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High-pressure decorative laminates (HPL, HPDL) — Sheets based on thermosetting resins (usually called laminates) — Part 2: Determination of properties

Stratifiés décoratifs haute pression (HPL, HPDL) -- Plaques à base de résines thermodurcissables (communément appelées stratifiés) -- Partie 2: Détermination des caractéristiques

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

This seventh edition cancels and replaces the sixth edition (ISO 4586-2:2015) which has been technically revised.

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

— correction of errors due to typographical, formatting, and omission issues.

A list of all parts in the ISO 4586 series can be found on the ISO website.

Introduction

In an effort to harmonize ISO 4586 with other high-pressure decorative laminate standards, multiple methods may be published that demonstrate similar properties. In these instances, the same test method title is given and is annotated as either “Method A” or “Method B”. This is the case in the following tests: Edge squareness — 8/9, Dry heat — 17/18 Dimensional stability at elevated temperatures — 19/20, Dimensional stability at ambient temperature — 21/22, Staining — 30/31, Lightfastness — 32/33, Formability — 38/39, and Blistering — 40/41. In these instances, either method may be utilized in testing. Compliance to both methods is not required. While these tests are similar they are by no means identical and results of one method do not necessarily correspond to the results of the accompanying test. In these situations, it is intended that the documentation in specific parts of ISO 4586 for performance requirements be consulted. Each specific method has performance requirements particular to that method for individual grades of high-pressure decorative laminate.

This document has been harmonized with EN 438-2 whenever possible.

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High-pressure decorative laminates (HPL, HPDL) — Sheets based on thermosetting resins (usually called laminates) — Part 2: Determination of properties

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1 Scope

This document specifies the methods of test for determination of the properties of high-pressure decorative laminates (HPL, HPDL) as defined in Clause 3. These methods are primarily intended for testing the sheets specified from ISO 4586-3 to ISO 4586-8.

The precision of the test methods specified in Clauses 5, 6, 7, 8, 9, 10, 13, 14, 16, 19, 20, 21, 22, 24, 25, 26, 39, and 40 is not known because interlaboratory data are not available. When interlaboratory data are obtained, precision statements will be added to the test methods at the following revision. As all the other test methods have an end point determination based on subjective judgement, it is not meaningful to make a statement of precision in these cases.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 62, *Plastics — Determination of water absorption*

Deleted: ISO 62, *Plastics — Determination of water absorption* ... [1]

ISO 105-A02, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

ISO 178, *Plastics — Determination of flexural properties*

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ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 1770, *Solid-stem general purpose thermometers*

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ISO 3668, *Paints and varnishes — Visual comparison of colour of paints*

ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance*

ISO 4892-2:2013, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 4892-3, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 9352, *Plastics — Determination of resistance to wear by abrasive wheels*

ISO 9370, *Plastics — Instrumental determination of radiant exposure in weathering tests — General guidance and basic test method*

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ISO 12945-2, *Textiles — Determination of fabric propensity to surface fuzzing and to pilling — Part 2: Modified Martindale method*

ISO 12947-1, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 1: Martindale abrasion testing apparatus*

EN 312, *Particleboards — Specifications*

Deleted: EN 312, *Particleboards — Specifications*¶ ... [4]

EN 316, *Wood fibreboards — Definition, classification and symbols*

ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*

CIE publication no. 85:1989, *Solar spectral irradiance*

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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:

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

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

3.1
high-pressure decorative laminate
HPL
HPDL
sheet consisting of layers of cellulosic fibrous material (normally paper) impregnated with thermosetting resins and bonded together by the *high-pressure process* (3.2)

Note 1 to entry: This is a general definition of high-pressure decorative laminate(s). More specific product definitions can be found from ISO 4586-3 to ISO 4586-8.3.2.

