भारतीय मानक

Indian Standard

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ISO 13287 : 2019

फुटवियर की परीक्षण पद्धतियाँ

भाग 25 स्लिप प्रतिरोध

Methods of Test for Footwear

Part 25 Slip Resistance

ICS 61.060

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Footwear Sectional Committee, CHD 19

NATIONAL FOREWORD

This Indian Standard (Part 25) which is identical to ISO 13287 : 2019 'Personal protective equipment — Footwear — Test method for slip resistance' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Footwear Sectional Committee and approval of the Chemical Division Council.

This Indian Standard first published as a part of IS 8085 under the general title 'Methods of test for footwear'. This part is an adoption of ISO 13287 : 2019 which specifies a method of test for the slip resistance of PPE footwear. It is not applicable to special purpose footwear containing spikes, metal studs or similar.

This Indian Standard is published in several parts. The other parts in this series are:

Part 1 Dimensions, fitting, adhesion test, peel test, heat resistance test and ageing test

Part 2 Footwear performance test, stiffness test for shanks, lastometer test for cracking of uppers ; and performance test for upper fabrics, coated fabrics, sock lining and other lining materials.

Part 3 Upper sole adhesion

Part 4 Resistance to crack initiation and growth — Belt flex method

Part 5 Longitudinal stiffness of shanks

Part 6 Abrasion resistance of uppers, linings and insocks

Part 7 Deformability of upper

Part 8 Delamination resistance of uppers

Part 9 Tear strength of uppers linings and insocks

Part 10 Heel attachment for whole shoe

Part 11 Attachment strength of straps, trims and accessories

Part 12 Tensile performance of elastic materials

Part 13 Seam strength for uppers, lining and insocks

Part 14 Water vapour permeability and absorption for uppers and lining

Part 15 Washability in a domestic washing machine for whole shoe

Part 16 Flexing durability for whole shoe

Part 17 Abrasion resistance for accessories shoe laces

Part 18 Peel strength before and after repeated closing for accessories touch

Part 19 Shear strength before and after repeated closing for accessories touch and close fasteners

Part 20 Flex Resistance for uppers and lining

Part 21 Strength of slide fastener pullers

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Part 26 Tensile strength and elongation for uppers

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Indian Standard

METHODS OF TEST FOR FOOTWEAR

PART 25 SLIP RESISTANCE

1 Scope

This document specifies a method of test for the slip resistance of PPE footwear. It is not applicable to special purpose footwear containing spikes, metal studs or similar.

Footwear claiming 'slip resistance' would be deemed an item of personal protective equipment.

NOTE For product development purposes, sole units, outsoles or other soling components such as top pieces may be tested.

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 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

ISO 4662, *Rubber, vulcanized or thermoplastic — Determination of rebound resilience*

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 http://www.electropedia.org/

3.1
normal force
force applied to the surface through the footwear, perpendicular (90°) to the surface

Note 1 to entry: The force includes the weight of the footwear, shoemaking last (4.1.1 or 4.1.2) or mechanical foot (4.1.3) and mounting.

3.2
frictional force
force parallel to the surface and against the direction of movement arising when footwear slides over a surface

3.3
coefficient of friction
CoF
ratio of the frictional force divided by the normal force

3.4
static contact time
time between initial contact of the footwear with the surface achieving a normal force of 50 N and the beginning of movement

3.5
measurement period
time interval during which the frictional force measurement is taken and during which the test conditions are satisfied

3.6
floor
material (flooring), without contaminant (lubricant), to be used as the test surface

3.7
surface
floor, with or without contaminant (lubricant), against which the footwear is tested

3.8
calibration test value
CTV
coefficient of friction between the Slider 96[1)] and the test surface

4 Apparatus and materials

4.1 One or more of the following foot forms to hold the item of footwear to be tested.

4.1.1 Standard shoemaking last, conforming to A.1.

4.1.2 Manufacturer's shoemaking last used to make the footwear sample to be tested, if required.

4.1.3 Mechanical foot, conforming to the dimensions given in A.2.

4.2 Mechanism for lowering the item of footwear onto the surface and applying the required normal force at the required time in accordance with Clause 6.

4.3 Device for measuring the normal force between the footwear and surface when setting up the test and during the measurement period to an accuracy of 2 % or better.

4.4 Steel floor, consisting of a stainless steel plate.

Surface roughness shall be measured in the area where the slip measurements are actually made. Measurements shall be made at 10 locations within this area and in the direction parallel to the direction of sliding movement in the test. At each location, measurements shall be made with a sampling length of 0,8 mm, taking five sampling lengths per location (evaluation length 4,0 mm).

The average roughness, R_z, shall be measured in accordance with ISO 4287. The overall mean value from all 10 locations shall be for R_z between 1,6 µm and 2,5 µm.

When the roughness parameter does not conform to the above specifications, the steel shall be prepared using silicon carbide abrasive paper or cloth for polishing in a backwards and forwards, linear motion, using a succession of reducing grit sizes. The polishing direction of each operation shall be perpendicular to the preceding operation with the final direction being parallel to the direction of sliding movement in the test. The preparation shall continue until the roughness parameter falls within the above specifications. New steel floor plates shall also be prepared by this method.

NOTE 1 For example, steel Number 1.4301, Type 2G (cold rolled, ground) conforming to EN 10088-2:2005.

1) Slider 96 is the trade name of a product supplied by Smithers Rapra. For contact details please visit http://isotc.iso.org/livelink/livelink?func=ll&objId=8867539&objAction=browse&sort=name. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

NOTE 2 Grit sizes 100 to 600 can be suitable.

4.5 Pressed ceramic tile floor, as specified in Annex B. The tiles shall not be modified in any way, for example, by mechanical or chemical treatment other than as allowed in B.2.

4.6 Other surfaces, for example, wood, concrete, stone and polymeric flooring, with or without lubricants may be used. The surface used shall be characterized by determining the coefficient of friction in accordance with Annex C.

4.7 Mechanism for inducing movement between the footwear and the surface at a time and speed as specified in Clause 6.

4.8 Device for measuring the frictional force between the footwear and surface during the measurement period to an accuracy of 2 % or better.

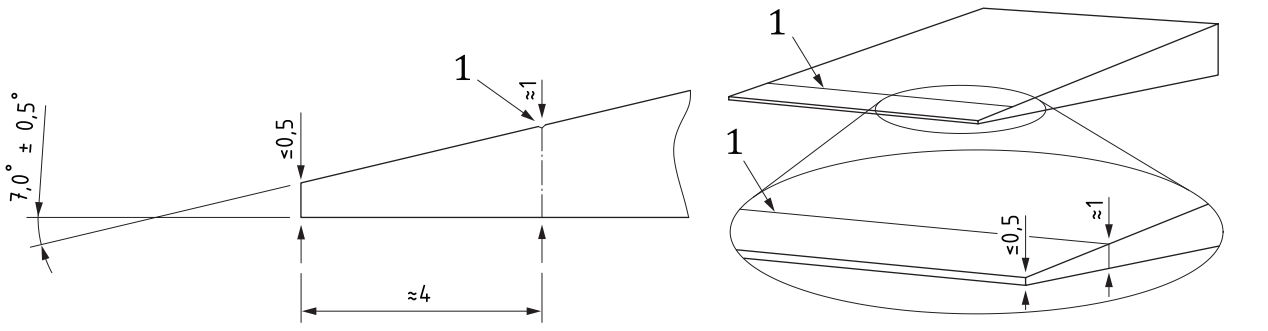
4.9 Silicon carbide paper, 400 grit size, mounted on a rigid block with a flat face measuring 100 mm × 70 mm and mass (1 200 ± 120) g.

