crazing
fracture of the glaze that appears as irregular hairline *cracks* (3.7)

3.9
dry spot
area on the face of a glazed tile which has no glaze

3.10
unevenness
depression in the surface of a tile or a glaze

3.11
pin hole
tiny pit in the surface of a glazed tile

3.12
glaze devitrification
crystallization of the glaze which is visually apparent

3.13
speck
spot
visually contrasting area in the tile face

3.14
underglaze fault
apparent fault covered by glaze

3.15
decorating fault
apparent fault in decoration

3.16
chip
fragment broken off from the edges, corners or surface of a tile

3.17
blister
small surface bubble or blow-out resulting from the expulsion of gas during firing

3.18
rough edge
irregularity along the edge of a tile

3.19
welt
unusually heavy accumulation of glaze in the form of a ridge along the edge

3.20
polishing defect
polishing effect
visual inconsistency resulting from the polishing process Note 1 to entry: Polishing defects include, but are not limited to, uneven polishing, inconsistent reflectivity, abrasive mark or grinder mark not fully removed from polishing, etc.

Note 1 to entry: Some optical characteristics are not included and are determined with specialized equipment.

4   Measurement of length and width

4.1   Apparatus

Vernier calipers, or other suitable apparatus for linear measurement.

4.2   Test specimens

Sampling is done as follows:

— for tiles with area, **A ≤ 0,04 m^2**, ten whole tiles in each type shall be tested;

— for tiles with area, **0,04 m^2 < A ≤ 0,36 m^2**, seven whole tiles in each type shall be tested;

— for tiles with area, **A > 0,36 m^2,** five whole tiles in each type shall be tested.

4.3   Procedure

Measure, to the nearest 0,1 mm, each side of the tile under test, at positions 5 mm from the corners.

4.4   Expression of results

The average dimension of square tiles is the average of four measurements. The average dimension of the sample is the average of 40 measurements.

For oblong tiles, each similar pair of sides of a tile provides the appropriate average dimension of the tile, i.e. an average of two measurements. The average dimensions for length and width of the sample are the average of 20 measurements each.

4.5   Test report

The test report shall include the following information:

a)   reference to this document;

b)   a description of the tiles;

c)   all individual measurements of length and width;

d)   the average size of each test specimen for square tiles, and the average length and width for each oblong tile;

e) the average size of the whole sampling for square tiles, and the average length and width for oblong tiles;

f) the deviation, as a percentage and in millimetres, of the average size of each tile (two or four sides) from the work size;

g) the deviation, as a percentage and in millimetres, of the average size of each tile (two or four sides) from the average size determined in (e).

5 Measurement of thickness

5.1 Apparatus

Micrometer screw gauge with anvils, of 5 mm to 10 mm diameter, or any other suitable instruments that can reproduce the measurements procedure described in 5.3.

5.2 Test specimens

Sampling is done as follows:

— For tiles with area, $A \leq 0,04\ m^2$, ten whole tiles in each type shall be tested.

— For tiles with area, $0,04\ m^2 < A \leq 0,36\ m^2$, seven whole tiles in each type shall be tested.

— For tiles with area, $A > 0,36\ m^2$, five whole tiles in each type shall be tested.

5.3 Procedure

For all tiles, except those with uneven surfaces, draw diagonals between the corners and measure the thickness at the thickest point within each of the four segments. All thickness measurements should include the dimensions of the ribs/panel mark or back-feet present at the back of the tile. Measure, to the nearest 0,1 mm, the thickness of each tile under test in four positions.

For tiles with uneven surfaces, draw four lines at right angles across the face at distances of 0,125; 0,375; 0,625 and 0,875 times the length measured from the end. Measure the thickness at the thickest point on each line.

5.4 Expression of results

For all the tiles, the average dimension of each individual tile is the average of four measurements.

5.5 Test report

The test report shall include the following information:

a) reference to this document;

b) a description of the tiles;

c) all individual measurements of thickness;

d) the average thickness of each tile;

e) the deviation, as a percentage and in millimetres, of the average thickness of each tile from the work size thickness.

