BRITISH STANDARD

BS EN ISO
10545-2:1997

Ceramic tiles —

Part 2: Determination of dimensions and surface quality

The European Standard EN ISO 10545-2:1997 has the status of a British Standard

ICS 91.100.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee B/539, Ceramic tiles and other rigid tiling, upon which the following bodies were represented:

Association of Building Engineers
British Adhesives and Sealants Association
British Ceramic Research Ltd.
British Ceramic Tile Council
Building Research Establishment
Chartered Institute of Building
Concrete Society
Construction Confederation
Consumer Policy Committee of BSI
Contract Flooring Association
Federation of Master Builders
Federation of Resin Formulators and Applicators
Health and Safety Executive
Institute of Clerks of Works of Great Britain
London Underground Ltd.
Mortar Producers' Association
National Federation of Clay Industries
National Federation of Terrazzo, Marble and Mosaic Specialists
National Master Tile Fixers' Association
National Tile, Faience and Mosaic Fixers' Society
Natural Slate Quarries Association
Royal Institute of British Architects
Stone Federation

This British Standard, having been prepared under the direction of the Sector Board for Building and Civil Engineering, was published under the authority of the Standards Board and comes into effect on 15 November 1997

The following BSI references relate to the work on this standard:
Committee reference B/539
Draft for comment 93/107015 DC

ISBN 0 580 28654 1

Amendments issued since publication

Amd. No.	Date	Comments

Contents

National foreword

This British Standard has been prepared by Technical Committee B/539 and is the English language version of EN ISO 10545-2:1997 *Ceramic tiles — Part 2: Determination of dimensions and surface quality*, published by the European Committee for Standardization (CEN). It is technically equivalent to ISO 10545-2:1995, including its Technical Corrigendum 1:1997, published by the International Organization for Standardization (ISO). It supersedes BS 6431-10:1984, which will be withdrawn when Parts 1 to 16 of BS EN ISO 10545 have all been published.

This Part of BS EN ISO 10545 was originally drafted by CEN/TC 67, *Ceramic tiles*, as EN 98, published in 1984, and confirmed in 1991. Subsequently the European Standard was revised by ISO as a Part of ISO 10545, which has now been approved by CEN as a Part of EN ISO 10545.

The editorial modifications mentioned in the EN ISO foreword have been made in this BS EN ISO text.

The technical changes from the method described in BS 6431-10 are as follows.

For the measurement of straightness of sides, rectangularity and surface flatness, a single diagrammatic figure replaces Figure 1 and Figure 2. The material of the calibrating plate for this measuring apparatus is not restricted to steel when measuring straightness and rectangularity.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN ISO title page, pages 2 to 10 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 10545-2

July 1997

ICS 91.100.20

Supersedes EN 98:1991

Descriptors: Ceramics, tiles, tests, determination, dimensions, surface condition, dimensional measurements

English version

Ceramic tiles — Part 2: Determination of dimensions and surface quality

(ISO 10545-2:1995, including Technical Corrigendum 1:1997)

Carreaux et dalles céramiques —
Partie 2: Détermination des caractéristiques dimensionelles et de la qualité de surface
(ISO 10545-2:1995, Rectificatif Technique 1:1997 inclus)

Keramische Fliesen und Platten —
Teil 2: Bestimmung der Maße und der Oberflächenbeschaffenheit
(ISO 10545-2:1995, einschließlich Technische Korrektur 1:1997)

This European Standard was approved by CEN on 1997-05-01. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN ISO 10545-2:1997 E

Foreword

The text of the International Standard from Technical Committee ISO/TC 189, Ceramic tiles, of the International Organization for Standardization (ISO) has been taken over as a European Standard by Technical Committee CEN/TC 67, Ceramic tiles, the secretariat of which is held by UNI.

This European Standard supersedes EN 98:1991.

EN ISO 10545 consists of the following Parts, under the common title *Ceramic tiles*.