NOTE This can be achieved using steel to make a block 22 mm thick.

4.10 Rigid wedges having a (7,0 ± 0,5)° angle for setting the contact angle. The tip of each wedge (Figure 1) shall be truncated to a maximum height of 0,5 mm as judged by graduated eyepiece or equivalent means. The width of the wedge should be sufficient to ensure that the full width of the heel or forepart shall be fully supported by the wedge. For the heel test, the length shall be sufficient to support the full length of the heel but shall not make contact with the forepart [see Figure 2 a)]. For the forepart test, the length of the wedge shall be sufficient to support the heel and forepart of the shoe [see Figure 2 b)].

The purpose of the wedge when used in 6.2.2 and C.4.3 is to ensure that the test footwear or specimen S96 is elevated by no more than ≈1 mm above the test surface when the contact angle is being set. To facilitate this, the wedge may be marked with a line parallel to, and ≈4 mm from, the truncated edge at the position where the wedge has a height of ≈1 mm, as shown in Figure 1.

Dimensions in millimetres



Key

1 marked line

Figure 1 — 7° wedge with line scribed ≈4 mm from truncated edge

4.11 Glycerol, aqueous solution with a viscosity of (0,2 ± 0,1) Pa·s. At 23 °C this corresponds to an aqueous solution containing a mass fraction of approximately 85,6 % to 92,8 % glycerol in demineralized water. For other temperatures, see Table 1 (values for temperatures in the range given in Table 1 may be interpolated). The solution shall be replaced 30 min after exposure to the ambient atmosphere unless it can be shown to still comply with Table 1.

NOTE As a solution containing a mass fraction of approximately 90 % glycerol is hygroscopic in air with a relative humidity of more than 32 %, it is advisable to use solutions with a mass fraction of approximately 90,0 % to 92,5 % glycerol.

Table 1 — Approximate concentrations of glycerol in demineralized water for different temperatures and viscosities

Temperature °C	Concentration and refractive index of glycerol in demineralized water for					
	0,1 Pa·s		0,2 Pa·s		0,3 Pa·s	
	Mass fraction %	Refractive index	Mass fraction %	Refractive index	Mass fraction %	Refractive index
21,0	84,5	1,450 0	89,5	1,457 4	91,9	1,461 0
23,0	85,6	1,450 9	90,4	1,458 4	92,8	1,462 0
25,0	86,6	1,451 2	91,4	1,459 4	93,7	1,462 8

4.12 Detergent solution, containing a mass fraction of 0,5 % sodium lauryl sulfate (SLS) in demineralized water.

4.13 Ethanol solution, containing a mass fraction of (50 ± 5) % ethanol GPR (CAS 64-17-5), which may be prepared from industrial methylated spirits GPR containing minimum 90 % ethanol, in demineralized water.

4.14 Propanone (acetone) (CAS Number 67-64-1), general laboratory grade.

5 Sampling and conditioning

5.1 Sampling

Unless otherwise specified, use a minimum of two samples, one left and one right, of the same type of footwear of the same size.

5.2 Conditioning

The test items shall be conditioned prior to the test at (23 ± 2) °C and (50 ± 5) % RH for a minimum of 24 h. If necessary, the sample may be removed from this standard atmosphere provided that its temperature is maintained at (23 ± 2) °C, that testing starts within 30 min after removal from this standard atmosphere and that the testing is carried out at (23 ± 2) °C.

6 Test method

6.1 Principle

The item of footwear to be tested is put on a surface, subjected to a given normal force, and moved horizontally relative to the surface (or the surface is moved horizontally relative to the item of footwear). Both the frictional force and normal force are measured and the dynamic CoF is calculated.

For each of the required measurements performed in accordance with this document, a corresponding estimate of the uncertainty of measurement should be evaluated. One of the following approaches shall be used:

— a statistical method, e.g. that given in ISO 5725-2[2];

— a mathematical method, e.g. that given in ISO/IEC Guide 98-3[3];

— uncertainty and conformity assessment as given in ISO/IEC Guide 98-4[4];

— JCGM 100:2008[5].

6.2 Test modes and test conditions

6.2.1 The footwear shall be tested in one or more of the following modes (see Figure 2):

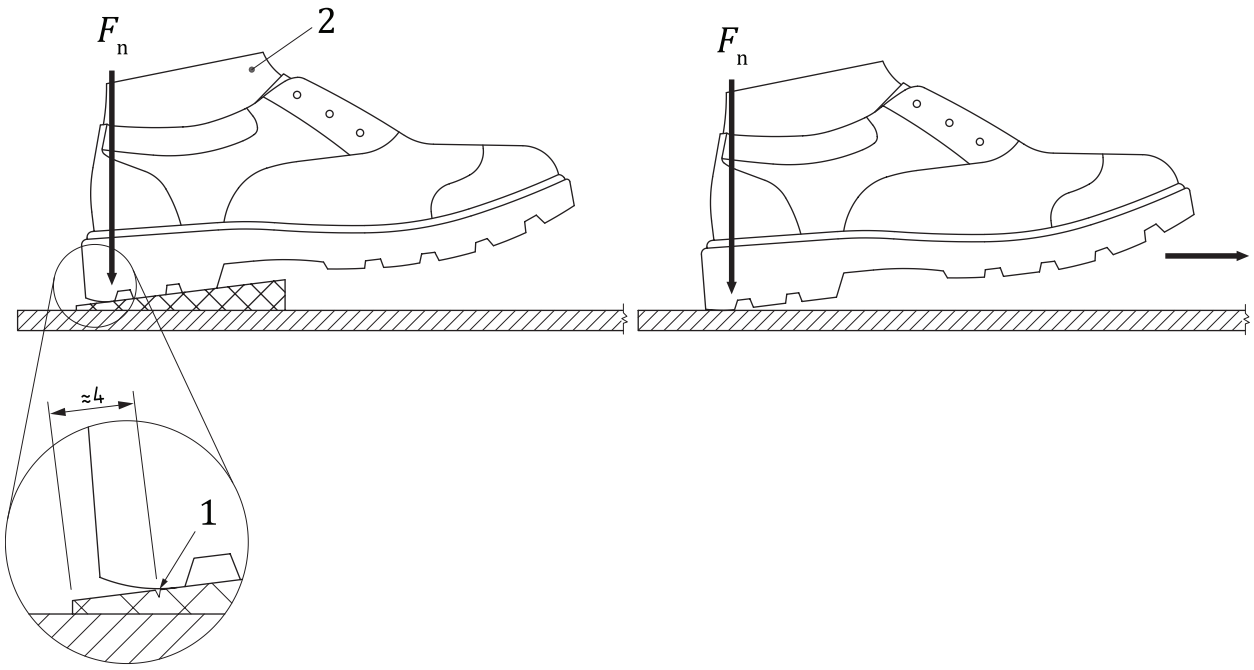
a) forward heel slip at angled contact;

b) backward slip on the forepart;