6 Measurement of straightness of sides

6.1 Calculation

The measurement is only relevant to the straight sides of tiles (Figure 1) and is expressed as:

— deviation, C, in millimetres;

— a percentage, using the formula.

$$\frac{C}{L} \times 100$$

where

C is the deviation from straightness at the centre of the measured side;
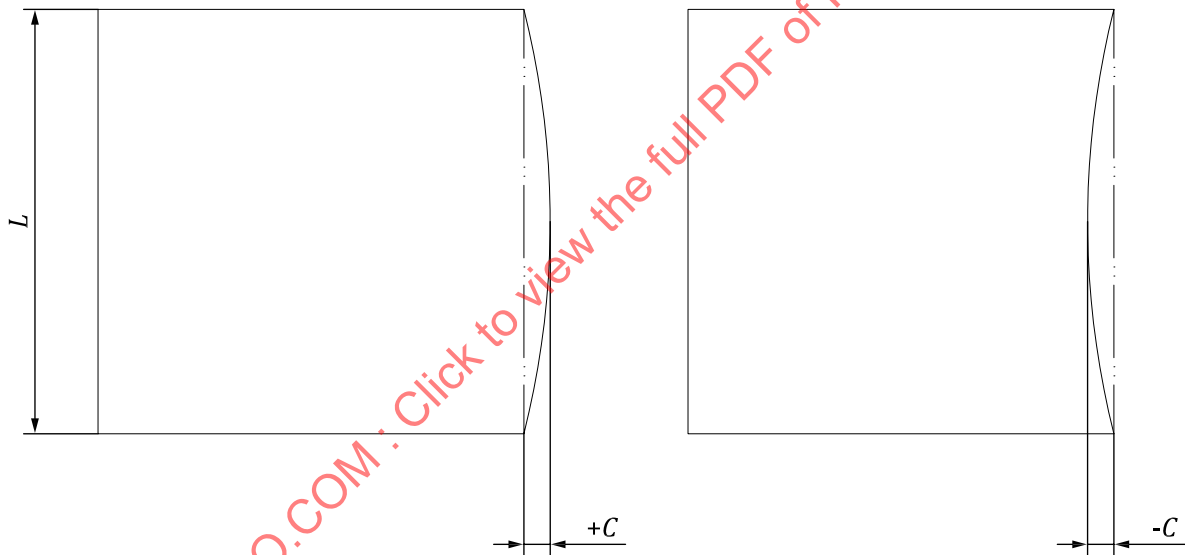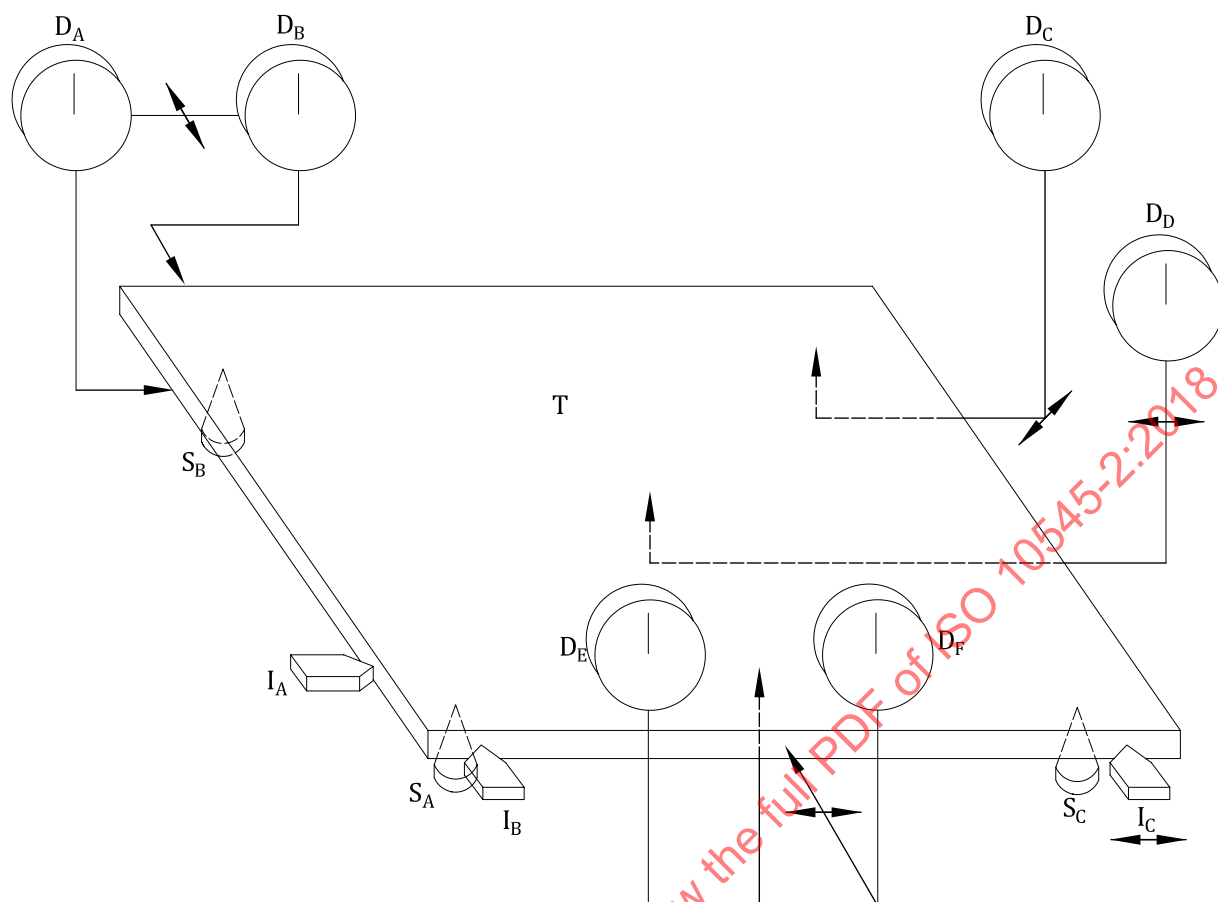
L is the work size of the measured side.