— *Part 1: Sampling and basis for acceptance;*

— *Part 2: Determination of dimensions and surface quality;*

— *Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density;*

— *Part 4: Determination of modulus of rupture and breaking strength;*

— *Part 5: Determination of impact resistance by measurement of coefficient of restitution;*

— *Part 6: Determination of resistance to deep abrasion for unglazed tiles;*

— *Part 7: Determination of resistance to surface abrasion for glazed tiles;*

— *Part 8: Determination of linear thermal expansion;*

— *Part 9: Determination of resistance to thermal shock;*

— *Part 10: Determination of moisture expansion;*

— *Part 11: Determination of crazing resistance for glazed tiles;*

— *Part 12: Determination of frost resistance;*

— *Part 13: Determination of chemical resistance;*

— *Part 14: Determination of resistance to stains;*

— *Part 15: Determination of lead and cadmium given off by glazed tiles;*

— *Part 16: Determination of small colour differences;*

— *Part 17: Determination of coefficient of friction.*

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 January 1998, and conflicting national standards shall be withdrawn at the latest by January 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 10545-2:1995 and ISO Technical Corrigendum 1:1997 has been approved by CEN as a European Standard without technical modifications, but with the following editorial modifications:

Existing ISO text	ISO text modified
5.1.1, fourth line: "calculate"	**5.1.1**, fourth line: "calculated"
7.1.13, NOTE 1, fourth line: "Cracks, nipped edges and nipped corners cannot..."	**7.1.13**, NOTE 1, fourth line: "Cracks and chips cannot..."
7.6 d): "the assessment of criteria used;"	**7.6** d): "the assessment criteria used;"

1 Scope

This part of ISO 10545 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.

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

2 Measurement of length and width

2.1 Apparatus

2.1.1 *Vernier calipers*, or other suitable apparatus for linear measurement.

2.2 Test specimens

Ten whole tiles shall be submitted to measurements.

2.3 Procedure

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

2.4 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.

2.5 Test report

The test report shall include the following information:

a) reference to this part of ISO 10545;

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 10 test specimens for square tiles, and the average length and width for oblong tiles;

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

g) the deviation, as a percentage, of the average size of each tile (two or four sides) from the average size of the 10 test specimens (20 or 40 sides).

3 Measurement of thickness

3.1 Apparatus

3.1.1 *Micrometer screw gauge with anvils*, of 5 mm to 10 mm diameter, or other suitable apparatus.

3.2 Test specimens

Ten whole tiles shall be submitted to measurements.

3.3 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. 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.

3.4 Expression of results

For all the tiles, the average dimension of each individual tile is the average of four measurements. The average thickness of the sample is the average of 40 measurements.

3.5 Test report

The test report shall include the following information:

a) reference to this part of ISO 10545;

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 or in millimetres (as required by the product standard), of the average thickness of each tile from the work size thickness.

4 Measurement of straightness of sides

4.1 Definition

For the purposes of this part of ISO 10545, the following definition applies.

4.1.1
straightness of sides
the deviation from straightness of the centre of the side in the plane of the tile

the measurement is only relevant to the straight sides of tiles (Figure 2) and is calculated as 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 length of the measured side.

4.2 Apparatus

4.2.1 *Apparatus*, as shown in Figure 1, or any other suitable instrument.

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

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

4.3 Test specimens

Ten whole tiles shall be submitted to measurements.

4.4 Procedure

Select an apparatus of the appropriate dimensions (**4.2.1**) 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 1.)

Fit the appropriate calibrating plate (**4.2.2**) 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.

4.5 Test report

The test report shall include the following information:

a) reference to this part of ISO 10545;

b) a description of tiles;

c) all individual measurements of straightness of sides;

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

5 Measurement of rectangularity

5.1 Definition

For the purposes of this part of ISO 10545, the following definition applies.

5.1.1
deviation from rectangularity
if a corner of a tile is placed against the angle of an accurate calibrating plate (see Figure 3), deviation from rectangularity is calculated as a percentage, using the formula

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

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 is the length of the adjacent side of the tile.

5.2 Apparatus

5.2.1 *Apparatus*, as shown in Figure 1, or any other suitable instrument.

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

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

5.3 Test specimens

Ten whole tiles shall be submitted to measurements.

5.4 Procedure

Select an apparatus of the appropriate dimensions (**5.2.1**) 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_S, I_C) are 5 mm from each corner of the side adjacent to the side being measured. (See Figure 1.) 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 1.)

Fit the appropriate calibrating plate (**5.2.2**) 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.

5.5 Test report

The test report shall include the following information:

a) reference to this part of ISO 10545;

b) a description of the tiles;

c) all individual measurements of rectangularity;

d) the maximum deviation from rectangularity, as a percentage related to the corresponding work sizes.

6 Measurements of surface flatness (curvature and warpage)

6.1 Definitions

For the purposes of this part of ISO 10545, the following definitions apply.