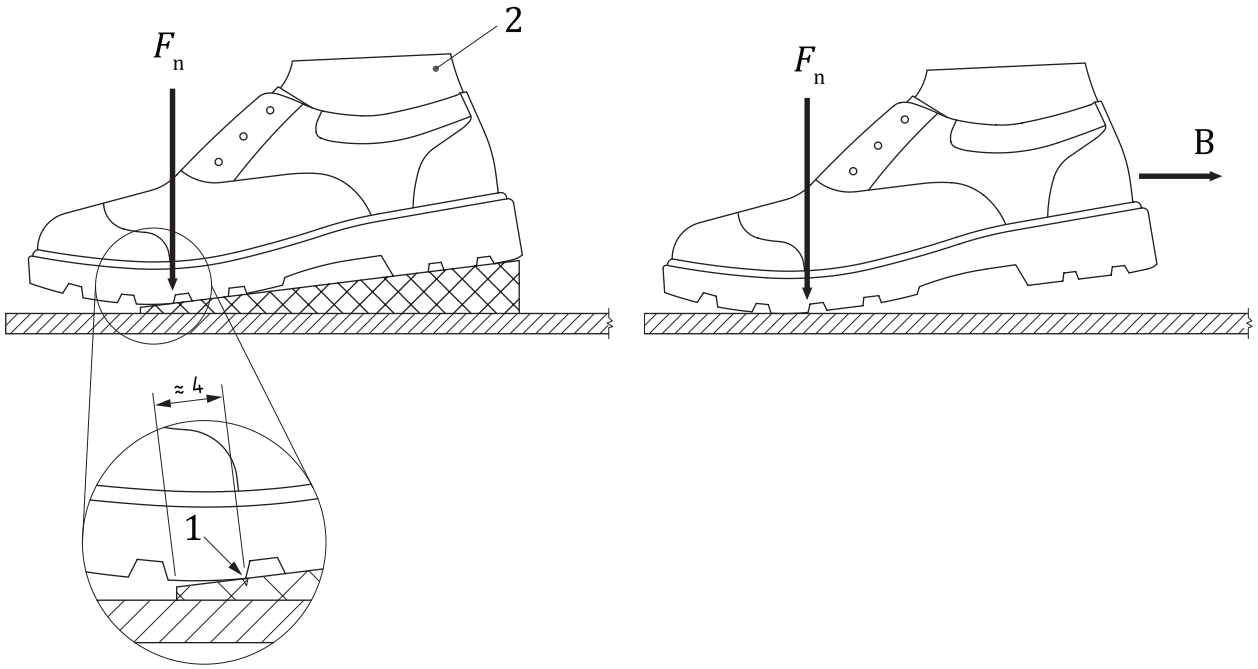
c) forward flat slip.

NOTE The heel test mode is considered the most important test mode in relation to reducing the risk of pedestrian slip.

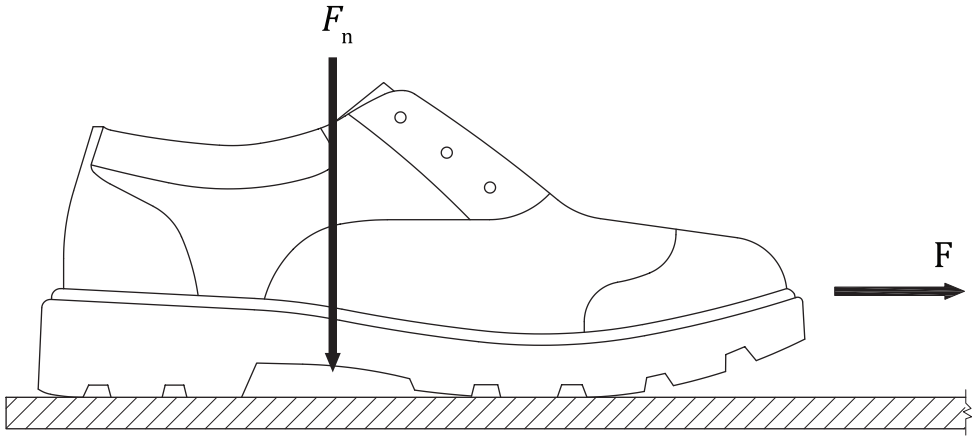
Dimensions in millimetres



a) Forward heel slip using standard or manufacturer's shoemaking last



b) Backward forepart slip using standard or manufacturer's shoemaking last



c) Forward flat slip using mechanical foot or manufacturer's shoemaking last

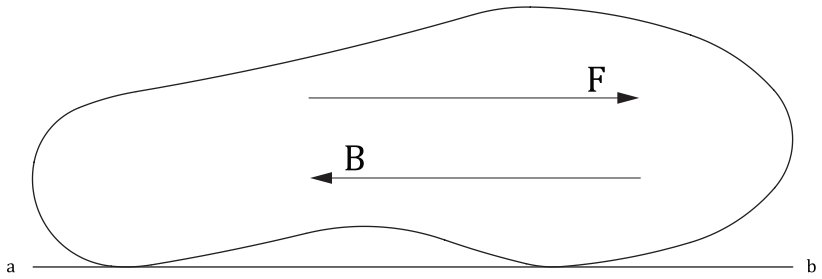
Key

1 marked line
2 shoemaking last
F_n normal force
F direction of sliding movement of shoe relative to surface in forward and flat test modes
B direction of sliding movement of shoe relative to surface in backward test mode

Figure 2 — Three test modes showing line of action of the normal force with respect to the outsole-floor contact area

6.2.2 For the heel and forepart test modes, the footwear shall be fitted onto a shoemaking last (4.1.1 or 4.1.2). The inside tangent of the shoemaking last, as defined by a straight line placed against the heel

and joint swell on the inside of the shoemaking last (line A-B in Figure 3), shall be aligned parallel to the direction of sliding movement (see Figure 3).



Key

F direction of sliding movement of shoe relative to surface in forward heel slip mode

B direction of sliding movement of shoe relative to surface in backward slip mode

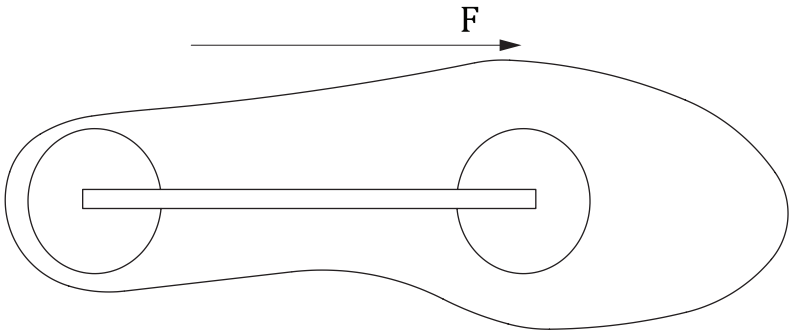
a-b Inside tangent.

Figure 3 — Inside tangent of the standard or manufacturer's shoemaking last aligned parallel to the direction of movement in heel and forepart test modes

In the heel test mode the footwear moves forward in the heel to toe direction. The contact angle between the bottom of the main area of the heel, not including any profile or chamfer at the rear edge of the heel, and the floor shall be (7,0 ± 0,5)° [see Figure 2 a)], determined using a rigid wedge (4.10) placed on the floor, the leading edge of the wedge shall be orthogonal to the direction of sliding movement. The shoemaking last, with the footwear mounted on it, shall be lowered onto the wedge under its own weight and adjusted until the footwear heel sits flat on the angled face of the wedge with ≈4 mm of the wedge extending beyond the rearmost contact point of the heel with the face of the wedge. The footwear forepart shall not contact the surface or the rigid wedge.

In the forepart test mode the footwear moves backwards in the toe to heel direction. The contact angle between the bottom of the shoe and the floor shall be (7,0 ± 0,5)° [see Figure 2 b)] determined using a rigid wedge (4.10) placed on the floor. The shoemaking last (4.1.1 or 4.1.2), with the footwear mounted on it, shall be lowered onto the wedge under its own weight and adjusted until the footwear bottom sits flat on the angled face of the wedge with ≈4 mm of the wedge extending beyond the foremost contact point of the forepart with the face of the wedge.

