FINAL
DRAFT

INTERNATIONAL
STANDARD

**ISO/FDIS
4211-5**

ISO/TC **136**

Secretariat: UNI

Voting begins on:
2021-07-23

Voting terminates on:
2021-09-17

Furniture — Tests for surface finishes —

Part 5:
Assessment of resistance to abrasion

Reference number
ISO/FDIS 4211-5:2021(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 136, *Furniture*.

A list of all parts in the ISO 4211 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document can be used in conjunction with other relevant documents containing methods for the assessment of the abrasion resistance of surfaces.

Furniture — Tests for surface finishes —

Part 5: Assessment of resistance to abrasion

1 Scope

This document specifies a method for the assessment of the abrasion resistance of surfaces with foils, laminates, melamine faced boards, pigmented and transparent lacquers.

The test is intended to be carried out on an unused part of the finished furniture, but can be carried out on test panels of the same material, finished in an identical manner to the finished product, and of a size sufficient to meet the requirements of the test.

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

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

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:

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

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

3.1
test surface
part of the test panel

3.2
test panel
panel including the test surface

Note 1 to entry: It may be cut from a finished item of furniture or it may be a separate panel produced in the same manner as the finished item of furniture.

3.3
test area
part of the test surface under the wheels covered by the abrasion paper strips

3.4
colour rendering index
R_a
unitless number that specifies how well the colour of an object appears under illumination by a light source compared to a reference light source

4 Principle

The test simulates the ability of the furniture surface under test, to resist abrasive wear-through. 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 specimen required to cause one defined degree of abrasion, is used as measurement of resistance to surface wear.

5 Apparatus and materials

5.1 Cleaning cloth. White soft absorbent cloth.

5.2 Calibration plates, which shall be Taber S-34[1)] 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.

5.3 Abrasion paper strips, which shall be Taber S-42[2)] or equivalent, of width (12,7 ± 0,1) mm and length about 160 mm, according to the following specifications:

a) paper of grammage from 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.

5.4 Test apparatus, which shall be as specified in ISO 9352 with following deviations[3)]:

a) the hardness of wheels' rubber layer shall be between 60 Shore A and 70 Shore A, when measured in the middle of the contact surface; make 4 measurements and calculate the average value;

The laboratories should measure the hardness at least once every 12 months. Checking of rubber wheels geometry shall be performed. If any deformation is observed the rubber wheel should be rejected.

b) weight of loading: every wheel shall apply a force (5,4 ± 0,2) N on the sample;

c) vacuum system: the suction nozzle should be as close to the surface as possible without rubbing it. The vacuum system shall remove practically all the dust;

d) the distance between the middle axis of the sample holder and the wheels should be calibrated according to Annex A;

e) the table rotary speed shall be (60 ± 2) r/min.

5.5 Balance, with an accuracy of 1 mg.

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

---

1) Taber S-34 is the trade name of a product supplied by Taber Acquisition Corp. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product named. Equivalent products may be used if they can be shown to lead to the same results.

2) Taber S-42 is the trade name of a product supplied by Taber Acquisition Corp. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product named. Equivalent products may be used if they can be shown to lead to the same results.

3) A suitable machine is available from Taber Acquisition Corp., Taber industries. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this machine.

5.7 Diffuse light source, providing evenly diffused light giving an illumination on the test surface of (1 200 ± 400) lx. This may either be diffused daylight or be diffused artificial daylight.

The daylight should be unaffected by surrounding trees, buildings, etc. When artificial light is used, it is recommended that it should have a correlated colour temperature of (6 500 + 50) K and a colour rendering index (R_a) greater than 92, by using a colour matching booth in accordance with ISO 3668.

6 Preparation and conditioning

6.1 Conditioning

Conditioning of test surface shall begin at least one week before testing and shall be carried out in air at a temperature of (23 ± 2) °C and relative humidity of (50 ± 5) %.

NOTE The final curing of some coatings, such as waterborne coatings, can require a longer conditioning time.

The conditioning time shall be stated in the test report.

Condition the abrasion paper strips at least for one week in the conditioning atmosphere of (23 ± 2) °C and (50 ± 5) % RH, before testing, see 5.6.

6.2 Test surface

Three test surfaces shall be prepared.

The test surface shall be taken at least 5 mm from the edge of the test panel.

Each test surface shall be a piece of test panel, shaped to fit the type of clamping device used. It shall usually be a square of 100 mm × 100 mm, and including an appropriated hole drilled in the centre to place the test surface in the axis of the apparatus.

The test surface shall be carefully wiped with a cleaning cloth (5.1) before the test.

