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Laminate floor coverings — Determination of abrasion resistance

Revêtements de sol stratifiés — Détermination de la résistance à l'abrasion

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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 meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 219, *Floor coverings*.

This second edition cancels and replaces the first edition (ISO 24338:2006) of which has been technically revised.

Laminate floor coverings — Determination of abrasion resistance

1 Scope

This International Standard specifies two methods (A and B) for measuring abrasion of laminate floor covering elements. The tests described measure the ability of the surface layer to resist abrasive wear-through.

Abrasion, according to method A, is achieved by rotating a test specimen in contact with a pair of loaded cylindrical wheels covered with specified abrasive paper. The resistance to wear, according to method B, is evaluated by abrading the face of test pieces with a specified abrasive applied by means of two loaded wheels. The number of revolutions of the test specimen required to cause a defined degree of abrasion is measured by both methods.

NOTE The precision of the methods is not known. When inter-laboratory data become available, a precision statement will be added.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

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

ISO 7267-2, *Rubber-covered rollers — Determination of apparent hardness — Part 2: Shore-type durometer method*

ASTM D785, *Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials*

3 Apparatus

3.1 Testing machine (for methods A and B) (see Figure 1)

3.1.1 Test specimen holder (for methods A and B)

Disc-shaped holder with a diameter of approximately 105 mm (item 7 in Figure 1), which rotates in a horizontal plane with a permitted deviation of ±2 mm/m at a frequency of (60 ± 2) rotations per minute and to which the test specimen (item 6 in Figure 1) can be clamped with a clamping screw (item 5 in Figure 1).

3.1.2 Holding and lifting device (for methods A and B)

Holding and lifting device for the abrasive wheels, so constructed that each wheel exerts a force of (5,4 ± 0,2) N (Method A) or (10 ± 0,2) N (Method B) on the test specimen.

For Method B, a counterweight of (150 ± 3) g is required to counterbalance the mass of the leather abrading wheel (see 3.2.3). A second pair of leather abrading wheels may be used for this purpose.

The calibration and maintenance of the Taber abrader arms should be carried out according to Annex A.

3.1.3 Rubber covered abrasive wheels (for method A)

Two cylindrical rubber-covered wheels of (12,7 ± 0,1) mm width and 50 mm diameter, which rotate freely about an axis (item 3 in Figure 1). The curved surface of the wheels, to a depth of 6 mm, shall be made of rubber (item 2) with a hardness of (65 ± 3) IRHD (according to ISO 48) or (65 ± 3) Shore A (according to ISO 7267-2). A description of the measurement and of a suitable measurement setup is shown in Annex B.

The inside faces of the wheels shall be (52,5 ± 0,2) mm, apart and equally spaced ((26,25 ± 0,10) mm) from the centre-line of the abrader head. The axis of the wheels shall be (19,05 ± 0,3) mm from the vertical axis of the test specimen holder.

3.1.4 Abrasive paper strips (for method A)

Abrasive strips of (12,7 ± 0,1) mm wide in the machine direction and approximately 160 mm long shall be used (item 1 in Figure 1).[1] They shall meet the following requirements:

— weight: 70 g/m^2 to 100 g/m^2;

— open coated 180 grit aluminium oxide (Al_2O_3), with a particle size that will pass through a 100 µm aperture sieve and be retained by a 63 µm aperture sieve;

— glue bonded;

— adhesive backing.

3.1.5 Calibration plates (for method A)

Rolled zinc sheet, with a thickness of (0,8 ± 0,1) mm and a Brinell hardness of (48 ± 2) (according to ISO 6506-1, with a ball diameter of 5 mm and a load of 360 N), shall be used.[2] For type approval or verification purposes, the zinc plate shall not be used for more than 10 calibrations per side.

3.1.6 Suction device (for method A)

Two suction nozzles (item 4 in Figure 1) shall be so fitted that they cover the abraded area of the test specimen. One nozzle shall be situated between the wheels, the other diametrically opposite. The centres of the nozzles shall be 77 mm apart and (2 ± 0,5) mm from the surface of the test specimen. When the nozzles are closed, there shall be a vacuum of 1,5 kPa to 1,6 kPa.

NOTE 1 It is important to ensure that the abrasive wheels are in good condition, as variations in flatness, hardness, regularity, roundness, and width can significantly affect the test result.

NOTE 2 It is important that the dimensions and tolerances in 3.1.6 and in Figure 1 are met as deviations can lead to errors exceeding 100 %. See Annex B for more information.

