SLOVENSKI STANDARD
SIST EN 438-2:1999

01-maj-1999

Okrasni visokotlaļ ni laminati (HPL) ï Ploģļ e iz duromerov - 2. del: Ugotavljanje lastnosti (ISO 4586-2:1988, modificiran)

Decorative high-pressure laminates (HPL) - Sheets based on thermosetting resins - Part 2: Determination of properties (ISO 4586-2:1988, modified)

Dekorative Hochdruck-Schichtpreßstoffplatten (HPL) - Platten auf Basis härtbarer Harze - Teil 2: Bestimmung der Eigenschaften (ISO 4586-2:1988, modifiziert)

Stratifiés décoratifs haute pression (HPL) - Plaques a base de résines thermodurcissables - Partie 2: Détermination des caractéristiques (ISO 4586-2:1988, modifiée)

Ta slovenski standard je istoveten z: **EN 438-2:1991**

ICS:

83.140.20	Laminatne ploģļ e	Laminated sheets

SIST EN 438-2:1999 **en**

EUROPEAN STANDARD

NORME EUROPEENNE

EUROPAISCHE NORM

EN 438-2:1991

May 1991

UDC 674.03:674.812.2-41:620.1

Descriptors: Plastics, laminated plastics, decorative coatings, thermosetting resins, plates, tests, characteristics

English version

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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 438-2:1991 E

Foreword

This draft European Standard has been drawn up by a CEN ad hoc group for decorative laminates. It has been prepared as a result of the primary questionnaire procedure (PQ) based on ISO 4586-2 : 1988.

The principal modifications compared with the International Standard are:

- rewriting of clauses 6 and 12;

- introduction of clause 27.

According to the common CEN/CENELEC rules, the following countries are bound to implement this European Standard:
Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

1 Scope and field of application

This part of EN 438 specifies the methods of test for determination of the properties of decorative high-pressure laminated sheets (HPL) as defined in clause 3. These methods are primarily intended for testing the sheets specified in EN 438-1.

2 References

EN 438-1	High pressure decorative laminates (HPL) - Sheets based on thermosetting resins - Part 1 : Specifications.
ISO 48	Vulcanized rubbers - Determination of hardness (Hardness between 30 and 85 IRHD).
ISO 62	Plastics - Determination of water absorption.
ISO 4892	Plastics - Methods of exposure to laboratory light sources.
ISO 6506	Metallic materials - Hardness test - Brinell test.

3 Definition

For the purpose of this standard the following definition applies:

decorative high-pressure laminated sheet (HPL) : A sheet consisting of layers of fibrous sheet material (for example paper) impregnated with thermosetting resins and bonded together by means of heat and a pressure of not less than 7 MPa*, a layer or layers on one or both sides having decorative colours or designs.

Decorative high-pressure laminated sheet (HPL) as defined in this standard is made from core layers impregnated with phenolic and/or aminoplastic resins and a surface layer or layers impregnated with aminoplastic resins (mainly melamine resins).

* 1 MPa = 1 MN/m^2

4 Thickness

4.1 Principle

Measurement of the thickness using a micrometer or a dial gauge indicator.

4.2 Apparatus

Thickness gauge (ratchet-type micrometer or dial gauge indicator), having two flat parallel measuring surfaces of diameter at least 6 mm and capable of being read to 0,01 mm. When the thickness of a decorative laminated sheet is being measured, the two surfaces shall exert a pressure of 10 to 100 kPa upon each other.

4.3 Test specimen

The specimen shall be the sheet under test, as received.

4.4 Procedure

Check the gauge for accuracy and then determine the thickness of the sheet to the nearest 0,02 mm. It is recommended that the thickness should be measured at a minimum of four points and at a distance of at least 20 mm from the edge of the sheet.

4.5 Test report

The test report shall include the following information:

a) a reference to this part of EN 438;

b) the name and type of product;

c) all values measured;

d) the location of the points at which measurements were made;

e) any deviation from the specified test method;

f) the date of the test.

5 Appearance

5.1 Surface defects

5.1.1 Principle

Inspection of sheets for surface appearance under standardized conditions of lighting and viewing.

5.1.2 Apparatus

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

5.1.2.2 Overhead white fluorescent lights, of colour temperature approximately 5 000 K and giving an intensity of 800 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.

5.1.3 Test specimen

The test specimen shall be the sheet under test, as received.

5.1.4 Procedure

Place the sheet, decorative face uppermost, on the inspection table. Wipe it free of any loose contamination, if necessary, with a soft cloth. Inspect it from the distance required by EN 438-1 for defects such as smudges, smears, finger-prints, scratches, foreign particles, damage or any other form of blemish evident within the decorative surface.

The inspector shall have normal vision, corrected if necessary. No magnifying glass shall be used in viewing the sheet.

5.1.5 Test report

The test report shall include the following information:

a) a reference to this part of EN 438;

b) the name and type of product;

c) the viewing distance and any defects observed;

d) any deviation from the specified test method;

f) the date of the test.

5.2 Warping

5.2.1 Apparatus

Straightedge, of 1 000 mm length, with micrometer (see figure 1).