For the flat test mode, the footwear shall be fitted onto the mechanical foot (4.1.3) or the manufacturer's shoemaking last (4.1.2). The mechanical foot shall be orientated such that the longitudinal axis of the mechanical foot is aligned parallel to the direction of sliding movement. The footwear shall be fitted onto the mechanical foot with the heel contact plate placed centrally in the heel seat with a small gap between the back edge and sides of the insole and with the forepart contact plate positioned approximately central to the forepart (see Figure 4). If using a manufacturer's shoemaking last in place of the mechanical foot, then the last shall be aligned such that the footwear attains the same orientation of the outsole tread pattern relative to the direction of slip as would be achieved if using a mechanical foot.

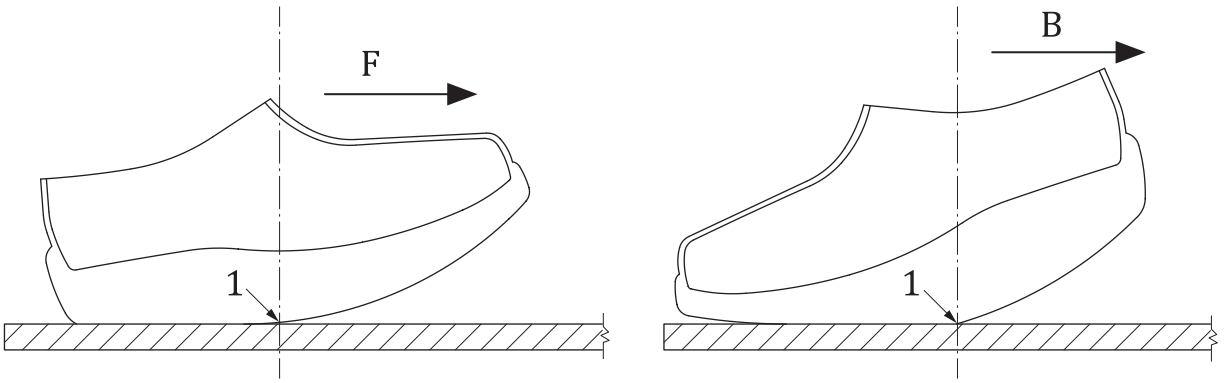


Key

F direction of sliding movement of shoe relative to surface in forward flat test mode

Figure 4 — Longitudinal axis of the mechanical foot aligned parallel to the direction of movement in flat test mode

For footwear with curved outsoles, set the angle of the shoemaking last such that the vertex is approximately the foremost point of contact between the outsole and the floor under full normal force, see Figure 5. The vertex is the central point of contact between the outsole and floor when the footwear is rested horizontally on the floor without additional load i.e. without last.



Key

F direction of sliding movement of shoe relative to surface in forward heel test mode

B direction of sliding movement of shoe relative to surface in backward forepart test mode

1 vertex of curved outsole

Figure 5 — Mounting footwear having curved outsole

6.2.3 The normal force (3.1) for footwear of European size 40 (UK size 7, Mondopoint 255) and above shall be (500 ± 25) N. For footwear of European size below 40, the normal force shall be (400 ± 20) N. Once achieved, the required normal force, within the stated tolerance, shall be maintained throughout the measurement period of the test (6.2.6).

In the heel test mode, the line of action of the normal force shall be aligned approximately through the rear edge of the heel-floor contact area determined under the weight of the shoe, last and mounting [see Figure 2 a)]. No additional force should be applied.

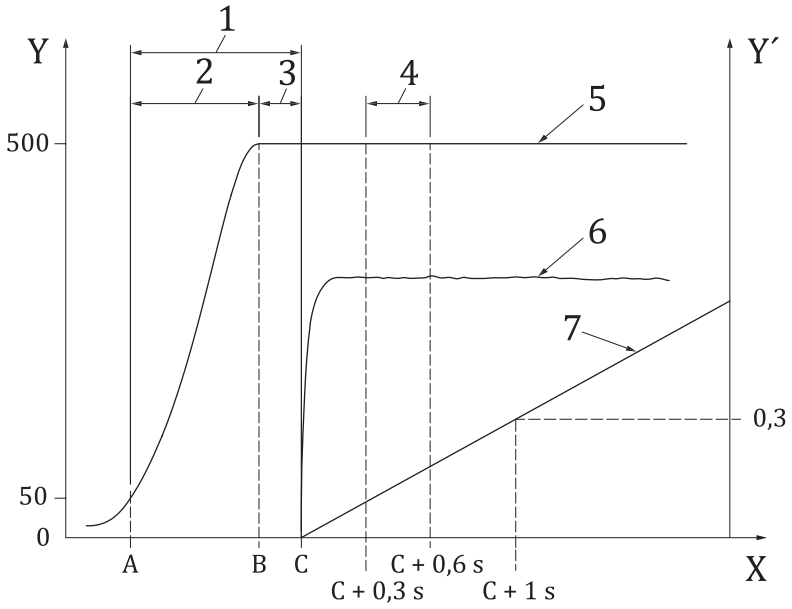
In the forepart test mode, the line of action of the normal force shall be aligned through a point at the approximate centre of the forepart region or approximately one third of the length of the outsole measured back from the end of the toe [see Figure 2 b)].

In the flat mode, the mechanical foot (4.1.3) determines the line of action of the normal force [see Figure 2 c)]. If the manufacturer's shoemaking last (4.1.2) is used, the line of action of the normal force shall be through the approximate mid-point of the length of the footwear.

6.2.4 The static contact time shall be a maximum of 1,0 s from an initial contact force of 50 N to achieving full normal force and initiation of sliding movement. Sliding movement shall start within 0,3 s of achieving the full normal force (see Figure 6).

6.2.5 The sliding velocity during the measurement period (6.2.6) shall be (0,3 ± 0,03) m/s.

6.2.6 The mean frictional force shall be measured over the measurement period between (0,30 ± 0,02) s and (0,60 ± 0,02) s after the start of sliding movement, during which the full normal force (6.2.3) and sliding speed is maintained (see Figure 6).



Key

X time (s)
Y force (N)
Y′ displacement (m)
A time at initial contact when normal force is 50 N
B time at which full normal force (e.g. 500 N) is reached
C time at start of movement
1 static contact time between points A and C: ≤1,0 s
2 time elapsed between points A and B: ≤1,0 s
3 time elapsed between points B and C: ≤0,3 s
4 measurement period between (C + 0,3 s) and (C + 0,6 s)
5 normal force
6 frictional force
7 displacement (sliding velocity during measurement period shall be 0,3 m/s)

Figure 6 — Illustrative test trace at 500 N normal force

7 Preparation of footwear and floor

7.1 Footwear

7.1.1 If there is a removable insock, it shall be taken out.

7.1.2 The upper of the footwear may be cut in order to facilitate its mounting on the last (4.1.1 or 4.1.2) or mechanical foot (4.1.3).

NOTE A sole unit or top piece can be tested by fixing to the bottom of a shoemaking last (4.1.1 or 4.1.2) or other suitable device, although the results may not be as reliable as testing whole shoes.

7.1.3 Condition the item of footwear in accordance with 5.2 prior to the first test. The item of footwear will not need to be re-conditioned following the initial conditioning (5.2) or between tests (e.g. different test modes or different surfaces) providing it is not removed from the standard temperature.