3.2
high-pressure process
simultaneous application of heat (temperature ≥ 120 °C) and high specific pressure (≥ 5 MPa), to provide flowing and subsequent curing of the thermosetting resins to obtain a homogeneous non-porous material with increased density (≥ 1,35 g/cm^3), and with the required surface finish

3.3
rub
<microscratch resistance> one revolution of the two outer drives of the Martindale tester

3.4
cycle
<microscratch resistance> completion of all the translational movements tracing a *Lissajous figure* (3.5) comprising 16 *rubs* (3.3)

3.5
Lissajous figure

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<microscratch resistance> figure created by movement which ranges changes from a circle gradually narrowing ellipses, until it becomes a straight line, from which progressively widening ellipses develop, in a diagonally opposite direction before the pattern is repeated

Note 1 to entry: This comprises 16 revolutions of the two outer drives and 15 revolutions of the inner drive of the Martindale tester.

4 Assessment of appearance

4.1 Principle

Laminates shall be inspected for surface appearance under standardised conditions of lighting and viewing.

4.2 Apparatus

4.2.1 Horizontal inspection table, of height approximately 700 mm and large enough to accommodate the largest sheets to be inspected.

4.2.2 Overhead white fluorescent lights, of colour temperature approximately 5 000 K and giving an intensity of 800 lx to 1 000 lx over the whole area of the largest sheets to be inspected. A convenient distance of the lights from the inspection table is approximately 1,5 m.

4.3 Test specimen

The specimen shall be the laminate under test, as supplied by the manufacturer.

4.4 Procedure

Place the laminate, decorative face uppermost, on the inspection table. Wipe it free of any loose contamination with a soft cloth, using a suitable cleaning agent if necessary. Inspect it from the distance required by the relevant part of ISO 4586 for defects such as smudges, smears, fingerprints, scratches, foreign particles, damage, or any other form of blemish evident within the decorative surface.

The inspector shall use normal vision, corrected if necessary.

4.5 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 4586-2;

b) name, type and nominal thickness of the product;

c) size of the laminate under test;

d) viewing distance;

e) total area of spot-type defects in square millimetres;

f) total length of hair-like defects in millimetres;

g) any deviation from the specified test method;

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h) date of the test.

5 Determination of thickness

5.1 Principle

The thickness of a laminate is measured using a micrometer or a dial gauge indicator.

5.2 Apparatus

5.2.1 Thickness gauge, (ratchet-type micrometer or dial gauge indicator), having two flat parallel measuring surfaces of diameter 6 mm and capable of being read to 0,01 mm.

When the thickness of a decorative laminate is being measured, the two surfaces shall exert a pressure of 10 kPa to 100 kPa upon each other.

5.3 Test specimen

The specimen shall be the laminate under test, as supplied by the manufacturer.

5.4 Procedure

Check the gauge for accuracy and then determine the thickness of the laminate to the nearest 0,01 mm. The thickness shall be measured at the centre of each edge, at a distance of at least 20 mm from the edge of the sheet.

5.5 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 4586-2;

b) name, type and nominal thickness of the product;

c) all values measured;

d) any deviation from the specified test method;

e) date of the test.

6 Determination of length and width

6.1 Principle

Measuring the length and width of the laminate using a metal tape or rule.

6.2 Apparatus

6.2.1 Steel tape or rule, of sufficient length to measure the greatest dimension of the laminate, and graduated to allow a reading accuracy of 1 mm.

6.3 Test specimen

The specimen shall be the laminate under test, as supplied by the manufacturer.

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6.4 Procedure

Apply the steel tape or rule (see 6.2.1) to each edge of the laminate in turn, on a line approximately 25 mm from and parallel to the edge. Measure the length on each edge to the nearest 1 mm.

6.5 Expression of results

The arithmetical means of the pairs of length and width measurements shall be calculated and expressed to the nearest 1 mm as the length and width of the laminate.

6.6 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 4586-2;

b) name, type and nominal thickness of the product;

c) length and width values;

d) any deviation from the specified test method;

e) date of the test.

7 Determination of edge straightness

7.1 Principle

Applying a metal straightedge to the edge of the laminate and measuring the deviation of the sheet edge from the metal straightedge using a steel rule.