5.2.2 Test specimen

The test specimen shall be the sheet under test, as received, stored in the conditions recommended by the manufacturer.

5.2.3 Procedure

Place the sheet under test concave side up on a flat surface. Measure the departure between the straightedge and the concave surface of the laminate at various positions.

5.2.4 Test report

The test report shall include the following information:

a) a reference to this part of EN 438;

b) the name and type of product;

c) the maximum warp, in millimetres;

d) any deviation from the specified test method;

e) the date of the test.

6 Resistance to surface wear

6.1 Principle

The test measures the ability of the decorative surface of the sheet 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 number of revolutions of the speciment required to cause a defined degree of abrasion is used as a measure of resistance to surface wear.

6.2 Materials

6.2.1 Calibration plates of rolled zinc sheet, having a thickness of 0,8 ± 0,1 mm and a Brinell hardness of 48 ± 2 when tested in accordance with ISO 6506, except that the ball diameter shall be 5 mm and the load 360 N.

6.2.2 Abrasive paper strips, of width 12,7 mm and length about 160 mm, having the following composition:

a) paper of grammage 70 to 100 g/m^2;

b) powdered aluminium oxide having a particle size such that it will pass through a sieve of aperture 100 um and remain on a sieve having an aperture of 63 um;

c) adhesive backing (optional).

6.2.3 Double-sided adhesive tape, only required if the abrasive paper has no adhesive backing.

6.3 Apparatus

6.3.1 Testing machine consisting of the following items (see figure 2).

6.3.1.1 Specimen holder, in the form of a disc (7) which rotates in a horizontal plane at a frequency of 58 to 62 r/min and to which the test specimen (6) can be clamped flat (5).

6.3.1.2 Abrasive wheels (3): two cylindrical rubber-covered wheels of width 12,7 mm and diameter 50 mm which rotate freely about a common axis. The curved surface of the wheels, to a depth of 6 mm, shall be of rubber (2) of hardness 50 to 55 IRHD when tested according to ISO 48. The inside faces of the wheels shall be 50 to 55 mm apart, and their common axis shall be 20 mm from the vertical axis of the specimen holder. The wheels shall be positioned symmetrically in a plane containing the axis of the specimen holder.

6.3.1.3 Holding and lifting device (8) for the abrasive wheels, so constructed that each wheel exerts a force of 5,4 ± 0,2 N on the test specimen.

6.3.1.4 Revolution counter

6.3.1.5 Suction device, so fitted that two nozzles (4) are over the abraded section of the specimen under test. One nozzle shall be situated between the wheels, the other diametrically opposite. The centres of the nozzles shall be 77 mm apart and 1 to 2 mm from the surface of the test specimen. When the nozzles are closed, there shall be a vacuum of 1,5 to 1,6 kPa.

6.3.2 Conditioning chamber, with a standard atmosphere of 23 ± 2 °C and relative humidity (50 ± 5) %.

6.4 Test specimens

Each test specimen shall be a piece of the sheet under test, shaped to fit the type of clamping device used. It will usually be a disc of diameter about 130 mm, or a square of about 120 mm with its corners rounded to give a diagonal of about 130 mm, and it will usually have a hole of diameter 6 mm in its centre. Three specimens shall be prepared.

6.5 Preparation of test specimens and abrasive paper

Clean the surface of the test specimens with an organic solvent which is immiscible with water, for example 1,1,1-trichloroethane. Precondition the test specimens and the abrasive strips for at least 72 h in the conditioning atmosphere (see 6.3.2) before testing.

6.6 Procedure

6.6.1 Preparation of abrasive wheels

Bond a strip of preconditioned abrasive paper (see 6.2.2) to each of the rubber-covered wheels using either the adhesive backing, if present, or the double-sided adhesive tape (see 6.2.3), in such a way that the cylindrical surface is completely covered, but without any overlapping of the abrasive paper (see figure 2, (1)).

6.6.2 Calibration of abrasive paper

Prepare two abrasive wheels with unused strips of abrasive paper from the batch to be used for testing (see 6.6.1).

Clamp a zinc plate (see 6.2.1) in the specimen holder (see 6.3.1.1), operate the suction device (see 6.3.1.5), and abrade the zinc plate for 500 revolutions. Wipe the zinc plate clean and weigh to the nearest 1 mg. Replace the abrasive paper on the wheels with unused strips from the same batch, clamp the same zinc plate in the specimen holder, lower the abrasive wheels and operate the suction device. Abrade the zinc plate for a further 500 revolutions, then wipe it clean and reweigh it to the nearest 1 mg. Its loss in mass shall be 130 ± 20 mg.

Any batch of abrasive paper which causes a loss in mass of the zinc plate outside this permitted range shall not be used for testing.

6.6.3 Abrasion of test specimen

Perform the test immediately after removal of the test specimen and calibrated abrasive paper from the preconditioning atmosphere.

Prepare sufficient abrasive wheels for the test using previously unused abrasive paper. Fit two wheels to the machine and set the revolution counter (6.3.1.4) to zero.

Clamp the specimen in the holder, ensuring that its surface is flat. Lower the abrasive wheels on to the specimen, operate the suction device and allow the specimen to rotate. Examine the specimen for wear after each 25 revolutions and examine the abrasive paper for clogging with abraded particles. Replace the abrasive paper if it becomes clogged, or after 500 revolutions, whichever happens first.

Continue the test in this way until the initial wear point (IP) is reached. Record the number of revolutions and resume the test until the final wear point (FP) is reached. Record the number of revolutions again.

The initial wear point (IP) is that point at which the first clearly recognizable wear-through of the print, pattern, plain colour coating or solid paper appears and the sub-layer becomes exposed in each of four quadrants. The sub-layer for printed patterns is the background on which the pattern is printed; for plain colours it is the first sub-layer of different colour.

The final wear point (FP) occurs in the case of a patterned laminate when about 95 % of the pattern is removed in the abraded area, and in the case of a plain colour laminate when an underlayer of a different colour is exposed over about 95 % of the abraded area.

Calculate the resistance to surface wear for each sample using the following formula:

$$\text{Resistance to surface wear (revs.)} = \frac{IP + FP}{2}$$

6.7 Expression of results

The initial point (IP) of the sample under test shall be the average of the IP values obtained on the three specimens.

The wear resistance of the sample under test shall be the average of the wear values obtained on the three test specimens, rounded to the nearest 50 revolutions.

6.8 Test report

The test report shall include the following information:

a) a reference to this part of EN 438;

b) identification of product;

c) the date of the test;

d) initial point of the sample under test, expressed as the number of revolutions;

e) resistance to surface wear of the sample under test, expressed as the number of revolutions.

7 Resistance to immersion in boiling water

7.1 Principle

The effect of immersion in boiling water for 2 h is determined by the increase in mass and thickness of a test specimen and by noting the occurence of any blistering or delamination.

The test is generally in accordance with ISO 62, except for a longer period of immersion in the boiling water and the requirement for thickness measurements.

7.2 Apparatus

7.2.1 Balance, accurate to 1 mg.

7.2.2 Oven, capable of being controlled at 50 ± 2 °C.

7.2.3 Vessel, containing boiling distilled water.

7.2.4 Vessel, containing distilled water at 23 ± 2 °C.

7.2.5 Desiccator.

7.2.6 Micrometer, thickness gauge.

7.2.7 Suitable heating apparatus (for example, electric hot-plate).

7.2.8 Specimen holder, to hold specimens vertically during immersion and prevent contact with other specimens or the vessel.

7.3 Test specimens

Each test specimen shall be 50 ± 1 mm square, the thickness of the sheet, and cut in such a way that no appreciable heat is generated and the edges are free from cracks. Cut edges shall be smooth. Three specimens shall be used.

7.4 Procedure

Dry the three test specimens for 24 ± 1 h in the oven (7.2.2), controlled at 50 ± 2 °C, allow to cool in the desiccator (7.2.5) to 23 ± 2 °C, and weigh each specimen to the nearest 1 mg (mass m_1).

Measure the thickness of each specimen as specified in clause 4, but at the centres of its four edges (d_1, d_2, d_3, d_4) and with the external edge of the micrometer anvil approximately 5 mm from each edge. Mark the measuring points so that subsequent measurements can be made in the same places.

Place the specimens in the vessel of boiling distilled water (7.2.3). Take care to prevent the specimens from making contact over any substantial area with one another or with the vessel.

After 2 h ± 5 min, remove the specimens from the boiling water and allow to cool for 15 ± 5 min in the vessel of distilled water maintained at 23 ± 2 °C (7.2.4). Take them from the water and remove all surface water with a clean dry cloth or with filter paper. Weigh the specimens again to the nearest 1 mg (mass m_2) within 1 min of taking them from the water.

Determine the thickness of each test specimen to the nearest 0,01 mm at the same points as before (d_5, d_6, d_7, d_8).

Examine each test specimen visually for change in appearance.

7.5 Expression of results

The boiling water absorbed by each test specimen is given, as a percentage by mass, by the formula

$$\frac{m_2 - m_1}{m_1} \times 100$$

where

m_1 is the mass of the specimen before immersion;

m_2 is the mass of the specimen after immersion.

The percentage increase in thickness at the measuring points of each test specimen is given by the forumulae

$$\frac{d_5 - d_1}{d_1} \times 100$$

$$\frac{d_6 - d_2}{d_2} \times 100, \text{ etc.}$$

where

d_1, d_2, d_3 and d_4 are the thicknesses measured before immersion;

d_5, d_6, d_7 and d_8 are the thicknesses measured after immersion.

The percentage by mass of boiling water absorbed by the sample under test shall be the average of the values obtained on the three test specimens.

The percentage increase in thickness of the sample under test shall be the average of the twelve values obtained at the four measuring points on all three specimens.

7.6 Test report

The test report shall include the following information:

a) a reference to this part of EN 438;

b) the name and type of product;

c) the average percentage increase in mass of the three specimens;

d) the average percentage increase in thickness of the three specimens;