7.1.4 Cleaning and preparation procedure

7.1.4.1 Within the conditioning period (5.2), wash the outsole (all parts that will be in contact with the surface during the test, including the heel and forepart) using an ethanol solution (4.13) and scrubbing with a clean medium stiff brush. Rinse with demineralized water. Dry using clean dry compressed air and then at ambient temperature. The item of footwear however should be allowed approximately 15 min to recover before abrading (7.1.5) and testing according to Clause 8.

7.1.4.2 If the soling is suspected of having a greasy contamination on the surface, it may also be tested after solvent wiping the surface. Solvent wiping is particularly applicable to direct reaction moulded PU outsoles where mould release agent is applied to the inside of the metal mould to prevent adhesion.

Such outsoles shall be tested according to the standard procedure, namely washed using an ethanol solution (4.13) as described above (7.1.4.1), superficially abraded (7.1.5) and tested according to Clause 8, then a second test made as follows: within the conditioning period thoroughly wipe the surface of the outsole with grease-free cotton wool wetted with propanone (4.14) and leave for at least 16 h before retesting according to Clause 8.

7.1.5 Within the conditioning period (5.2) and after washing (7.1.4.1), the following abrasive cleaning procedure shall be carried out on the footwear, which may be mounted on an appropriate shoemaking last.

Prepare the outsole (all parts that will be in contact with the surface during the test, including the heel and forepart) of the footwear by lightly abrading it with silicon carbide paper affixed to a rigid block (4.9). No significant additional pressure shall be applied other than by the weight of the block (see Figure 7). Use linear or circular abrasion but with the final abrasion being linear and in the direction parallel to the direction of sliding movement in the test. Only superficial abrasion shall be applied that does not significantly change the tread pattern or the surface texture of the outsole, and that produces a final visually uniform appearance. Any debris shall be removed using clean dry compressed air. The item of footwear, however, should be allowed approximately 15 min to recover following preparation.

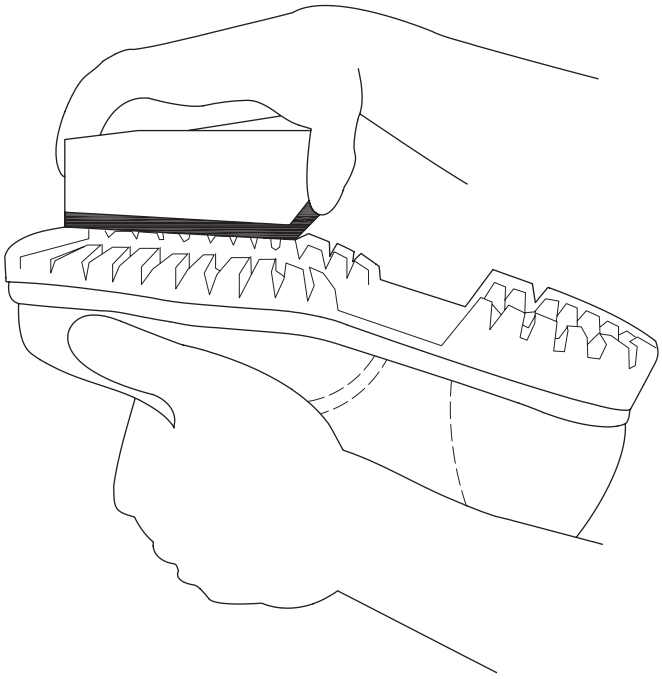


Figure 7 — Preparation of the outsole

7.1.6 Avoid subsequent contamination of the outsole other than by the test surface.

7.1.7 Each part of the outsole (heel and/or forepart) shall be washed (7.1.4.1) and re-prepared (7.1.5) after every 30 single tests on that part of the outsole (a single test being as defined in 8.8).

7.2 Floor

7.2.1 If the test floor comprises more than one piece of flooring, each piece shall be prepared as follows, and the test floor assembled ensuring that the edges of each piece are closely mated with no significant gap or unevenness across the joint(s).

7.2.2 Wash the floor with an ethanol solution (4.13), scrubbing gently with a clean medium stiff brush. Rinse with demineralized water. Dry using clean dry compressed air and then at ambient temperature.

7.2.3 Avoid subsequent contamination of the floor other than by the lubricant and footwear.

7.2.4 If the floor is used with SLS (4.12) then check the CTV (Annex C, starting at C.4) after every 40 single tests (a single test being as defined in 8.8); if the CTV falls outside the required CTV range (C.4.7 to C.4.9) then clean the floor according to C.3.5 and determine the CTV again and assess against the requirements (C.4.7 to C.4.9). If the floor is used with glycerine (4.11) then it shall be re-cleaned at the end of the day's testing. If using the standard ceramic tile (4.5) then see also Annex B.

7.2.5 Condition the floor in accordance with 5.2 prior to the first test. The floor will not need to be re-conditioned following the initial conditioning (5.2) or between tests (e.g. different test modes or different surfaces) providing it is not removed from the standard temperature. The floor however should be allowed approximately 15 min to recover following preparatory abrasion (B.2) if carried out.

7.2.6 Separate tiles should be used for SLS (4.12) and glycerol (4.11) tests.

8 Procedure

8.1 Prepare the item of footwear in accordance with 7.1.

8.2 Unless it has already been done, mount the item of footwear securely on the shoemaking last (4.1.1 or 4.1.2) or mechanical foot (4.1.3) as required, depending on the test mode to be used (6.2) and attach it to the testing machine. Select the largest size shoemaking last that will ensure a tight fit without distorting the footwear outsole; this is usually the last marked the same size as the footwear or one size smaller. If slippage is found to occur between the last or mechanical foot and the footwear during testing, prevent it by appropriate means, e.g. by placing some paper or cloth in the toe of the footwear and/or applying two-sided adhesive tape or abrasive paper to the underside of the last or mechanical foot.

8.3 Prepare the floor in accordance with 7.2.

8.4 Mount the floor securely on the test machine.

If possible, the footwear-floor contact area should not pass over a joint during the measurement period particularly in the heel test mode.

8.5 Mount the footwear on the test machine in the test mode required and in accordance with 6.2.1 to 6.2.3.

8.6 Apply the lubricant (4.11 or 4.12), if required, to the floor (4.4, 4.5 or 4.6) by pouring, or by other suitable means that avoids foaming of the liquid, such that it forms a visually continuous layer corresponding to approximately 10 ml/100 cm^2 covering the whole floor-footwear contact area. Before each test ensure that the layer is visually continuous. Ensure the flooring is thoroughly cleaned (7.2.2) between changing lubricants.

NOTE A trough or similar device can be used to entrap lubricant within the footwear/floor contact area to ensure that the required minimum depth of lubricant is reached.

8.7 Select the normal force in accordance with 6.2.3.

8.8 Activate the test sequence as follows: lower the item of footwear onto the surface ensuring that the footwear is fully supported by the surface, apply the normal force and initiate the sliding movement between the footwear and surface. Record the frictional force with the force measuring device (4.8) in accordance with the conditions given in 6.2.4 and 6.2.5. Determine the mean frictional force during the measurement period and calculate the mean CoF for that measurement (CoF_1) (6.2.6). CoF may be recorded to 2 or more decimal places.

Care should be taken when interpreting the results of tests on other floors (4.6) having a significant surface profile. In such cases, it is desirable to report the maximum and minimum CoF values recorded during the measurement period (6.2.6) in each test (8.8).

8.9 Repeat 8.8 four times to obtain five consecutive measurements (CoF_1 to CoF_5) refreshing the lubricant (8.6) if required between each measurement. Calculate and report the arithmetic mean of the CoF (CoF_m) to 2 decimal places.