6.1.1
surface flatness
defined by measurements in three positions on the surface of tiles

tiles that have relief on the proper surface preventing measurement on that surface shall, where possible, be measured on the back

6.1.2
centre curvature
the departure of the centre of a tile from the plane in which three of the four corners lie (See Figure 4.)

6.1.3
edge curvature
the departure of the centre of one edge of a tile from the plane in which three of the four corners lie (See Figure 5.)

6.1.4
warpage
the departure of the fourth corner of the tile from the plane in which the other corners lie (See Figure 6.)

6.2 Apparatus

6.2.1 *For tiles larger than 40 mm × 40 mm*

6.2.1.1 *Apparatus*, as shown in Figure 1, or any other suitable instrument.

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.

6.2.1.2 *A perfectly flat calibrating plate*, of metal or glass, and at least 10 mm thick for the apparatus described in **6.2.1.1**.

6.2.2 *For tiles of dimensions 40 mm × 40 mm or less*

6.2.2.1 *Metal straightedge*

6.2.2.2 *Thickness-feeler gauges*

6.3 Test specimens

Ten whole tiles of each type shall be submitted to measurements.

6.4 Procedure

6.4.1 *For tiles larger than 40 mm × 40 mm*

Select an apparatus of the appropriate size (**6.2.1.1**) and place the corresponding calibrating plate (**6.2.1.2**) 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 1.)

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.

6.4.2 *For tiles of dimensions 40 mm × 40 mm or less*

In order to measure edge curvature, place a straightedge (**6.2.2.1**) across the edges and measure the gap under the straightedge using the feeler gauges (**6.2.2.2**). Determine the centre curvature in the same manner, but along diagonals.

There shall be no warpage measurement.

6.5 Expression of results

Centre curvature is expressed as a percentage of the length of the diagonal.

Edge curvature is expressed as a percentage of

— the length and width for oblong tiles;

— the size for square tiles.

Warpage is expressed as a percentage of the length of the diagonal. Measurements for tiles with spacer lugs shall be expressed in millimetres.

6.6 Test report

The test report shall include the following information:

a) reference to this part of ISO 10545;

b) a description of tiles;

c) all individual measurements of centre curvature;

d) all individual measurements of edge curvature;

e) all individual measurements of warpage;

f) the maximum centre curvature, as a percentage or in millimetres (as required by the product standard), related to the diagonal calculated from the work size;

g) the maximum edge curvature, as a percentage or in millimetres (as required by the product standard), related to the corresponding work size;

h) the maximum warpage, as a percentage or in millimetres (as required by the product standard), related to the diagonal calculated from the work sizes.

7 Surface quality

7.1 Definitions of surface defects and intentional effects

For the purposes of this part of ISO 10545, the following definitions apply.

7.1.1
cracks
any fracture in the body of the tile visible on the face or the back or both

7.1.2
crazing
fracture of the glaze that appears as irregular hairline cracks

7.1.3
dry spots
areas on the face of a glazed tile which have no glaze

7.1.4
unevenness
an unintentional depression in the surface of a tile or a glaze

7.1.5
pin hole
tiny pit in the surface of a glazed tile

7.1.6
glaze devitrification
unintentional crystallization of the glaze which is visually apparent

7.1.7
specks or spots
any unintentional visually contrasting areas in the tile face

7.1.8
underglaze fault
any apparent fault covered by glaze

7.1.9
decorating fault
any apparent fault in decoration

7.1.10
chip
fragment broken off from the edges, corners or surface of a tile

7.1.11
blister
small surface bubble or blow out resulting from the expulsion of gas during firing

7.1.12
rough edge
any unintentional irregularity along the edge of a tile

7.1.13
welt
unusually heavy accumulation of glaze in the form of a ridge along the edge

NOTE 1 In order to judge whether an intentional decorative effect is acceptable or whether there is a defect, the relevant clause of the product standard should be referred to. Cracks and chips cannot be intentional effects.

7.2 Apparatus

7.2.1 *Fluorescent lighting*, of colour temperature 6 000 K to 6 500 K.

7.2.2 *A 1 m ruler*, or other suitable means of measuring distance.

7.2.3 *A light meter*

7.3 Test specimens

At least 1 m^2 of tiles and a minimum of 30 of them shall be examined.

7.4 Procedure

Place the tiles, with the proper surface under observation, so that they can be viewed perpendicularly to the surface at a distance of 1 m. Illuminate them with an even light intensity of 300 lx at the surface of the tiles and check the light intensity at the centre and each corner of the area of tiles being examined.

View the tiles with the naked eye or with spectacles if usually worn.