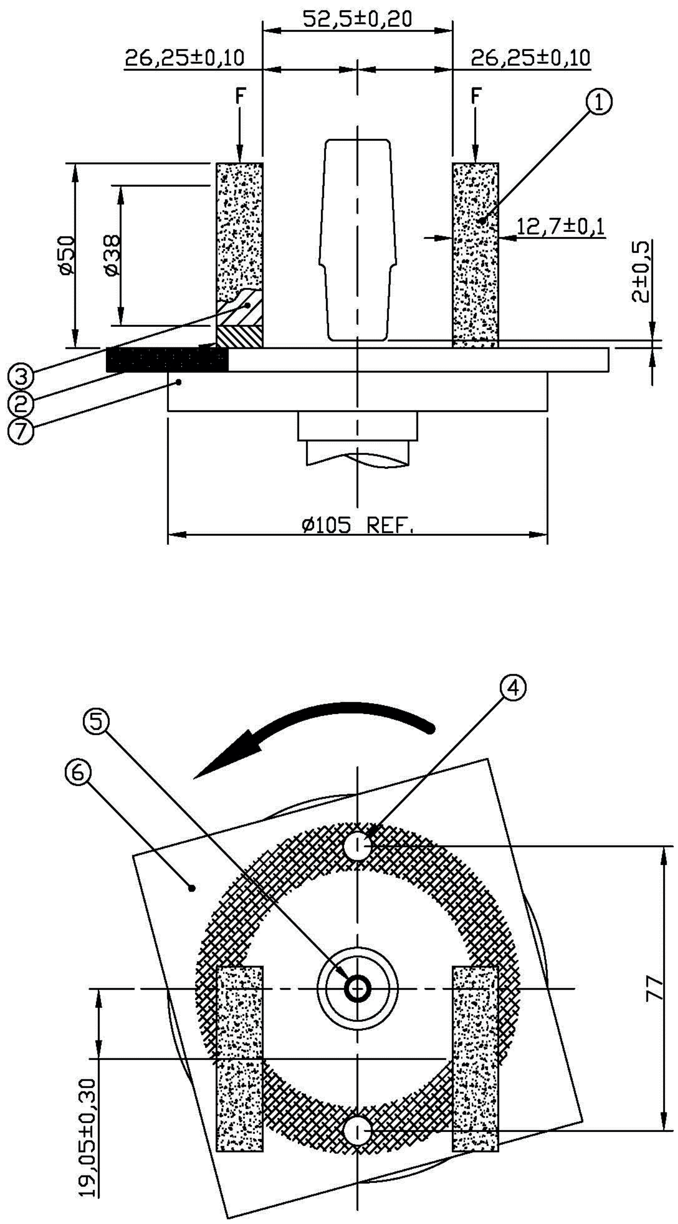
3.1.7 Revolution-counter (for methods A and B)

A revolution counter is used to record the number of revolutions of the specimen holder.

1) The abrasive paper strips **"S42"**, made by TABER Industries, are an example of a suitable product available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product. Equivalent products may be used if they can be shown to lead to the same results.

2) Taber S-34 made by TABER Industries 455 Bryant Street, North Tonawanda, New York 14120 USA is an example of a suitable equipment available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product. Equivalent products may be used if they can be shown to lead to the same results.

Dimensions in millimetres



Key

1 abrasive paper
2 rubber
3 abrasive wheel
4 suction nozzle
5 clamping screw
6 specimen
7 specimen holder disc

Figure 1 — Abrasion resistance testing machine

3.2 Grit feeder and accessories (only for method B)

The grit feeder shall have a minimum storage capacity of about 200 g of grit and it shall be possible to open the feeder at its top and at its bottom. The bottom opening shall be positioned (10 ± 1) mm above the face of the test piece and have a length of (16 ± 1) mm and a width of (3,18 ± 0,38 mm). The length of the bottom opening shall be installed radially to the test specimen holder. A device in the grit feeder shall ensure a regular flow. The feeder shall also be equipped with a device that ensures an immediate stop of the feeding when required (see Figure 2 and Figure 3).

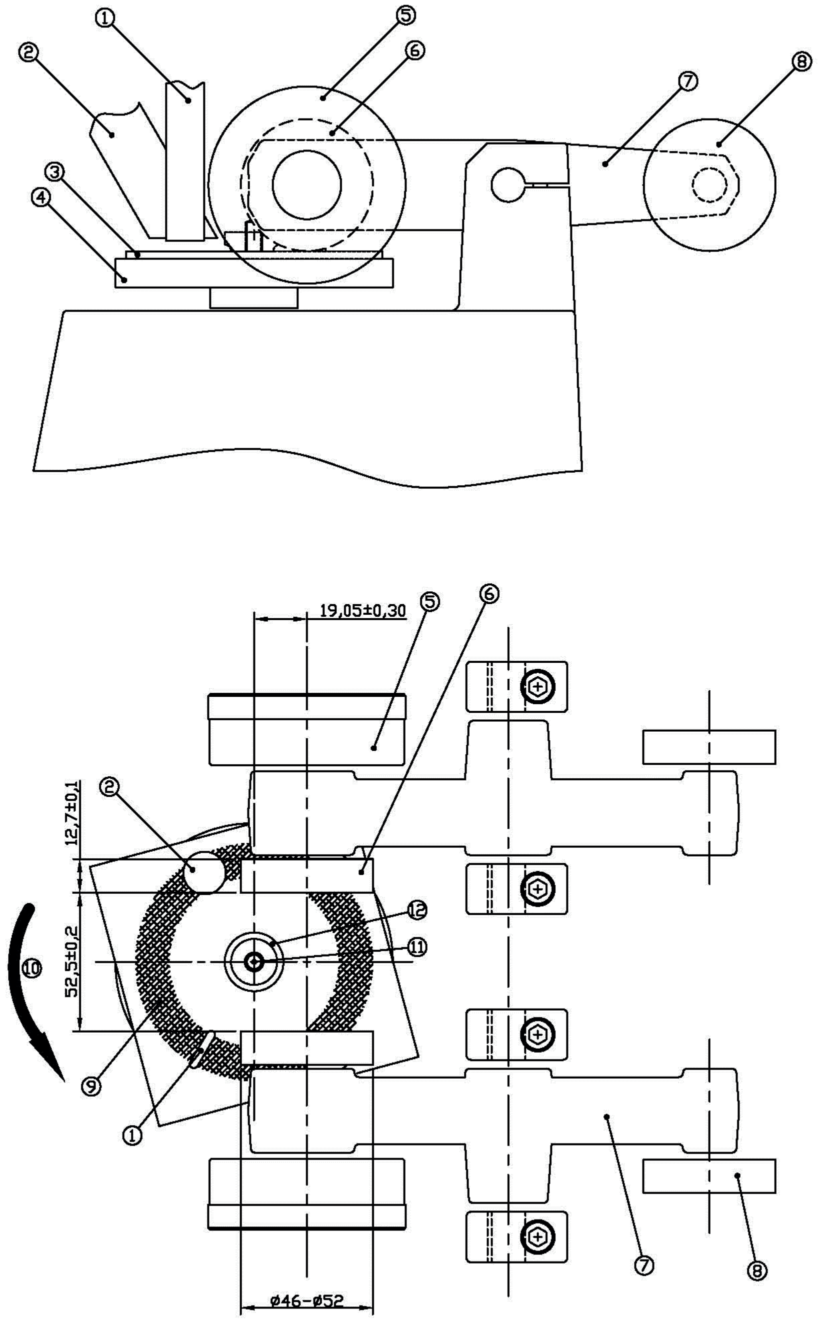
3.2.1 Vacuum cleaning device[3)]