7.2 Apparatus

7.2.1 Metal straightedge, of 1 000 mm length.

7.2.2 Steel rule, graduated in 0,5 mm divisions.

7.3 Test specimen

The specimen shall be the laminate under test, as supplied by the manufacturer.

7.4 Procedure

Apply the metal straightedge (see 7.2.1) to each edge of the laminate in turn, and use the steel rule (see 7.2.2) to measure the maximum deviation of the edge of the laminate from the metal straightedge (x in Figure 1) to the nearest 0,5 mm.

7.5 Expression of results

The maximum deviation from the metal straightedge shall be recorded for each of the four edges. Results shall be designated (+) if the edge is convex, and (−) if the edge is concave.

7.6 Test report

The test report shall include the following information:

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a) a reference to this document, i.e. ISO 4586-2;

b) name, type and nominal thickness of the product;

c) test result for each of the four edges;

d) any deviation from the specified test method;

e) date of the test.

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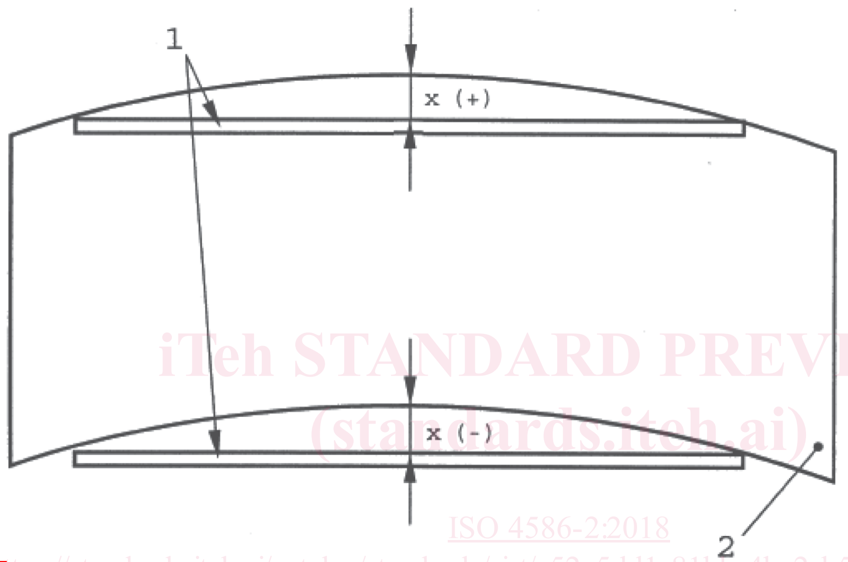

Key

1 metal straightedge

2 laminate

Figure 1 — Edge straightness measurement

8 Determination of edge squareness (Method A)

8.1 Principle

Applying a right-angled square to the corner of the laminate and measuring the deviation of the edge from the square using a steel rule.

8.2 Apparatus

8.2.1 Right-angled square, with one arm of at least 1 000 mm long (see Figure 2).

8.2.2 Steel rule, graduated in 0,5 mm divisions.

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8.3 Test specimen

The specimen shall be the laminate under test as supplied by the manufacturer.

8.4 Procedure

Apply the right-angled square (see 8.2.1) to one corner of the laminate and measure the deviation of the edge of the laminate from the arm of the square at a distance of 1 m from the corner. Record the results to the nearest 0,5 mm. Repeat the procedure with the square applied to the diagonally opposite corner of the laminate.

Dimensions in millimetres

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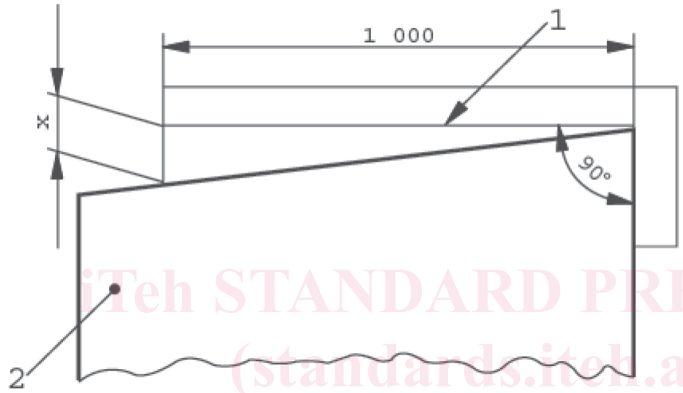

Key

1 right-angled square

2 laminate

Figure 2 — Edge squareness measurement

8.5 Expression of results

The maximum deviation from the square shall be recorded for the two diagonally opposite corners (x in Figure 2).