However, if the five consecutive results (CoF_1 to CoF_5) show a systematic increase or decrease of more than 0,03 or 10 %, whichever the greater, of the initial reading (CoF_1), discard these results and repeat the test.

If the results continue to show a systematic increase or decrease, cease testing and report the lowest CoF recorded in the first set of five measurements (CoF_1 to CoF_5) and whether the CoF was increasing or decreasing.

8.10 If further tests using the same item of footwear and surface are to be made, for example in different test modes (6.2.1), remove excess lubricant from the floor using a clean paper towel and adjust the contact mode, taking care not to contaminate the footwear or surface, and repeat 8.6 to 8.9.

8.11 Other items of footwear may be tested on the same surface, however, the test floor shall be re-cleaned in accordance with 7.2.2.

8.12 If the same item of footwear is to be tested with different lubricants, remove the footwear from the test machine and wash the outsole in accordance with 7.1.4.1. However, demineralized water may be used in place of ethanol if the previous lubricant (4.11, 4.12) used is water soluble, before continuing.

8.13 Repeat 8.1 to 8.12 using the second sample of the footwear (5.1).

9 Test report

The test report shall contain the following information:

a) a reference to this document, i.e. ISO 13287:2019;

b) identification or description of the footwear item(s) tested, including marked footwear size, foot (left or right) and a colour photograph of the outsole which clearly shows the tread design and colour, plus the hardness of the material of the wearing face in contact with the ground, if available;

c) identification of the mounting method used (standard or manufacturer's shoemaking last, including the last reference, or mechanical foot) for each test mode;

d) the CoF as in 8.9 for each item of footwear, specifying the test combination chosen (floor, e.g., Eurotile 2, steel or other, and lubricant) and test mode (forward heel, backward forepart or forward flat);

e) if the footwear is tested before and after solvent cleaning as per 7.1.4.2, then both the CoF values before and after cleaning shall be reported;

NOTE It will be desirable to include a note that footwear CoF values by ISO 13287:2019 are not directly comparable with those by ISO 13287:2012 unless the adjustment factor incorporated in ISO 13287:2012 is taken into account.

f) identification or description of any other surface or lubricant used, including, where practicable, the calibration test value (CTV) measured in accordance with Annex C;

g) date of test;

h) any deviation from the method given in this document.

Annex A
(normative)

Standard shoemaking last and mechanical foot for testing footwear

A.1 Standard shoemaking last

Plastic standard shoemaking last, type M3601[2)].

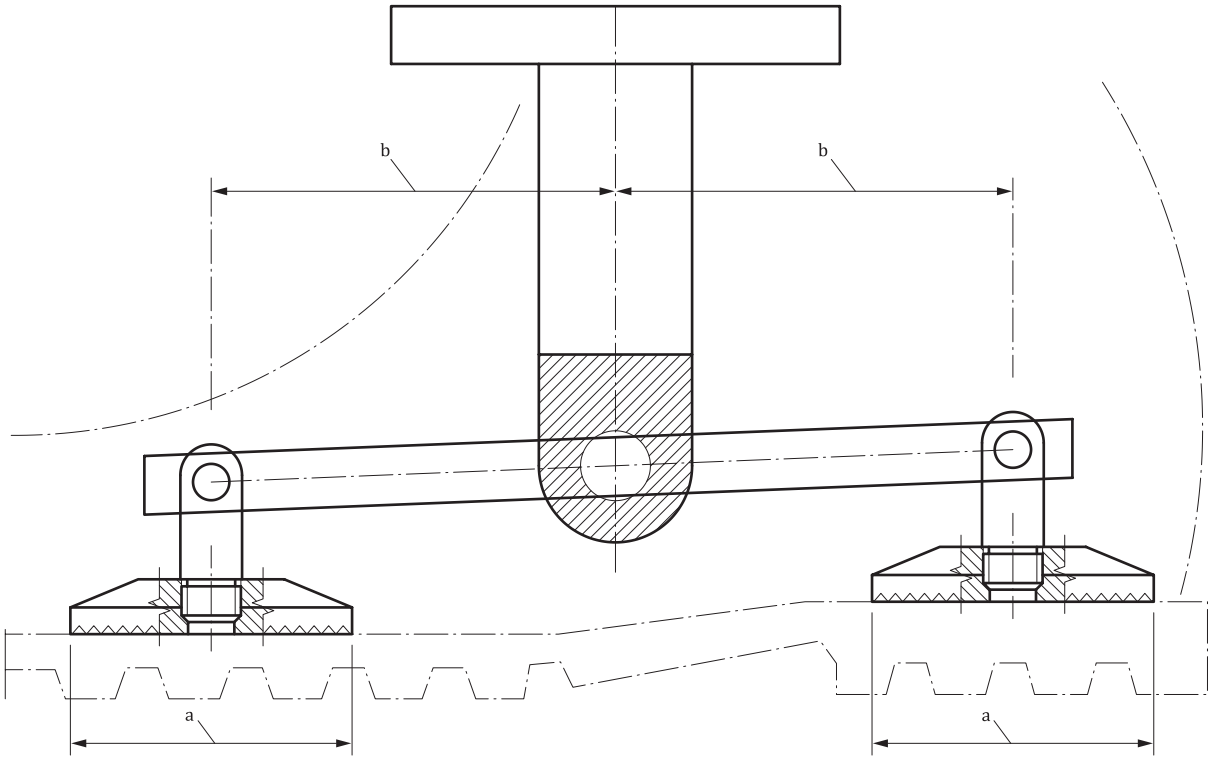
A.2 Mechanical foot[3)]

An example of a suitable mechanical foot is shown in Figure A.1. The dimensions "a" and "b" shown in Figure A.1 depend on the footwear size being tested and shall be as follows:

European (Mondopoint)	Diameter of the contact plates mm	Distance of the centres of the contact plates from the centre axis mm
below 36 (below 225)	40	60
36 to 39 (225 to 245)	40	70
40 to 44 (255 to 280)	55	80
above 44 (above 280)	55	90

2) For details of a suitable supplier of the shoemaking last please visit http://isotc.iso.org/livelink/livelink?func=ll&objId=8867539&objAction=browse&sort=name.

3) For details of suitable suppliers of the mechanical foot please visit http://isotc.iso.org/livelink/livelink?func=ll&objId=8867539&objAction=browse&sort=name.



a Diameter of the contact plates.

b Distance of the centres of the contact plates from the centre axis.

Figure A.1 — Example of a suitable mechanical foot

Annex B
(normative)

Specification of Eurotile 2 (OFIR)

NOTE Eurotile 2 superseded Eurotile 1. Eurotile 1 is no longer available therefore this document now defines Eurotile 2 as the sole reference ceramic tile.

B.1 General

B.1.1 Only pressed ceramic Eurotile 2[4)] tiles giving CTV by the method specified in Annex C, in the range 0,20 to 0,26, shall be used for testing footwear.

Tiles giving values below this range shall be discarded.

For tiles giving values above this range (>0,26); to lower such values an appropriate pre-treatment may be applied by slight abrasion using rubber specified in B.2.1.1, provided it does not affect planarity and homogeneity of the test surface. B.2 describes a pre-treatment method that has proven to be suitable.

The CTV shall be re-determined at least once per day prior to testing footwear. If used with SLS (4.12) then the CTV shall be re-determined no less frequently than after every 40 single tests (a single test being as defined in 8.8).