A suction nozzle, positioned (3 ± 2) mm above the track to be abraded, shall be installed in the axial vertical plane on the left wheel after the abrasive grit passes under the wheel (relative to the rotation direction, see Figure 3). The vacuum power shall be set at a level that removes all dust and debris.

Figure 2 — Example of a Taber Abrader with Grit Feeder

3) Equipment of this type, Taber Abrader and Taber Grit Feeder, are made by TABER Industries, 455 Bryant Street, North Tonawanda, New York 14120 USA. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product.

Dimensions in millimetres



Key

1	grit nozzle
2	suction nozzle
3	test piece
4	specimen holder
5	testing weight
6	abrading wheel
7	abrader arm
8	wearing surface
9	counterweight
10	direction of rotation
11	clamping screw
12	nut

Figure 3 — Drawing of an abrader with grit feeder

3.2.2 Abrading material

Abrasive grain (bauxite based, electric arc furnaced aluminium oxide) with a chemical composition according to Table 1 shall be used.[4] The abrasive mineral has a specific mass of 3,96 g/cm^3 and a Knoop hardness of 21 kN/mm^2. The medium grain shape of the mineral has a bulk density in the range of 1,51 g/cm^3 to 1,62 g/cm^3 according to FEPA standard 44-D. Particle size distribution ranges between 45 and 75 µm with a reduced fines portion according to Table 2 determined according to FEPA standard 42-D.

Table 1 — Chemical composition

Type of oxide	Al_2O_3	Fe_2O_3	SiO_2	TiO_2	CaO	ZrO_2	MgO
Mass-%	>95	<0,30	<0,90	2,4 to 3,0	<0,30	<0,30	<0,30

Table 2 — Grain distribution

Sieve no.	170	200	270	270 to 325	>325
Grading in µm	90	75	53	45	
Grain distribution in %	0	0 to 5	≥45	≥80	0 to 10

The abrading material shall be stored in a dry place and shall be used only once. It shall not be sieved before use.

3.2.3 Leather abrading wheels[5]

Two cylindrical wheels, which turn freely around their axis, with a nominal diameter of 44,4 mm and a width of 12,7 mm. They are fitted with a leather strip of (12,7 ± 0,1) mm wide and with a minimum thickness of 1,5 mm. The overall diameter of the wheels, with leather strips, shall not exceed 52 mm or be less than 46 mm.

The hardness of the leather strips shall be suitable for the purpose. It is measured according to ISO 868 with a Shore-hardness meter of Type A with the following deviation:

— the Shore-A hardness is measured at four points in the middle of the tire tread of the abrading wheels (deviation from ISO 868, 5.1, 5.2, and 8.1).

The hardness of the leather is suitable if all the results are contained within the range A/1:85 to A/1:95.

The distance between the internal faces of the wheels shall be (52,5 ± 0,2) mm, their common axis being set, by (19,05 ± 0,3) mm nominally, off the axis of the specimen holder. The axis of rotation of the test piece shall be equidistant from the two wheels.

Prior to testing, new abrading wheels shall be preconditioned: Subject new wheels to an initial 2 000 cycle test following the procedure described in 6.2.

3.2.4 Stopwatch

A stopwatch accurate to ±0,1 s.

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4) The abrading material **"ALODUR ESK 240 (EN 14354)"**, made by Treibacher Schleifmittel, Postfach 1, A-9523 Villach-Landskron Seebach 2, Austria, is an example of a suitable product available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product. Equivalent products may be used if they can be shown to lead to the same results.

5) The abrading wheels "S-39", made by TABER Industries are an example of a suitable product available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product. Equivalent products may be used if they can be show to lead to the same results.