Figure 1 — Straightness of sides

6.2 Apparatus

6.2.1 Apparatus, any suitable instrument that can reproduce the measurements procedure described in 6.4 (example of an apparatus is shown in Figure 2).

The dial gauge (D_F) is used for measuring the straightness of sides.

Key

T	tile
S_A, S_B, S_C	supporting studs
I_A, I_B, I_C	locating studs
D_A, D_B, D_C, D_D, D_E, D_F	dial gauges

Figure 2 — Example of an apparatus for the measurement of straightness of sides, rectangularity and surface flatness

6.2.2   Calibrating plate, of accurate dimensions and with straight, flat sides.

6.3   Test specimens

Sampling is done as follows:

— For tiles with area, **A ≤ 0,04 m²**, ten whole tiles in each type shall be tested.

— For tiles with area, **0,04 m² < A ≤ 0,36 m²**, seven whole tiles in each type shall be tested.

— For tiles with area, **A > 0,36 m²,** five whole tiles in each type shall be tested.

6.4   Procedure

Select an apparatus of the appropriate dimensions (6.2.1) so that, when a tile is placed in the apparatus, on the supporting studs (S_A, S_B, S_C), the locating studs (I_A, I_B, I_C) are 5 mm from each corner of the side being measured. see Figure 2.

Fit the appropriate calibrating plate (6.2.2) exactly into position on the instrument, and adjust the dial gauge reading to a suitable known value.

Remove the calibrating plate, place the proper surface of the tile on the locating studs in the apparatus, and record the dial gauge reading in the centre of the side. If the tile is square, rotate it to obtain four measurements. Repeat this procedure for each tile being tested. In the case of oblong tiles, use separate instruments of the appropriate dimensions to measure lengths and widths. Measure to the nearest 0,1 mm.

6.5 Test report

The test report shall include the following information:

a) reference to this document;

b) a description of tiles;

c) all individual measurements of straightness of sides;

d) the maximum deviation from straightness, in millimetres and as a percentage related to the corresponding work sizes.

7 Measurement of rectangularity

7.1 Calculation

If a corner of a tile is placed against the angle of an accurate calibrating plate [see Figures 3 a and b)], deviation from rectangularity is expressed as:

— deviation, δ, in millimetres for square tiles [see Figure 3 a)] and deviation, δ_L and δ_S, for oblong tiles [see Figure 3 b)];

— a percentage, using the formula:

$$\frac{\delta}{L} \times 100 \text{ for square tiles, and } \frac{\delta_L}{S} \times 100 \text{ and } \frac{\delta_S}{L} \times 100 \text{ for oblong tiles}$$

where

δ is the deviation of the outer corner of the side of the tile (measured 5 mm from the corner) from the inner side of the calibrating plate;