8.6 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 4586-2;

b) name, type and nominal thickness of the product;

c) test result;

d) any deviation from the specified test method;

e) date of the test.

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9 Determination of edge squareness (Method B)

9.1 Principle

To determine the squareness of a laminate by measuring the length of diagonal dimensions.

9.2 Apparatus

9.2.1 Steel rule, graduated in 0,5 mm divisions.

9.3 Test specimen

The specimen shall be the laminate under test as supplied by the manufacturer.

9.4 Procedure

Measure the distance from one corner to the opposite corner and record as $L1$. Measure the opposite diagonal and record as $L2$ (see Figure 3).

EXAMPLE $|L1 - L2|$ = Squareness.

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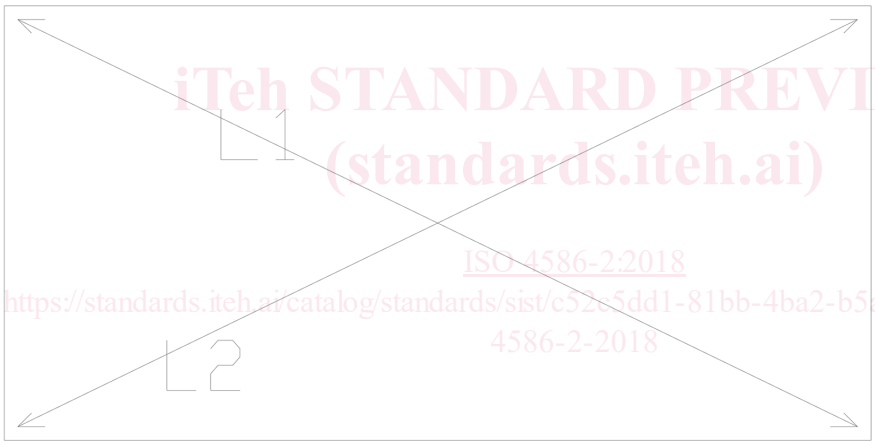

Figure 3 — Squareness

9.5 Expression of results

Squareness is determined as the absolute value of the difference of $L1$ from $L2$.

9.6 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 4586-2;

b) name, type and nominal thickness of the product;

c) test result;

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d) any deviation from the specified test method;

e) date of the test.

10 Determination of flatness

10.1 Principle

Measuring the bow (flatness deviation) of the laminate using a bow gauge placed at the position of greatest deformation.