The preparation of the test area and the viewing for the test shall not be performed by the same person.

Intentional effects in the surface shall not be regarded as defects.

7.5 Expression of results

Surface quality is expressed as the percentage of tiles without defects.

7.6 Test report

The test report shall include the following information:

a) reference to this part of ISO 10545;

b) a description of tiles;

c) the number of tiles examined;

d) the assessment criteria used;

e) the percentage of tiles without defects.

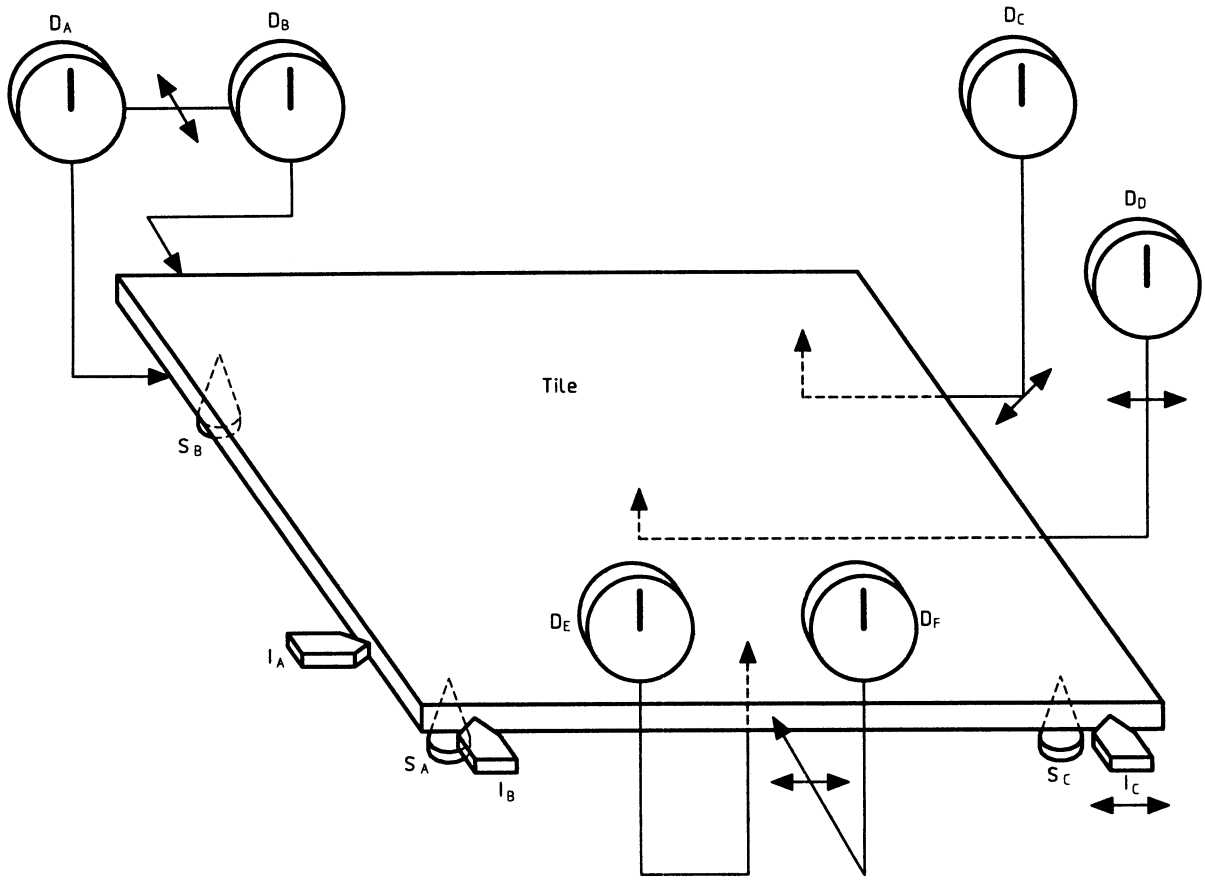

Figure 1 — Apparatus for the measurement of straightness of sides, rectangularity and surface flatness