3.2.5 Grit collection container

A container of known mass to collect the grit when calibrating the grit feeder.

3.2.6 Calibration plates[6)]

Calibration plates made of cell-cast acrylics with Rockwell Hardness M 94 according to ASTM D785.

3.2.7 Transparent template to evaluate the wear of the abraded area

A transparent template shall be used for visual observation of wear-through. Each quadrant shall be divided into four sectors of 22,5° (see Figure 4).

NOTE There is no commercial source available. This template can be easily made from a transparent film

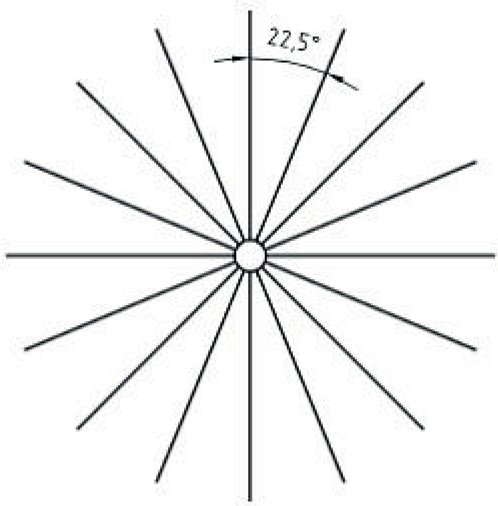


Figure 4 — Transparent template for visual observation of wear-through

3.3 Additional material or equipment (methods A and B)

3.3.1 Weighing equipment

For determining the mass loss of the zinc plate by the sand paper or calibrating the grit flow of the abrading material, weighing equipment with an accuracy of ±1 mg is needed.

3.3.2 Conditioning chamber

The conditioning chamber shall be able to maintain a standard climate of (23 ± 2) °C and (50 ± 5) % relative humidity.

4 Test specimens

For each method one laminate floor covering element is needed. Take from this element three test specimens, measuring approximately 100 mm × 100 mm:

— two centred 10 mm in from the short edges;

6) The calibration plates “S38”, made by TABER Industries, are an example of a suitable product available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product Equivalent products may be used if they can be shown to lead to the same results.

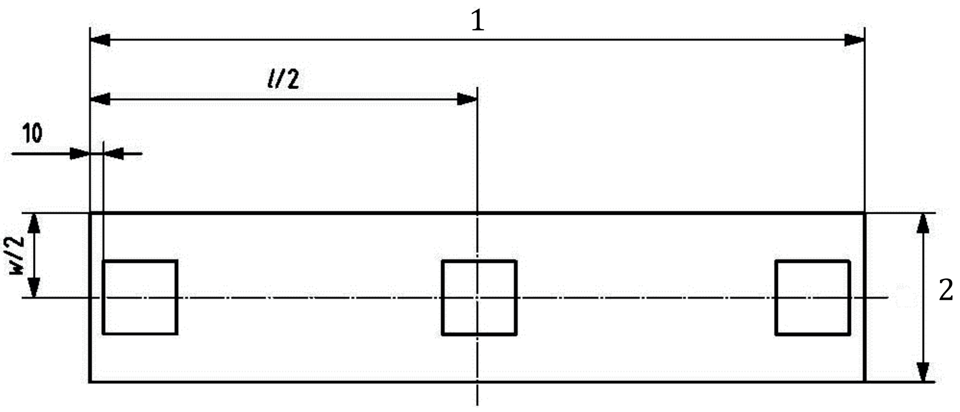
— one exactly in the centre of the element (see Figure 5).

Machined edges and machined surfaces shall be avoided in the specimens. If the thickness of the specimens exceeds 8 mm, the specimens shall be milled down from the backside to (7,5 ± 0,5) mm to ensure a horizontal load of the abrader arms. Make sure that specimens are uniformly flat and parallel after milling.

If the dimension of the elements makes the described sampling impossible, the test specimens shall be sampled from the nearest available area. If the elements measure less than 100 mm, then a joint is necessary. The joint shall be positioned in the middle of the 100 mm × 100 mm specimen.

Drill a (7,2 ± 0,1) mm centre hole into the test specimen.

Dimensions in millimetres



Key

1 length of the sample

2 width of the sample

Figure 5 — Sampling from one floor covering element

5 Procedure of method A

5.1 General

The resistance to wear is evaluated by abrading the face of test specimens with a specified abrasive paper applied by means of two loaded wheels. Characteristic rub-wear action is produced by contact of the test specimen, against the sliding rotation of the two abrading wheels. As the turntable rotates, the wheels are driven by the sample in opposite directions about a horizontal axis displaced tangentially from the axis of the sample. One abrading wheel rubs the specimen outward toward the periphery and the other, inward toward the centre while a vacuum system removes loose debris during the test. The resulting abrasion marks form a pattern of crossed arcs in a circular band that cover an area approximately 30 cm^2.

5.2 Preparation of test specimens and abrasive papers

Clean the surface of the test specimens with an organic solvent which is immiscible with water. Using a marker pen, mark the surface of each test specimen with two lines at right angles so that the surface area is divided into quadrants (see Figure 6).

Precondition the test specimens and the abrasive papers (3.1.4) for at least 24 h in the conditioning chamber (3.3.2). After preconditioning, seal the paper strips in polythene bags (maximum 10 strips per bag) until required for immediate use.

