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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



Reference number
ISO 10545-2:1995(E)

Foreword

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International Standard ISO 10545-2 was prepared by Technical Committee ISO/TC 189, *Ceramic tile*.

ISO 10545 consists of the following parts, under the general 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*

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- 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

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Ceramic tiles —

Part 2:

Determination of dimensions and surface quality

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 cm² 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:

- reference to this part of ISO 10545;
- a description of the tiles;
- all individual measurements of thickness;
- the average thickness of each tile;
- 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) (see 5.4) 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:

- reference to this part of ISO 10545;
- a description of tiles;
- all individual measurements of straightness of sides;
- 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 calculate 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_B , 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:

- reference to this part of ISO 10545;
- a description of the tiles;
- all individual measurements of rectangularity;
- 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 edge 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 centre 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 x 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 x 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 x 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 x 40 mm or less

In order to measure edge curvature, place a straight-edge (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, nipped edges and nipped corners 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 m² 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 of criteria used;
- e) the percentage of tiles without defects.

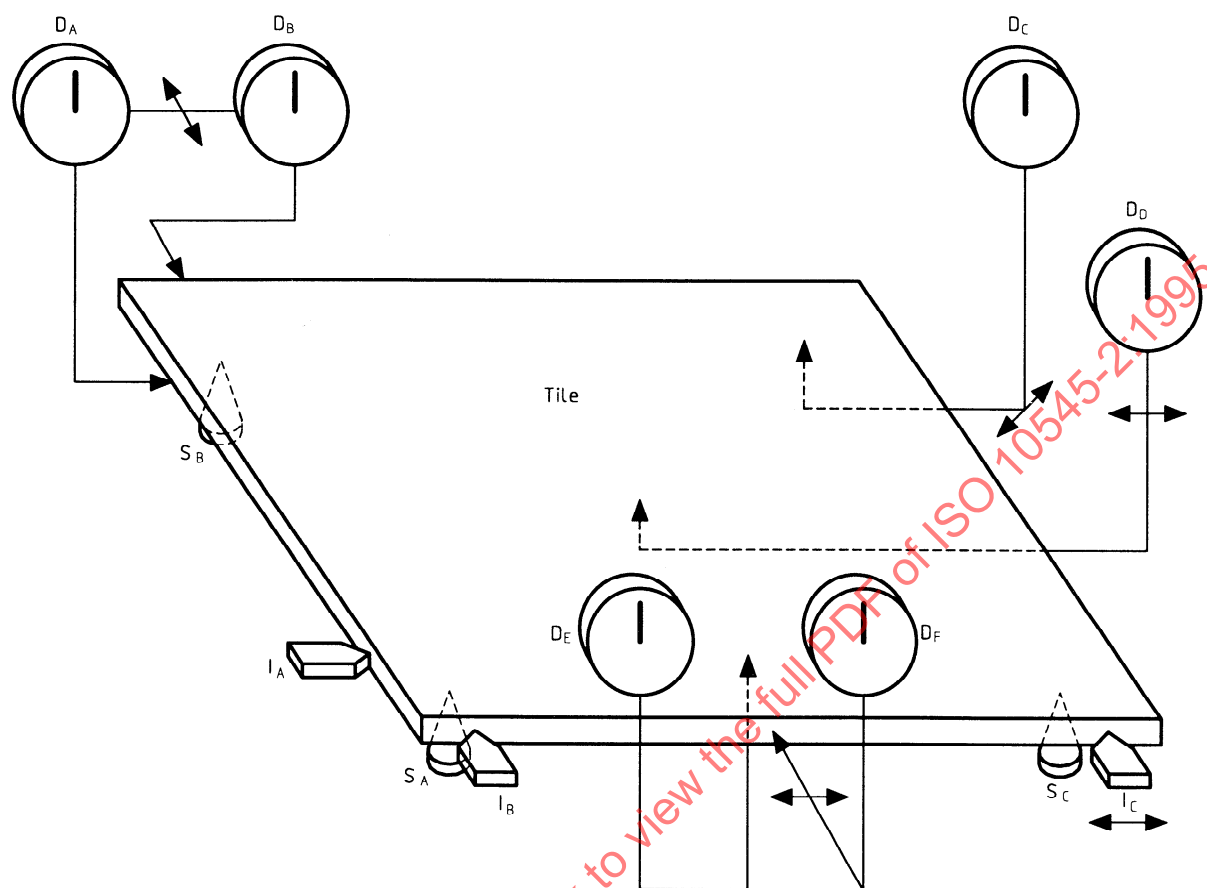
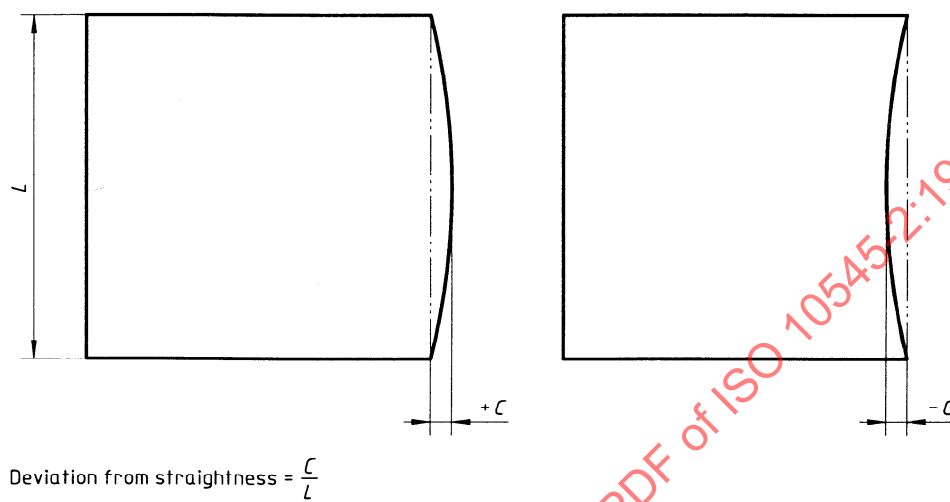
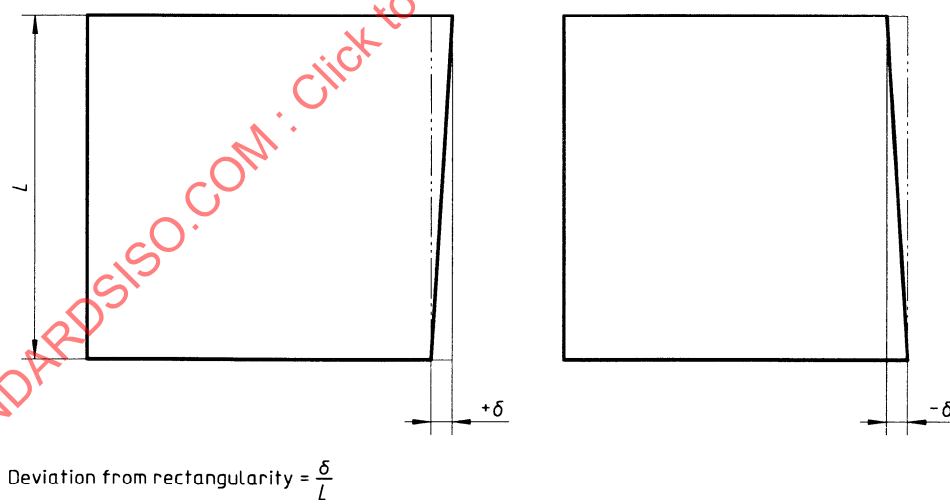
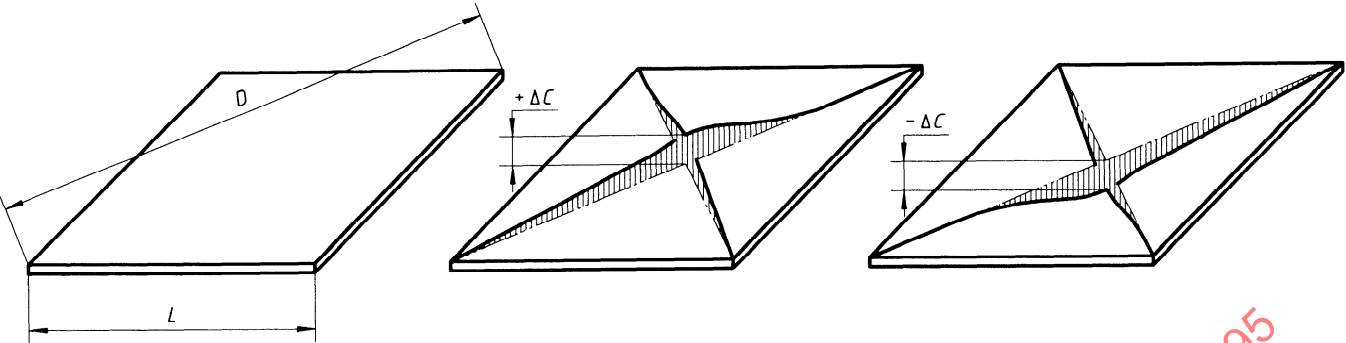