NOTE This means, for example, that the CTV would have to be re-determined after testing two types or styles of footwear [two samples of each type (5.1)] in two test modes, such as heel and flat, and five measurements made for each.

B.1.2 When this document is used in conjunction with ISO 20345:2011, ISO 20346:2014 or ISO 20347:2012 the following adjustment factors shall be applied to the results obtained in 8.8 or 8.9:

— for Heel test on Eurotile2 with SLS (Condition A, ISO 20345, ISO 20346 or ISO 20347) the resultant CoF value shall be reduced by 0,03;

— for Flat test on Eurotile2 with SLS (Condition B, ISO 20345, ISO 20346 or ISO 20347) the resultant CoF value shall be reduced by 0,07.

This clause will become obsolete when, ISO 20345, ISO 20346 or ISO 20347 are republished in due course.

Also:

When this document is used in conjunction with ISO 20344:2011, Annex C shall be taken as superseding ISO 20344:2011, 5.11.2.

4) For details of suitable suppliers of Eurotile 2 please visit http://isotc.iso.org/livelink/livelink?func=ll&objId=8867539&objAction=browse&sort=name.

B.2 Preparatory abrasion method for new specimens of Eurotile 2

B.2.1 Apparatus

B.2.1.1 Rubber – Standard Test Material SBR1[5)].

B.2.1.2 A means of mounting the rubber (B.2.1.1) on a device similar, or equivalent, to that shown in Figure B.1 such that it can be tested in the flat contact mode in accordance with 6.2.

B.2.2 Procedure

a) If the rubber (B.2.1.1) has a shiny finished surface it shall be abraded with 400 grit paper or use the reverse face.

b) Mount the rubber (B.2.1.1) on the device B.2.1.2.

c) Mount the device on the test machine in the flat test mode such that pressure is evenly distributed.

d) Mount the tile sample to be prepared securely on the test machine.

e) Operate machine according to 6.2.3 to 6.2.5 and apply a normal force of 500 N.

f) Perform approximately 5 preliminary test-cycles (approximately 25 slips) in the dry condition, wiping any debris away with medium brush or paper towel between each set of 5 cycles.

g) Ensure sufficient area of tile is prepared such that subsequent footwear tests can be completed on pre-abraded tile. This may require several passes repositioning the tile each time depending on the length and width of the device (B.2.1.2).

h) Wash and dry surface of the tile (7.1.4.1) prior to footwear testing.

NOTE 1 The precise method of preparing the tiles is not considered to be critical provided the principles outlined above are followed.

NOTE 2 There is no need to measure or record the CoF values during this preparatory abrasion,

5) For details of suitable suppliers of SBR1 please visit http://isotc.iso.org/livelink/livelink?func=ll&objId=8867539&objAction=browse&sort=name. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

Dimensions in millimetres

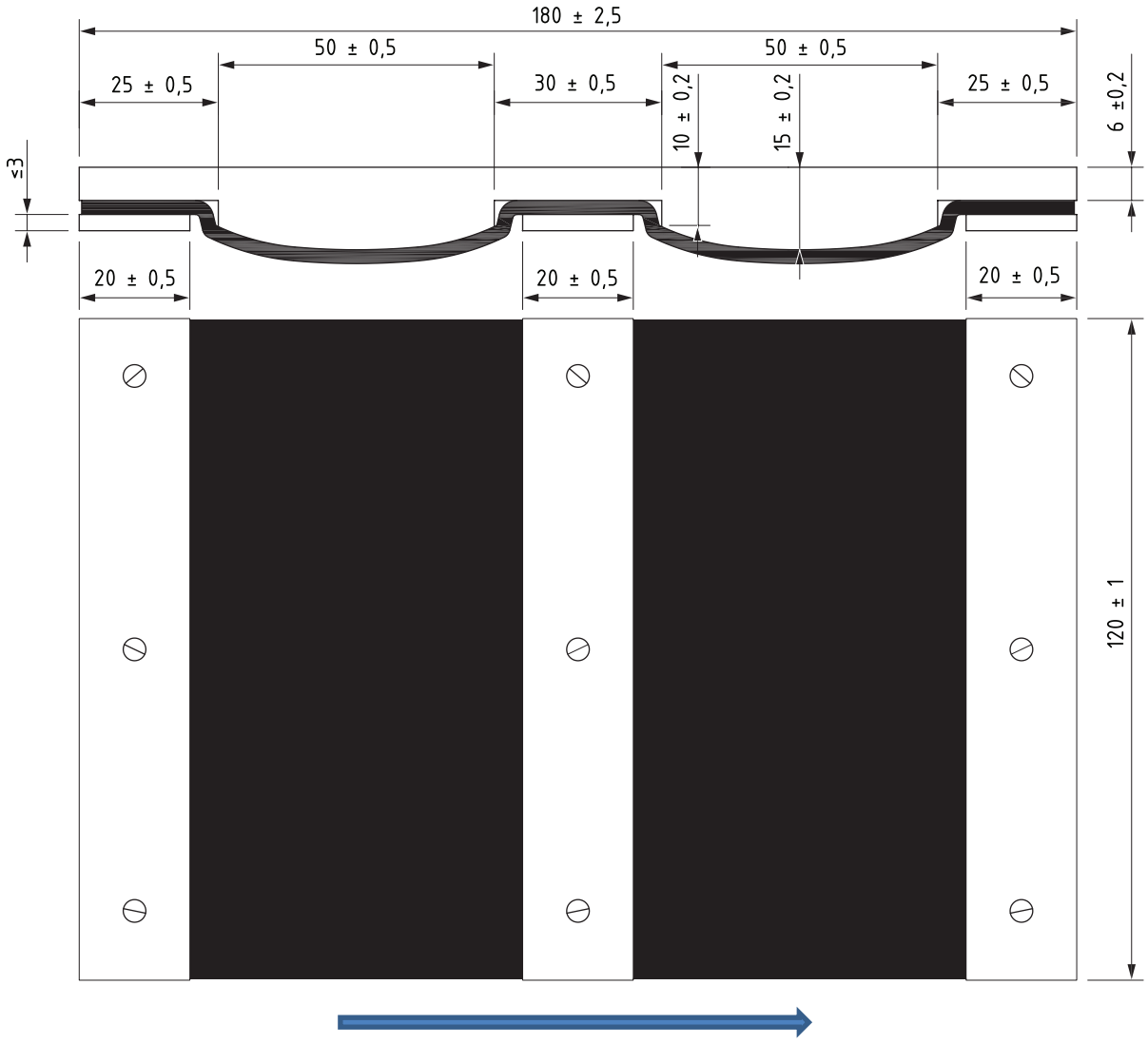


Figure B.1 — Example of a suitable means of mounting SBR1 for preparatory abrasion of Eurotile 2

Annex C
(normative)

Calibration procedure for Eurotile 2 and other test surfaces

C.1 General

Before performing a test on ceramic tiles (4.5) or on other hard surfaces (4.6), the tile or other surface shall be characterized in accordance with the following procedure.

Only ceramic tiles (4.5) giving test results in the range specified in B.1 shall be accepted as within calibration for testing footwear. Tiles giving results outside the specified range shall be rejected.

C.2 Apparatus and materials (additional to those in Clause 4)

C.2.1 Specimen Slider 96 of calibrated hardness (96 ± 2) IRHD measured value at (23 ± 2) °C and specified resilience in accordance with ISO 4662 of (24 ± 2) % at 23 °C. Required specimen Slider 96 (specimen S96) size: 25,4 mm wide, at least 50 mm long and 5 mm to 7 mm thick. The walls shall be vertical and the edges square.