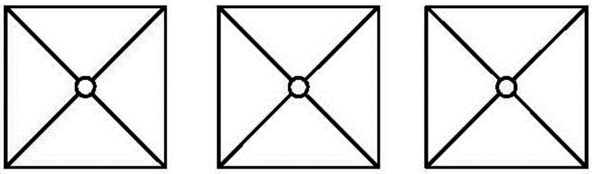


Figure 6 — Division of the three test specimens into quadrants

5.3 Preparation of abrasive wheels

Bond a strip of preconditioned unused abrasive paper to each of the rubber covered wheels (3.1.3). Ensure that the cylindrical surface is completely covered without any overlapping of the paper. The outside diameter of the finished assembled wheel shall be (50,90 ± 0,65) mm.

5.4 Determination of the abrasion rate of abrasive paper

Prepare two wheels with preconditioned unused abrasive paper according to 5.1 from the same batch to be reserved for testing.

Clamp a zinc plate (3.1.5) in the test specimen holder (3.1.1), start the suction device (3.1.6), reset the revolution counter (3.1.7) 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. Renew the abrasive papers with preconditioned unused strips from the same batch, and abrade the zinc plate for a further 500 revolutions. Wipe the zinc plate clean and weigh it again to the nearest 1 mg.

The loss in mass shall be (120 ± 20) mg. Any lot of abrasive paper which causes a loss in mass outside this range shall not be used for testing.

5.5 Abrasion of test specimen

Perform the test immediately after the determination of the abrasion rate. Prepare two wheels with preconditioned unused abrasive paper from the same batch previously approved by determination of abrasion rate (5.3). Fit the wheels to the machine and reset the revolution-counter to zero. Clamp the first test specimen in the holder. Ensure that the surface of the test specimen is flat. Lower the wheels, start the suction device and abrade the test specimen.

Examine the test specimen for abrasion after each 100 revolutions and renew the abrasive papers after every 200 revolutions.

Continue the test in this way until the initial wear point (IP) is reached.

The initial wear point (IP) is that point at which the first clearly recognizable wear-through of the print 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 layer of different colour.

For specimens with a joint, disregard the wear that occurs within 10 mm on either side of the joint.

Record the number of revolutions as the IP-value. Repeat the test immediately using the two remaining test specimens.

To determine the initial wear point (IP), Figure 7 can be used. To precisely determine the size of the wear-through area, the “Dirt size estimation chart”[7] can be used.

Insufficient test

Wear-through is evident only in one quadrant

Correct test

Wear-through is evident in three quadrants

Excessive test

Wear-through has passed beyond the initial wear point

Figure 7 — Assessment of initial wear point

5.6 Expression of results

Calculate the average of the IP-values obtained from the three test specimens to the nearest 100 revolutions.

5.7 Test report

The test report shall include the following information:

a) a reference to this International Standard (ISO 24338) and the used method (i.e. method A);

b) the name and type of product;

c) the average initial point, in revolutions, of the three samples rounded to the nearest 100 cycles;

d) any deviation from the specified procedure;

e) the date of the test.

6 Procedure of method B

6.1 General

A specified loose abrasive is fed continuously on to the face of the test piece, in the track of the loaded wheels. As the specimen rotates the rub-wear action of the wheels and abrasive grit causes abrasion on the test piece. After passing under both wheels, the loose abrasive is removed by a vacuum.

7) Dirt size estimation chart” is the trade name of a product supplied by TAPPI, 15 Technology Parkway South, Suite 115, Peachtree Corners, Atlanta, GA 300922910, USA, tel. +1 770 446 1400, fax +1 770 446 6947. The chart is the TAPPI Size Estimation Chart, product code 0109DIRTT.

6.2 Maintenance of the abrading wheels

The abrading wheels can be used as long as the specifications described in 3.2.3 are complied with. When they are not, the wheels shall be removed and replacement shall be carried out.

6.3 Operation of the abrader

To start the wear test

— fix the test piece on the specimen holder,

— position the vacuum cleaning nozzle, start the vacuum described in 3.2.1,

— position the bottom opening of the grit feeder described in 3.2,

— set the revolution counter to zero,

— lower the abrading wheels to the surface of the test piece,

— open the grit feeder, with the rate of grit flow calibrated per section 6.4.1,

— start rotation of the test piece.

To halt the wear test

— stop rotation of the test piece,

— close the grit feeder,

— stop the vacuum,

— raise the abrading wheels,

— record the number of revolutions.

6.4 Calibration

6.4.1 Rate of grit flow

Before each test, calibrate the grit flow from the grit feeder by means of

— the container specified in 3.2.5,

— a stopwatch as specified in 3.2.4, and

— weighing equipment as specified in 3.3.1.

The grit flow shall last for (60 ± 1) s.

Collect and weigh the quantity of grit that flowed from the grit feeder. Be certain to subtract the mass of the container from this measurement.

The grit feeder is properly calibrated if the measured mass is (21 ± 3) g.

This calibration shall be repeated after each test specimen or 5 000 revolutions or each break that lasts longer than 30 min.

6.4.2 Abrading capacity

For every new package of abrading material, the abrading capacity shall be checked. Start a wear test in accordance with the procedure defined in 6.2, the test piece being replaced by the calibration plate specified in 3.2.6.