The test surface shall be substantially flat, and free from defect such as scratch, colour fading and surface folding.

6.3 Preparation of test surfaces and abrasive paper

Using a suitable marker pen, mark the surface of each test surface with two lines at right angles, diagonals, so that the surface area is divided into four quadrants, according to Figure 1.

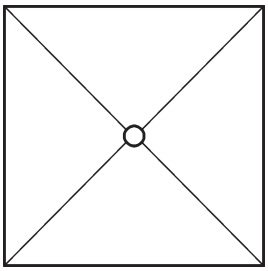

Figure 1 — Test surface area divided into four quadrants

7 Test procedure

7.1 Preparation of abrasive wheels

Bond a strip of conditioned unused abrasive paper to each of the rubber covered wheels. Ensure that the cylindrical surface is completely covered, but without any overlapping of the abrasive paper.

7.2 Calibration of abrasive paper

Carry out this calibration three times for each box.

Prepare two abrasive wheels, in the correct hardness range (5.4), with conditioned unused strips of abrasive paper.

Clamp a zinc plate in the specimen holder, start the vacuum device, set the revolution-counter to zero, lower the wheels, ensuring that the arms are horizontal and the load on the zinc plate is (5,4 ± 0,2) N, 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.

Any box containing abrasive paper which causes a loss in mass of the zinc plate which is outside (110 ± 20) mg, for any pair of calibrate strips, shall not be used for testing.

Calculate a correction factor by use of Formula (1):

$$CF = \frac{(avg)}{(110)} \tag{1}$$

where

CF is the correction factor;

avg is the mean value if three calibrations, in mg;

110 is the limit for the mass loss value of the zinc plate, in mg.

Report this factor in the test report.

7.3 Abrasion of test area

Perform the test immediately after removal of the test surface and calibrated abrasive paper from the conditioning atmosphere.

Prepare two wheels, in the correct hardness range, with preconditioned unused abrasive paper from the same box previously approved by calibration. Fit the wheels to the machine and set the revolution counter to zero.

Clamp the test surface in the holder, ensuring that it is placed horizontally. Lower the abrasive wheels on to the specimen, ensuring that the arms are horizontal and the load on the samples is (5,4 ± 0,2) N. Start the vacuum device for removing practically all the dust, and begin abrading the test area.

NOTE If the arms are not horizontal, then there are two possibilities: to modify appropriately the apparatus or to reduce appropriately the thickness of the test surface before the conditioning, see Clause 6.

Before each assessment, in order to correctly assess the Initial Wear Point (IP), see 7.4, ensure the surface is free of dust. If needed, wipe with the cleaning cloth.

At the beginning of the test, the visual assessment shall be carried out, depending on the expected IP (see 7.4), as follows:

— under 200 revolutions, every 10 cycles;

— over 200 revolutions, every 25 cycles;

— over 500 revolutions, every 50 cycles;

— when close to IP, the assessment shall be carried out every 10 cycles.

Replace the abrasive paper after every 200 revolutions.

Continue the test in this way until the IP is reached. Record the number of revolutions.

7.4 Determination of initial wear point (IP)

7.4.1 General

The determination of IP shall be established by one observer experienced in this type of assessment. In case of a dispute, three observers shall carry out the visual assessment.

The determination of IP shall be carried out under the light described above, see 5.7.

To assess the IP, see 7.4.2 to 7.4.4.

7.4.2 Foil, uncoated and coated laminate and melamine faced boards

The first clearly recognisable wear-through of the print, pattern or plain colour appears and the sublayer becomes exposed in four quadrants.

Compare the examined test surface with the examples for IP points, see Table B.1.

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.

7.4.3 Pigmented lacquers

The first clearly recognisable wear-through of the substrate, or layer with other colour, appears in all the four quadrants.

7.4.4 Transparent lacquers on wood or lignocellulosic-substrates

The first clearly recognisable wear-through of the lacquers becomes exposed in four quadrants, see examples in Table B.2.

The following procedure shall be used:

— draw a circle on the abrasion trace by using a marker pen giving a contrast with the sample colour (not waterproof ink);

— if the ink penetrates into the wood grain along the grain direction in any part of abrasion trace, the IP point is nearly reached;

— the IP shall be assessed by using any agent suitable for marking when the wood or wood veneer substrate is exposed, such as a water solution of a volume fraction of 0,1% methyl blue. The liquid shall be spread over the surface and removed with a dry paper in order to colour the abraded surface and distinguish it from the not completely abraded surface.

Compare the examined test surface with the examples for IP points and deviations described in Annex B.