Figure 1 — Apparatus for the measurement of straightness of sides, rectangularity and surface flatness

**Figure 2 — Straightness of sides****Figure 3 — Rectangularity**

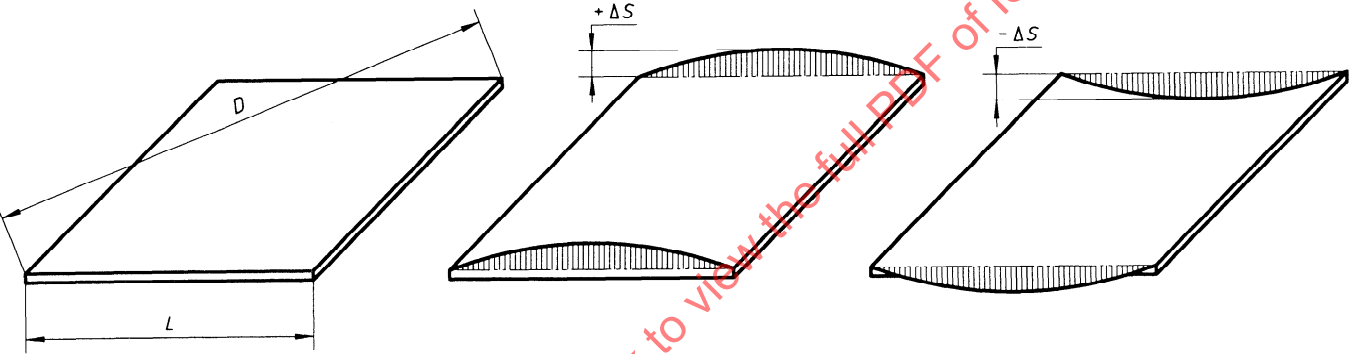
Work size



Centre curvature = $\frac{\Delta C}{D}$

Figure 4 — Centre curvature

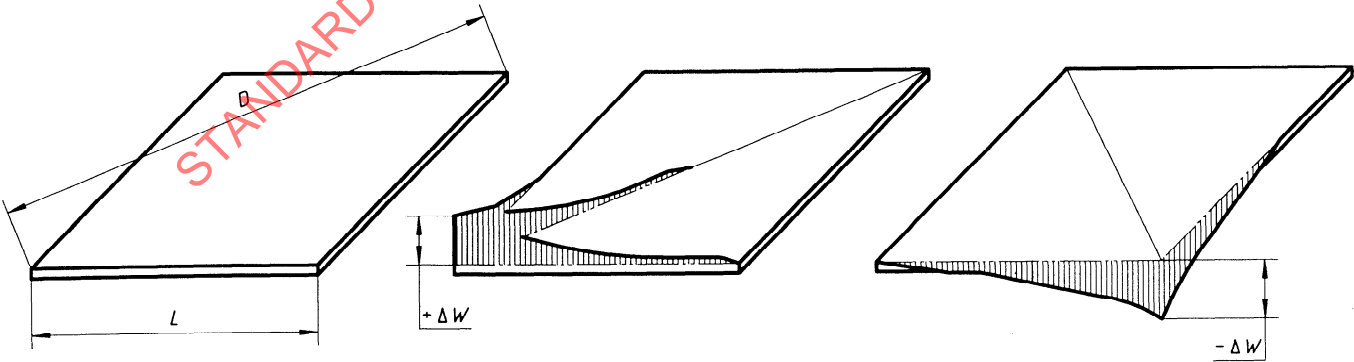
Work size



Edge curvature = $\frac{\Delta S}{L}$

Figure 5 — Edge curvature

Work size



Warpage = $\frac{\Delta W}{D}$

Figure 6 — Warpage