Wipe clean the calibration plate with a soft cloth that has been dampened with an antistatic spray. Measure the initial mass of the calibration plate, and then secure the calibration plate to the specimen holder.

Operate the abrader for 2 000 revolutions. Replenish the abrading material as necessary.

Determine the difference between the initial mass of the calibration plate and the mass after 2 000 revolutions.

Repeat the test two additional times with an untested side of a calibration plate (each side of the plate can be used only one time).

Calculate the average of the three mass loss measurements in mg.

The result is acceptable if

— the average loss of mass is (145 ± 20) mg, and

— no individual measurement is beyond the range (145 ± 25) mg.

Calculate the calibration factor as follows:

$$\text{Calibration factor} = \frac{\text{average of mass loss (in g)}}{0{,}145\,\text{g}} \quad (1)$$

6.5 Abrasion of test specimen

Prior to the wear test, condition the three test specimens as specified in 5.1.

Run the abrader as specified in 6.2 until wear-through has occurred. Using the transparent template (3.2.7), wear through occurs when the test specimen shows

— wear in 12 sectors of 16, and

— wear at least in 1 sector per quadrant (See Figure 8).

Inspect the test piece after every 200 revolutions. When the test nears its end, inspect after every 100 revolutions.

At specimens with a joint, wear-through within 10 mm of the centre joint shall be disregarded.

Insufficient wear　　Ideal wear　　Excessive wear

Figure 8 — Assessment of wear

6.6 Expression of results

For each specimen tested, multiply the number of total revolutions with the calibration factor determined in 6.4.2 to obtain corrected single test values.

Calculate the average of corrected single test values for the three test specimens. Round the number of revolutions to the nearest hundred and report the result as abrasion resistance.

6.7 Test report

The test report shall include the following information:

a) a reference to this International Standard (ISO 24338) and the used method (i.e. method B);

b) the name and type of product;

c) the result of abrasion resistance, corrected single values and calibration factor;

d) any deviation from the specified procedure; and

e) the date of the test.

Annex A
(normative)

Calibration and maintenance of abrasion equipment

A.1 General

This annex gives an example of a procedure for calibration and maintenance of equipment used for abrasion resistance testing. This information has been developed for specific equipment. Other manufacturers of similar equipment may have other calibration procedures and methods.

The procedures outlined below do not necessarily address all potential sources of variance. The schedule for use of described procedures has not been established. Good laboratory practice and experience will indicate required intervals in each laboratory.

Improper alignment of the abrasive wheels can lead to each wheel abrading a different path from its complementary wheel across the sample as well as the wheels on other machines. Path surface area can differ by as much as 20 % and the area abraded by both wheels on a sample could be less than 50 % of the total abraded area for that sample, hence the source of potential error.

Three parts have been identified as potential sources of error. Each is addressed separately; however each is dependent upon the other. The first is bearing wear (looseness), the second is shaft wear and the third is alignment of the arms. They are addressed without any order of priority below.

A.2 Apparatus

A.2.1 Calibration block

A block preferably of steel measuring 77,9 mm × 77,9 mm × 25 mm with a hole drilled and threaded with UNF 1/4 inch in the centre (38,95 ± 0,02) mm of the 77,9 mm × 77,9 mm face such that the block can be threaded onto the holder disc of the abrader. All edges shall be made with a radius of 1 mm.

A.2.2 Feeler gauges

Feeler gauges of various thickness.

A.2.3 Shim washers

Shim washers of various thickness ranging from 0,05 mm and up shall be used. The inside diameter shall be 8 mm and the outside diameter shall be 13 mm.

A.3 Procedure

A.3.1 Bearing Wear

Examine each arm of the abrader visually and by hand for any bearing wear. Specific areas to examine are the pivot areas of the abrader arm and the shaft on which the wheel revolve. This includes but is not limited to any sideways, twisting, or other motion outside the specific rotation of the arm or the shaft. Any movement noted other than the pivoting of the arm or shaft requires that further examination be made to determine the cause of the excess movement.

Specific repairs shall be completed before attempting subsequent steps of the procedure.

A.3.2 Shaft Wear

In certain instances, the shaft for the abrader wheel may slide end to end. This movement shall be eliminated by placing shim washers of appropriate thickness between the bearing face and the shaft keeper ring on the end of the shaft opposite the abrader wheel mounting. This can be measured using the feeler gauges to measure the gap prior to disassembly and the appropriate thickness of shim washers placed on the shaft.

A.3.3 Alignment

The following procedure shall be used.

a) Remove the rubber wheels from their respective shaft mounting and set aside. Remove the rubber mat on the sample table (if used).

b) Attach the calibration block to the table by the threaded mount.

c) Gently lower the arms with the exposed shaft ends onto the block. Rotate the block to square the block with the shaft face of each arm. The face of each shaft shall squarely meet the adjacent face of the calibration block without force and without any gap. If the arm does not seat squarely onto the block or leaves a gap between the face and block then that arm shall be aligned.

d) If the alignment does not allow the wheel shaft to rest against the shaft hub and face, the arm shall be moved away from the block by loosening the two set screws on the top of the machine toward the back that holds the shaft on which the arm pivots and moving the entire arm assembly away from the block enough so that the shaft face and hub rest squarely against the calibration block. Retighten the set screws and recheck.

e) If the alignment leaves a gap between the shaft hub/face and the calibration block, the arm shall be moved toward the block by loosening the two set screws on the top of the machine toward the back that holds the shaft on which the arm pivots and moving the entire arm assembly towards the block enough so that the shaft face and hub rest squarely against the calibration block. Retighten the set screws and recheck.

In the case of a dual head abrader, the alignment is more complex due to the common mount utilized by the shaft holding the interior arms for each side of the abrader. In the case of a dual head abrader, the following order of alignment adjustments is made (see Figure A.1).

a) Remove rubber wheels and table mats from both heads and attach the calibration block to the left head.

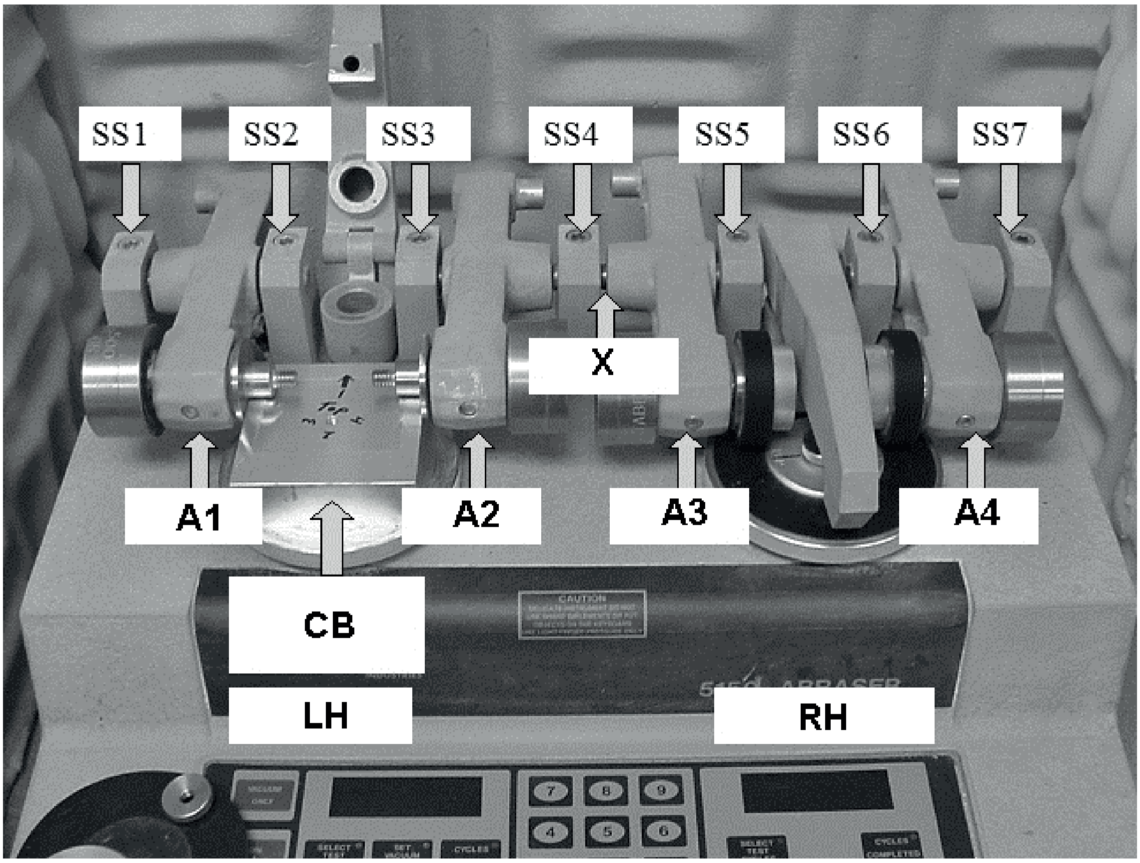
b) Check Arm 1 for correct alignment. If adjustment is required loosen SS1 and SS2 and move the arm assembly in or out to squarely align the shaft face/hub to the calibration block. Retighten the set screws and recheck.

c) Check Arm 2 for correct alignment. If adjustment is required loosen SS3, SS4, and SS5 and move the arm assembly in or out to squarely align the shaft face/hub to the calibration block. Retighten the set screws SS3 and SS4 and recheck.

d) Remove the calibration block from the left head and attach to the right head.

e) Check Arm 3 for correct alignment. SS5 is loose. Seat the shaft beneath SS5 fully to the left and check the Arm 3 alignment. If the shaft face/hub is too tight to the calibration block, shims shall be removed from Arm 3 assembly at the point the shaft seats into the arm at point X. Part the assembly by moving the Arm 3 and shaft under SS5 fully to the right and remove the shims as needed to squarely place the shaft face/hub against the calibration block. Retighten the set screw SS5 and recheck. If the shaft face/hub is loose against the calibration block, shims shall be added to the arm 3 at the point the shaft seats into the arm at point X. Measure the gap between the block and the shaft face/hub with the feeler gauge to determine the thickness of shim washers to add. Part the assembly by moving the Arm 3 and shaft under SS5 fully to the right and add the shims as needed to squarely place the shaft face/hub against the calibration block. Retighten the set screw SS5 and recheck.

f) Check Arm 4 for correct alignment. If adjustment is required loosen SS6 and SS7 and move the arm assembly in or out to squarely align the shaft face/hub to the calibration block. Retighten the set screws and recheck.