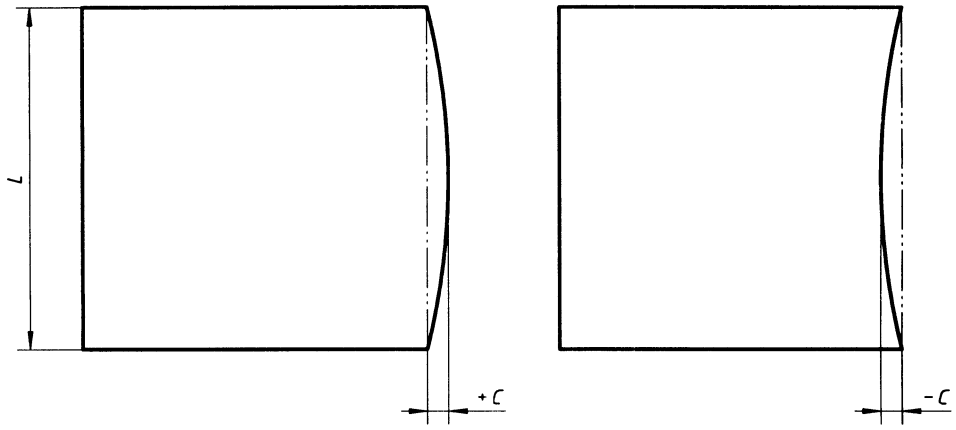

Figure 2 — Straightness of sides

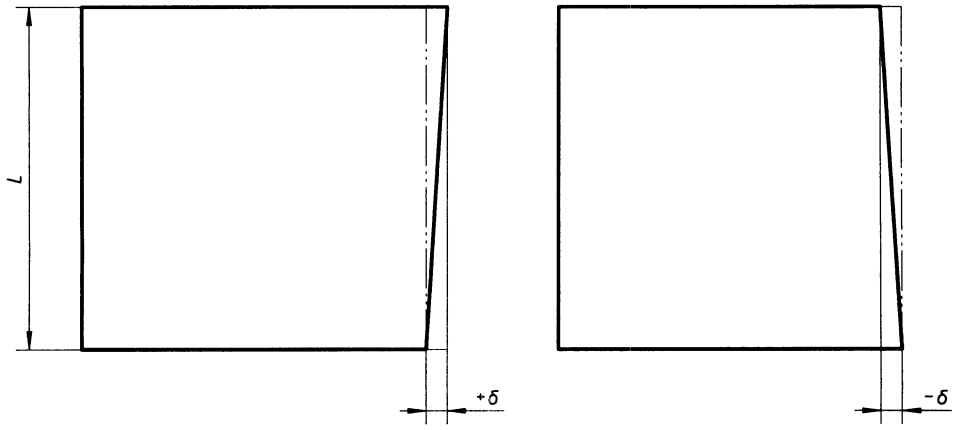

Figure 3 — Rectangularity

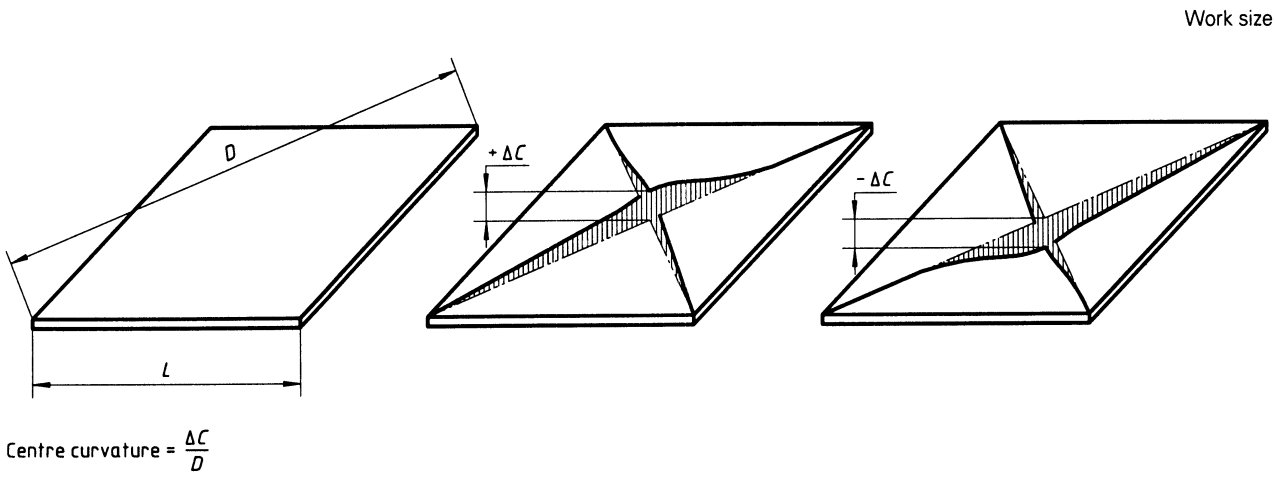