10.2 Apparatus

10.2.1 Bow gauge, of length 1 000 mm graduated to permit a reading accuracy of 0,1 mm (see Figure 4).

Dimensions in millimetres

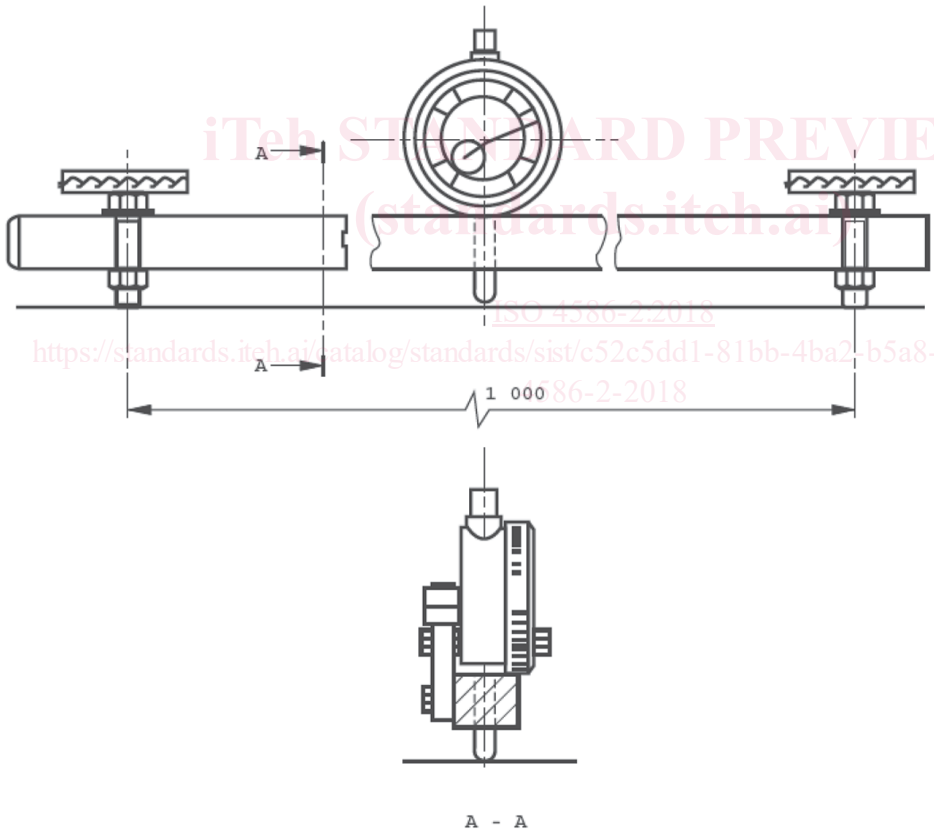

Figure 4 — Bow gauge for measuring flatness

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10.3 Test specimens

The specimen shall be the laminate as supplied by the manufacturer. In cases of dispute the laminate shall be pre-conditioned in accordance with the manufacturer's recommendations until equilibrium is reached.

10.4 Procedure

Place the laminate concave side up without restraint on a flat horizontal surface.

Place the bow gauge (see 10.2.1) so that the three feet (two fixed and one movable) are lightly touching the surface of the laminate in the area of greatest deformation, and measure the flatness deviation (shown on the dial gauge) to the nearest 0,1 mm.

10.5 Expression of results

The maximum flatness deviation measured using the bow gauge shall be recorded.

10.6 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 4586-2;

b) name, type and nominal thickness of the product;

c) maximum flatness deviation;

d) any deviation from the specified test method;

e) date of the test.

11 Resistance to surface wear

11.1 Principle

The test measures the ability of the decorative surface of the laminate under test to resist abrasive wear through to the sub-layer. Abrasion is achieved by rotating a specimen in contact with a pair of loaded cylindrical wheels covered with abrasive paper. The wheels are positioned so that their cylindrical faces are equidistant from the specimen's axis of rotation but not tangential to it. As they are turned by the rotating specimen they abrade an annular track on the specimen's surface. The numbers of revolutions of the specimen required to cause defined degrees of abrasion are used as measures of resistance to surface wear. This test is not applicable to flooring grade laminates.

11.2 Materials

11.2.1 Calibration plates of rolled zinc sheet, (Taber S-34 or equivalent), having a thickness of (0,8 ± 0,1) mm and a Brinell hardness of (48 ± 2) when tested in accordance with ISO 6506-1, except that the ball diameter shall be 5 mm and the load 360 N.

11.2.2 Abrasive paper strips

a) paper of grammage 70 g/m² to 100 g/m²;

Deleted: Dimensions in millimetres¶

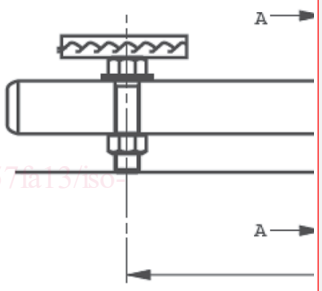

Figure 4 — Bow gauge for measuring flatness¶

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