Key

SS1 to SS7	set screws
X	point X
A1 to A4	arms 1 to 4
CB	calibration block
LH	left head
RH	right head

Figure A.1 — Dual head abrader with calibration block and identification points

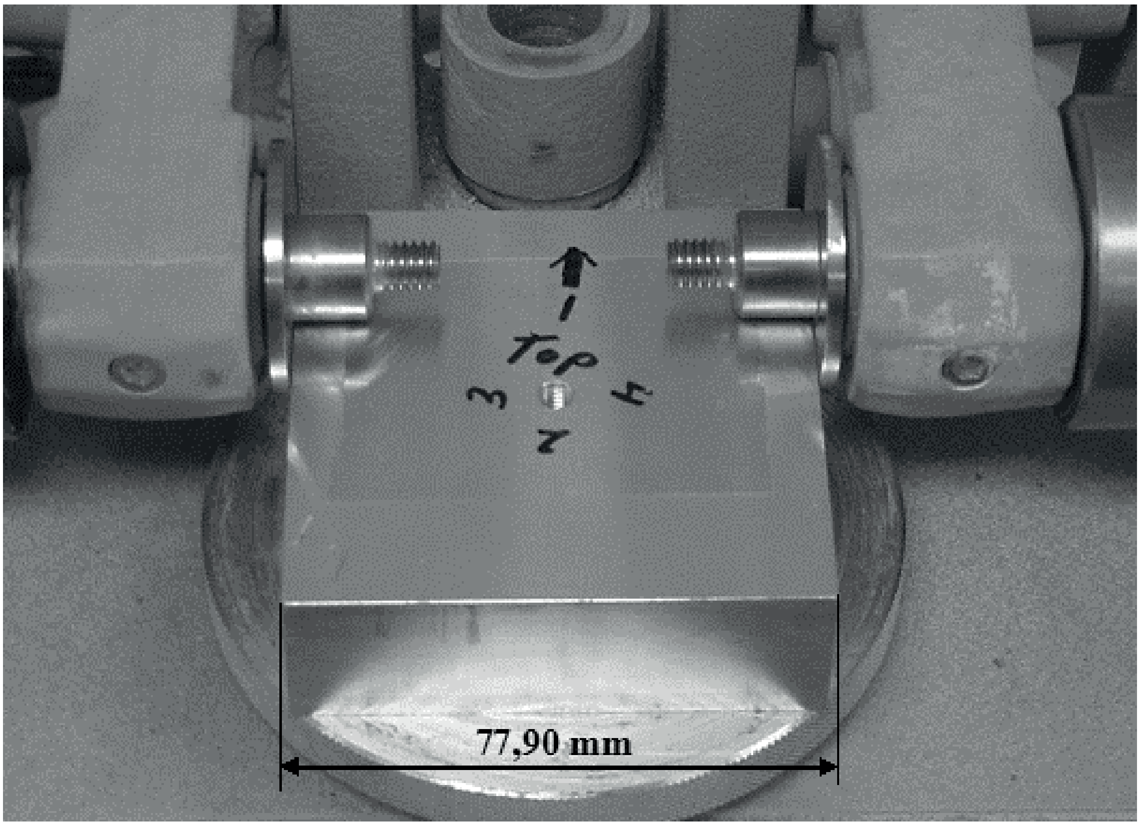


Figure A.2 — Calibration block with arms correctly aligned

Annex B
(normative)

Measurement of shore A hardness

For shore A test measurements, the apparatus used shall be a shore type A durometer instrument[8)] with a 12,7 mm presser foot diameter, an operating stand with a mechanically controlled rate of descent, and a 1 kg mass centred on the axis of the indenter.

The wheel to be tested shall be firmly located with its major axis horizontal and with the area in which the hardness is to be measured uppermost and positioned directly under the durometer indenter by means of a fixture or V-block (Figure B.1).

The hardness measurements shall be taken vertically on the apex of the wheel with the indenter normal to the wheel tread surface and in the middle of the wheel tread. The presser foot shall be applied to the wheel tread at a controlled rate of descent, without shock until the full force of the 1 kg mass is applied to the wheel tread surface. The reading shall be taken 5 s after the presser foot is in firm contact with the wheel surface.

Four points shall be measured at equally spaced intervals around the diameter of the wheel and the average of these measurements shall be calculated for wheel hardness.

Figure B1 — Example for a suitable measurement setup

8) A suitable measurement setup can be purchased from Rex Gauge Company, Inc. 1250 Busch Parkway, Buffalo Grove, IL 60089 (www.durometer.com) This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product. Equivalent products may be used if they can be show to lead to the same results.

Bibliography

[1] ISO 4545-4, *Metallic materials — Knoop hardness test — Part 4: Table of hardness values*

[2] FEPA standard 42-D, Grains of fused aluminium oxide, silicon carbide and other abrasive materials for bonded abrasives and for general industrial applications

[3] FEPA standard 44-D, Grains of fused aluminium oxide, silicon carbide and other abrasive materials. Determination of bulk density

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