Figure 4 — Centre curvature

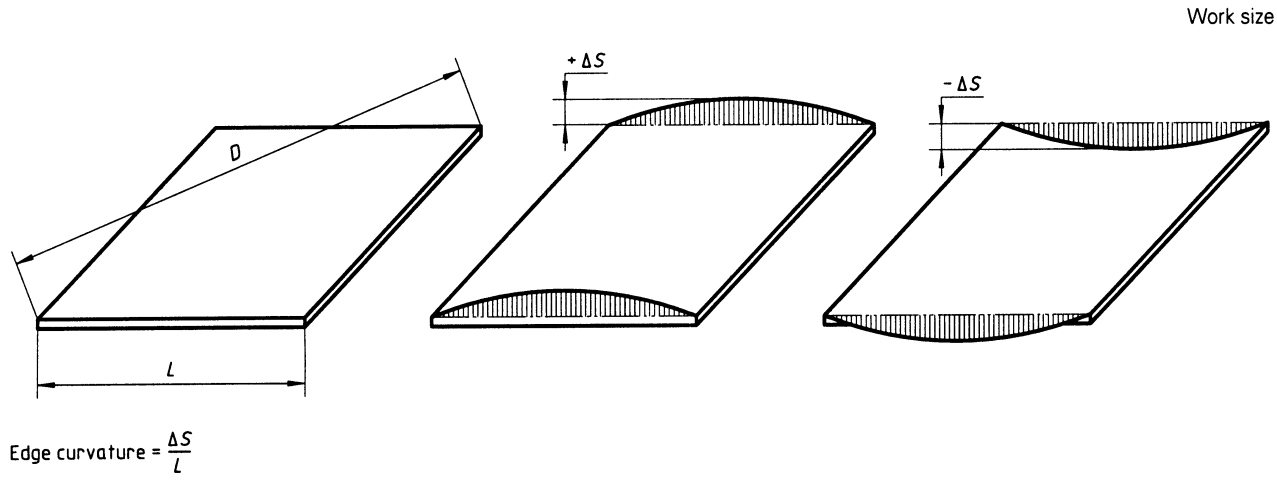

Figure 5 — Edge curvature

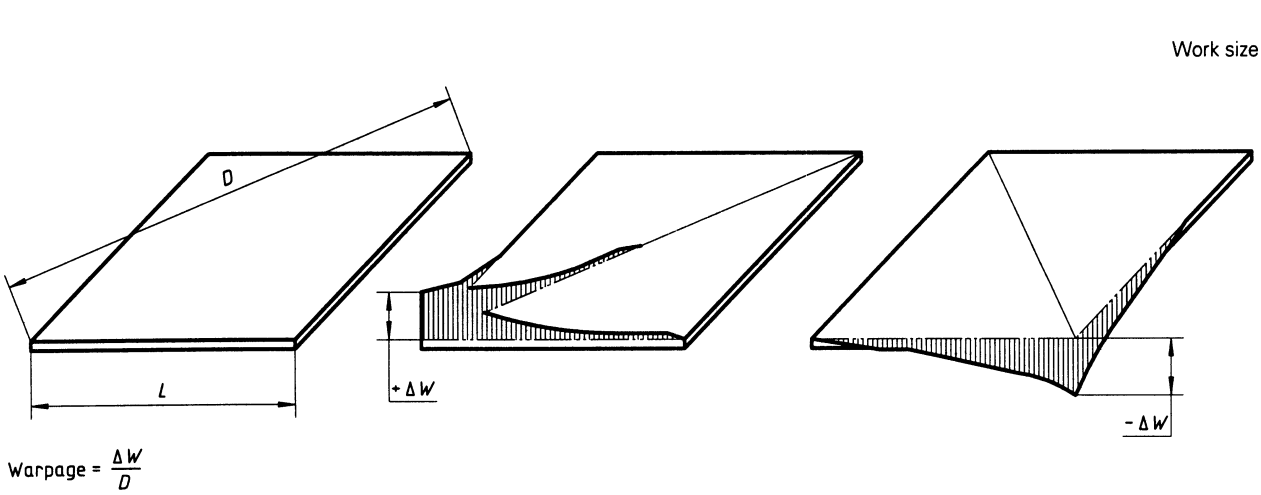

Figure 6 — Warpage

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL