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Dekorativni visokotlaļ ni laminati (HPL) - Ploġļ e na osnovi duromernih smol - 2. del: Ugotavljanje lastnosti

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

Dekorative Hochdruck-Schichtpressstoffplatten (HPL) - Platten auf Basis härtbarer Harze (Schichtpressstoffe) - Teil 2: Bestimmung der Eigenschaften

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

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ICS:

83.140.20	Laminatne ploġļ e	Laminated sheets

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This European Standard was approved by CEN on 10 December 2004.

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Contents

Foreword

This document (EN 438-2:2005) has been prepared by Technical Committee CEN /TC 249, *"Plastics"*, the secretariat of which is held by IBN.

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of an identical text or by endorsement, at the latest by July 2005, and conflicting national standards shall be withdrawn at the latest by July 2005.

This document supersedes EN 438-1:1991 and EN 438-2:1991.

This document is a revision of EN 438:1991 *"High-pressure decorative laminates (HPL) - Sheets based on thermosetting resins (Usually called Laminates)"* and consists of seven parts:

Part 1: *Introduction and general information*

Part 2: *Determination of properties*

Part 3: *Classification and specifications for laminates less than 2 mm thick intended for bonding to supporting substrates*

Part 4: *Classification and specifications for Compact laminates of thickness 2 mm and greater*

Part 5: *Classification and specifications for flooring grade laminates less than 2 mm thick intended for bonding to supporting substrates*

Part 6: *Classification and specifications for Exterior-grade Compact laminates of thickness 2 mm and greater*

Part 7: *Compact laminate and HPL composite panels for internal and external wall and ceiling finishes*

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

1 Scope

This part of EN 438 specifies the methods of test for determination of the properties of high-pressure decorative laminates as defined in Clause 3. These methods are primarily intended for testing the sheets specified in EN 438-3, 4, 5 and 6.

The precision of the test methods specified in Clauses 5, 6, 7, 8, 9, 12, 17, 18, 32 and 33 of this part of EN 438 is not known because inter-laboratory data are not available. When inter-laboratory 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 referenced documents are indispensable for the application 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.

EN 312, *Particleboards — Specifications*

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

EN 20105-A02, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour (ISO 105-A02:1993)*

EN ISO 62, *Plastics — Determination of water absorption (ISO 62:1999)*

EN ISO 105-B02, *Textiles — Tests for colour fastness — Part B02: Colour fastness to artificial light: Xenon arc fading lamp test (ISO 105-B02:1994, including amendment 1:1998)*

EN ISO 178*, Plastics - Determination of flexural properties (ISO 178:2001)*

EN ISO 291, *Plastics — Standard atmospheres for conditioning and testing (ISO 291:1995)*

EN ISO 4892-1, *Plastics - Methods of exposure to laboratory light sources - Part 1: General guidance (ISO 4892-1:1999).*

EN ISO 4892-2:1999, *Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc sources (ISO 4892-2:1994).*

EN ISO 4892-3, *Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps (ISO 4892-3:1994).*

EN ISO 6506-1, *Metallic materials — Brinell hardness test - Part 1: Test method (ISO 6506-1:1999)*

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*

3 Terms and definitions

For the purposes of this document, the following term and definition applies:

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

The high pressure process is defined as the 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/cm³), and with the required surface finish.

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 5000 K and giving an intensity of 800 to 1000 lux 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 EN 438 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) reference to this part of EN 438;

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;

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

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 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) reference to this part of EN 438;

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

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.

6.4 Procedure

Apply the steel tape or rule (see 6.2) 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) reference to this part of EN 438;

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 1000 mm length.

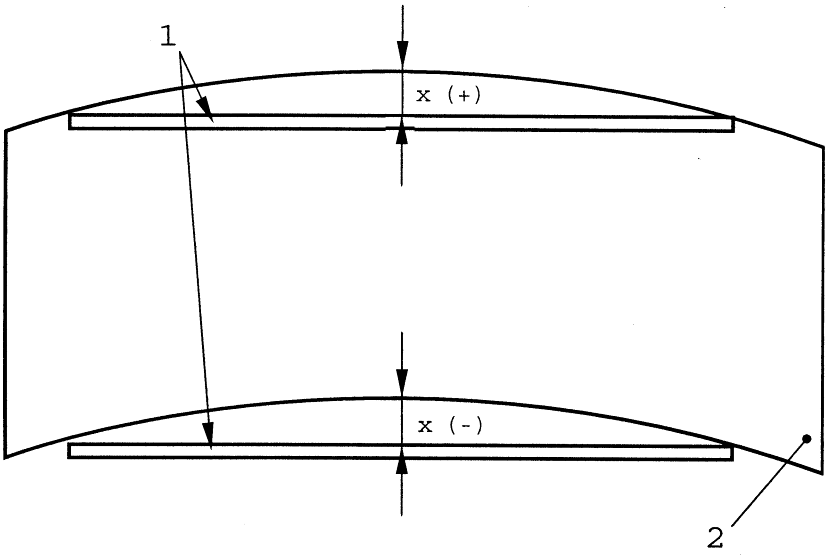
7.2.2 Steel rule, graduated in 0,5 mm divisions.

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.



Key

1 Metal straightedge

2 Laminate

Figure 1 — Edge straightness measurement

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:

a) reference to this part of EN 438;

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.

8 Determination of edge squareness

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 two arms of at least 1000 mm long (see Figure 2).

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

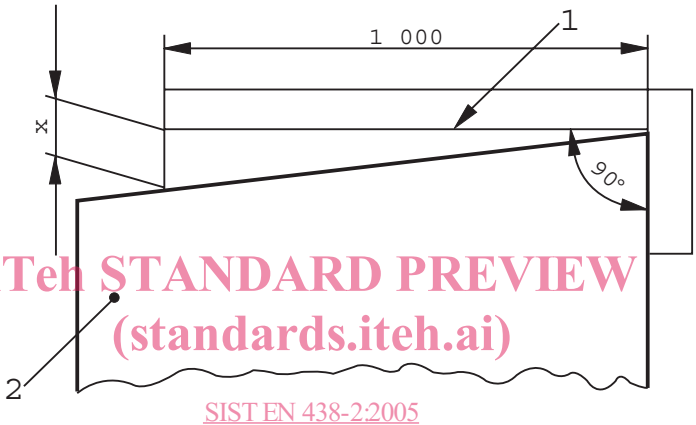
8.3 Test specimen

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 metre 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



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) reference to this part of EN 438;

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.

9 Determination of flatness

9.1 Principle

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

9.2 Apparatus

Bow gauge, of length 1000 mm graduated to permit a reading accuracy of 0,1 mm (see Figure 3).

Dimensions in millimetres

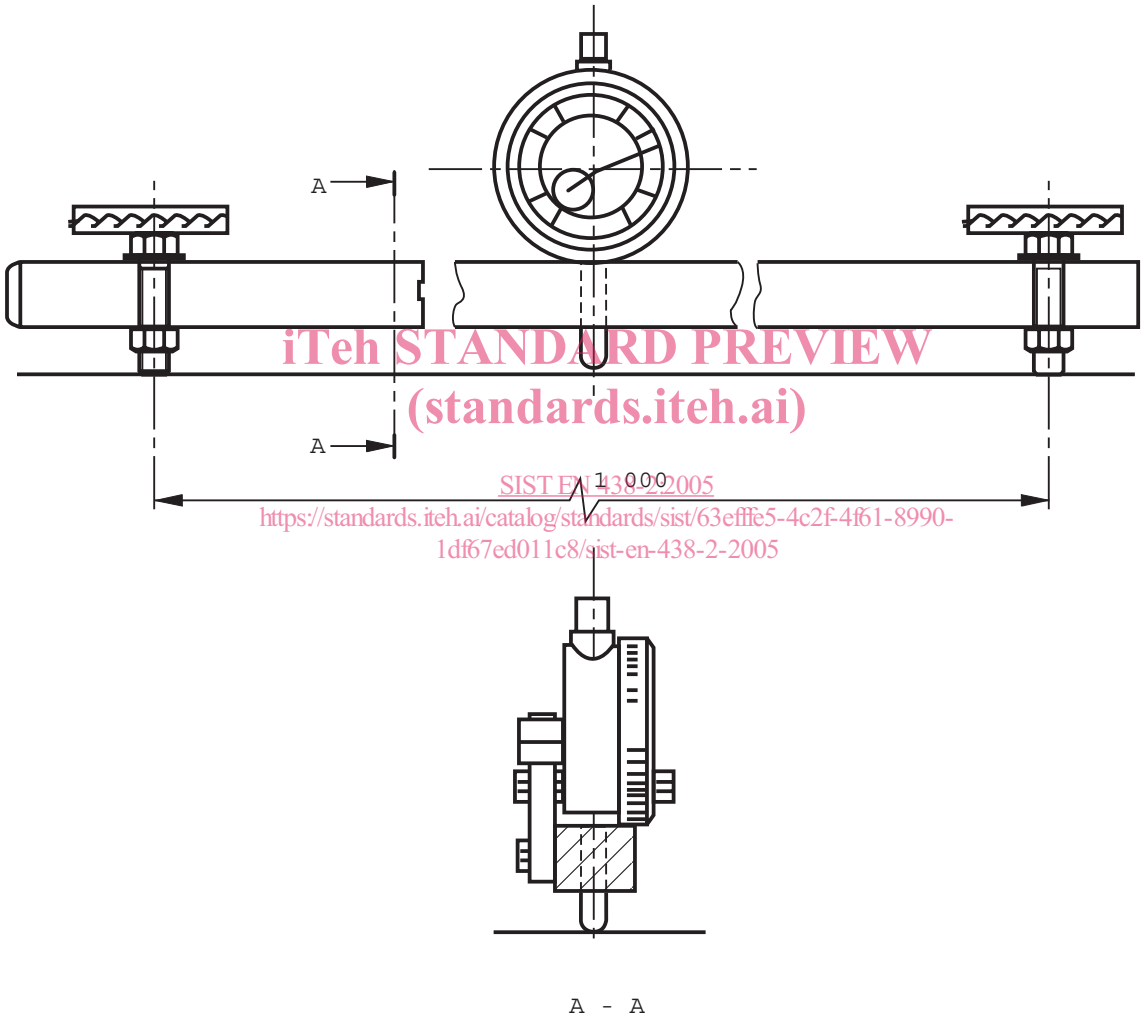


Figure 3 — Bow gauge for measuring flatness

9.3 Test specimens

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

9.4 Procedure

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

Place the bow gauge (see 6.2) 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.

9.5 Expression of results

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

9.6 Test report

The test report shall include the following information:

a) reference to this part of EN 438;

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.

10 Resistance to surface wear

10.1 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.

10.2 Materials

10.2.1 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, except that the ball diameter shall be 5 mm and the load 360 N.

10.2.2 Abrasive paper strips, (Taber S-42 or equivalent), of width 12,7 mm and length about 160 mm, having the following composition:

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

b) open coated 180 grit powdered aluminium oxide (Al_2O_3) having a particle size such that it will pass through a sieve of aperture 100 μm and remain on a sieve having an aperture of 63 μm;

c) adhesive backing (optional).

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

10.3 Apparatus

10.3.1 Test machine, as specified in ISO 9352.

NOTE A suitable machine is available from Taber Acquisition Corp., Taber Industries, 455 Bryant St, P.O. Box 164, North Tonawanda, NY 14120, USA. (This test machine is an example of a suitable machine available

commercially. This information is given for the convenience of users of this part of EN 438 and does not constitute an endorsement by CEN of the machine.)

10.3.2 Conditioning chamber, in accordance with EN ISO 291, with a standard atmosphere of (23 ± 2) °C, relative humidity (50 ± 5) %.

10.4 Test specimens

Each specimen shall be a piece of the laminate 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 100 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.

10.5 Preparation of specimens and abrasive paper

Clean the surface of the specimens with a non-hazardous organic solvent which is immiscible with water. Using a suitable marker pen, mark the surface of each specimen with two lines mutually at right angles so that the surface area is divided into quadrants.

Precondition the specimens and the abrasive strips for at least 72 h in the conditioning atmosphere (see 10.3.2) before testing. After preconditioning seal the paper strips in suitable polythene bags (maximum 10 strips per bag) until required for immediate use.

10.6 Procedure

10.6.1 Preparation of abrasive wheels

Bond a strip of preconditioned unused abrasive paper (see 10.2.2) to each of the rubber covered wheels, using either the adhesive backing, if present, or the double-sided adhesive tape (see 10.2.3). Ensure that the cylindrical surface is completely covered, but without any overlapping of the abrasive paper.

10.6.2 Calibration of abrasive paper

Prepare two abrasive wheels with preconditioned unused strips of abrasive paper from the batch to be used for testing (see 10.6.1).

Clamp a zinc plate (see 10.2.1) in the specimen holder, start the suction device, set the revolution-counter to zero, lower the wheels 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 preconditioned 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 an additional 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.

10.6.3 Abrasion of specimen

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

Prepare two wheels with preconditioned unused abrasive paper from the same batch previously approved by calibration. Fit the wheels to the machine and set the revolution counter to zero.

Clamp the specimen in the holder, ensuring that the surface of the specimen is flat. Lower the abrasive wheels on to the specimen, start the suction device and begin abrading the specimen.

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 recognisable wear-through of the print, pattern or plain colour appears and the sub-layer becomes exposed in three quadrants. The initial wear point is reached when there are areas of at least 0,60 mm^2 wear-through in two quadrants and an area of 0,60 mm^2 wear-through becomes visible in a third quadrant.

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 [1) 2)].

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.

10.7 Expression of results

Calculate the wear resistance, expressed as a number of revolutions, for each specimen using the following equation:

$$\text{Wear resistance} = \frac{IP + FP}{2}$$

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

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

10.8 Test report

The test report shall include the following information:

a) reference to this part of EN 438;

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

c) initial wear point (IP) for the sample under test, in revolutions;

d) resistance to surface wear of the sample under test, in revolutions;

e) any deviation from the specified test method;

f) date of the test.

11 Resistance to abrasion (flooring grade laminates)

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 number of revolutions of the

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1) **IP-poster.** This is a full-colour photographic visual aid with text in the three CEN languages, to assist correct interpretation, and increase repeatability and reproducibility in the determination of the initial wear point (IP). The poster has been developed by CEN/TC134/SC2, and is available from SIS Förlag AB, Box 6455, SE-113 82 STOCKHOLM, Sweden; Tel. 00 46 8 610 30 60, Fax 00 46 8 30 18 50 (order reference 21824 IP-poster).

2) **Dirt size estimation chart.** The use of this chart is recommended to precisely determine the size in mm^2 of the wear-through area. It is available from TAPPI, Technology Park/Atlanta, P.O. Box 105 113, Atlanta, GA 30348-5113, USA; Tel. 00 1 770 446 1400, Fax. 00 1 770 446 6947 (order reference TAPPI - Dirt size estimation chart).