L and S are the work size of the sides (in millimetres) of the tile per Figures 3 a) and b).
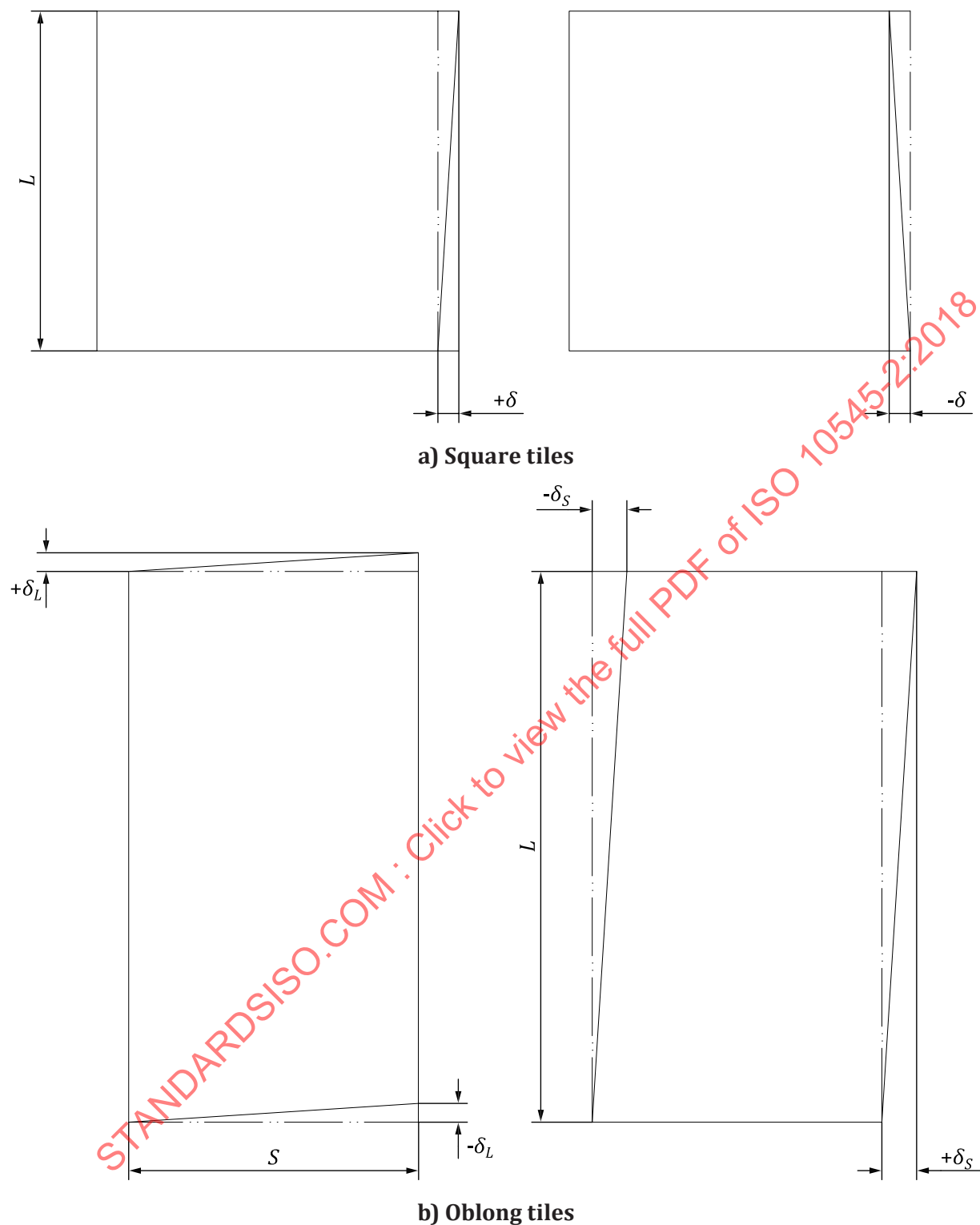
Figure 3 — Rectangularity

7.2 Apparatus

7.2.1 Apparatus, any suitable instrument that can reproduce the measurements procedure described in 7.4 (example of an apparatus is shown in Figure 2).

The dial gauge (D_A) is used for measuring rectangularity.

7.2.2   Calibrating plate, of accurate dimensions and with straight, flat sides.

7.3   Test specimens

Sampling is done as follows:

— For tiles with area, **A ≤ 0,04 m^2**, ten whole tiles in each type shall be tested.

— For tiles with area, **0,04 m^2 < A ≤ 0,36 m^2**, seven whole tiles in each type shall be tested.

— For tiles with area, **A > 0,36 m^2,** five whole tiles in each type shall be tested.

7.4   Procedure

Select an apparatus of the appropriate dimensions (7.2.1) so that, when a tile is placed in the apparatus, on the supporting studs (S$_A$, S$_B$, S$_C$), the locating studs (I$_A$, I$_B$, I$_C$) are 5 mm from each corner of the side adjacent to the side being measured (See Figure 2.) The plunger of the dial gauge (D$_A$) shall also be 5 mm from the corner of the tile on the side being measured (see Figure 2).

Fit the appropriate calibrating plate (7.2.2) exactly into position on the instrument, and adjust the dial gauge reading to a suitable known value.

Remove the calibrating plate, place the proper surface of the tile on the locating studs in the apparatus, and record the dial gauge reading 5 mm from the corner. If the tile is square, rotate it to obtain four measurements. Repeat this procedure for each edge of a square tile. Repeat this procedure for each tile being tested. In the case of oblong tiles, use separate instruments of the appropriate dimensions to measure lengths and widths. Measure to the nearest 0,1 mm.

For oblong tiles with longer edge ≥60 cm, and ratio between longer edge and shorter edge ≥3, only δ_L and percent deviation shall be determined [see Figure 3 b)].

7.5   Test report

The test report shall include the following information:

a)   reference to this document;

b)   a description of the tiles;

c)   all individual measurements of rectangularity;

d)   the maximum deviation from rectangularity, in millimetres and as a percentage related to the corresponding work sizes, except for oblong tiles when the longer edge ≥60 cm, and the ratio between the longer edge and the shorter edge ≥3, only report δ_L and percent deviation $\dfrac{\delta_L}{S}$ [see Figure 3 b)].

8   Measurements of surface flatness (curvature and warpage)

NOTE   Measurements of surface flatness are not possible where the accuracy of the feeler gauge measurement would be impacted due to surface characteristics of the tile.

8.2   Apparatus

8.2.1   For tiles larger than 40 mm × 40 mm

8.2.1.1   Apparatus, any suitable instrument that can reproduce the measurements procedure described in 8.4 (example of an apparatus is shown in Figure 2).

In order to measure smooth-surfaced tiles, the supporting studs (S_A, S_B, S_C) shall be 5 mm in diameter. In order to obtain meaningful results for other tile surfaces, suitable supporting studs shall be used.

8.2.1.2   A perfectly flat calibrating plate, of metal or glass, and at least 10 mm thick for the apparatus described in 8.2.1.1.

8.2.2   For tiles of dimensions 40 mm × 40 mm or less

8.2.2.1   Metal straightedge.

8.2.2.2   Thickness-feeler gauges.

8.3   Test specimens

Sampling is done as follows:

— For tiles with area, **$A \leq 0,04\ m^2$**, ten whole tiles in each type shall be tested.

— For tiles with area, **$0,04\ m^2 < A \leq 0,36\ m^2$**, seven whole tiles in each type shall be tested.

— For tiles with area, **$A > 0,36\ m^2$,** five whole tiles in each type shall be tested.

8.4   Procedure

8.4.1   For tiles larger than 40 mm × 40 mm

Select an apparatus of the appropriate size (8.2.1.1) and place the corresponding calibrating plate (8.2.1.2) exactly into position on top of the three accurately positioned studs (S_A, S_B, S_C). The centre of each stud shall be 10 mm from the side of the tile, and the two outer dial gauges (D_E, D_C) shall be 10 mm from the sides of the tile.

Adjust the three dial gauges (D_D, D_E, D_C) to a suitable known value (see Figure 2).

Remove the calibrating plate, place a tile on the apparatus with the glaze or proper surface downwards, and record the three dial gauge readings. If the tile is square, rotate it to obtain four measurements of each property. Repeat this procedure for each tile being tested. In the case of oblong tiles, use separate instruments of the appropriate dimensions. Record the maximum centre curvature (D_D), edge curvature (D_E) and warpage (D_C) for each tile. Measure to the nearest 0,1 mm.