Storage of specimen S96:

— storage temperature should be below 25 °C and preferably below 15 °C;

— moist conditions should be avoided and conditions should be such that condensation does not occur;

— it should be protected from light, particularly direct sunlight and strong artificial light;

— it should be protected from circulating air by wrapping or storing in airtight containers (paper and polythene are both suitable, however, plasticized PVC film is not to be used).

Specimen S96 is supplied with a certificate stating the date the sample shall be discarded.

C.2.2 Means of cutting specimen S96. Specimen S96 (C.2.1) is supplied pre-moulded in a suitable size and form. However, if larger sheets of specimen S96 are obtained, then a means is required of cutting a rectangular specimen such that it has vertical walls, square edges, and is (25,4 ± 1,0) mm wide and at least 50 mm long. A means of trimming specimens parallel to the 25,4 mm edge while retaining a vertical wall and square edge may also be required (see C.3.6).

NOTE Cutting by some methods such as shoemaking press knives may produce concave walls.

C.2.3 Rigid, rectangular backing plate, with dimensions at least as wide as the specimen cut with the device and at least 50 mm long.

C.2.4 Means of securely attaching specimen S96 (C.2.1) to the backing plate (C.2.3). Suitable adhesives include epoxy resins, cyanoacrylate or solvent-based contact adhesive. The face to be bonded should be lightly abraded with abrasive paper (C.2.6) then dried in clean, dry compressed air or by wiping with a suitable solvent such as ethanol and allowing to dry in air before bonding.

NOTE Double-sided tape may be suitable when a low level of CoF is expected, for example when testing on ceramic tile (4.5) with detergent solution (4.12).

C.2.5 **Means of attaching** the specimen S96 backing plate (C.2.3) to the test apparatus at the required contact angle.

NOTE A rectangular metal box of dimensions 180 mm × 90 mm × 90 mm can be used to replace the shoemaking last or mechanical foot (4.1.1, 4.1.2 or 4.1.3) and the backing plate (C.2.3) attached to it.

C.2.6 **Silicon carbide paper**, 400 grit size, mounted on a flat rigid surface.

C.3 Preparation of test slider and tile or other surface

C.3.1 If necessary, cut to size a sample of specimen S96 (C.2.1) using the device (C.2.2) and clean using demineralized water, then dry in air.

NOTE If other contamination, such as by oil, has occurred, discard and use a new sample of specimen S96.

C.3.2 Attach the specimen S96 (C.3.1) to the backing plate (C.2.3) using adhesive (C.2.4).

C.3.3 Holding the specimen S96 by the backing plate (C.2.3) and applying a light, evenly distributed pressure, abrade the surface of the rubber against the abrasive paper (C.2.6) until a visually even level of abrasion is achieved and the surface is parallel with the backing plate. For this procedure, alternately use a backward and forward linear movement in a direction parallel to the long side of the specimen S96, and a side-to-side movement in a perpendicular direction, with the final direction of abrasion being parallel to the long side.

C.3.4 Remove any debris from the surface of specimen S96 using clean, dry compressed air.

C.3.5 Clean the ceramic tile (4.5) in accordance with 7.2.2. Other surfaces (4.6) should be cleaned using appropriate cleaning agents.

C.3.6 The condition of the specimen S96 shall be restored at intervals as repeated use will cause edges to become rounded or a concave chamfer may develop across the tested edge. Either use the abrasion method described above to restore the slider to the correct condition, and/or cut away the affected end section of material, providing at least 50 mm length remains and the new cut edge is vertical and flat.

Both ends and surfaces of specimen S96 may be used, provided that the end used is in the correct condition.

When the thickness of specimen S96 has been reduced to 5 mm by repeated use, or its expiry date reached (C.2.1), it shall be replaced.

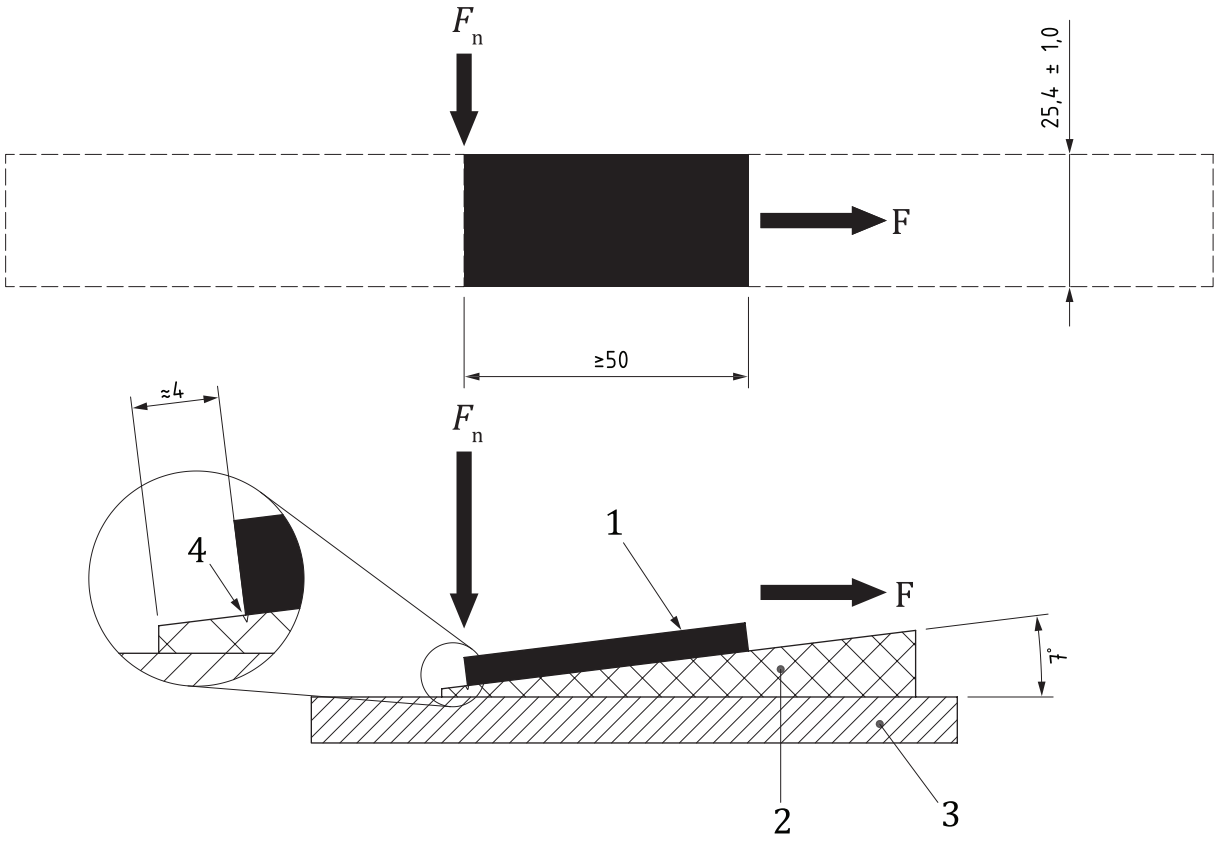
C.4 Calibration test procedure

C.4.1 Condition the test floor (4.5 or 4.6) and specimen S96 (C.2.1) for at least 3 h at the standard atmosphere (5.2).

C.4.2 Attach the backing plate (C.2.3) with specimen S96 attached to the test machine so that the 25,4 mm edge is perpendicular to the direction of sliding movement and the line of action of the normal force passes through the specimen S96/floor contact area.

C.4.3 Using the shorter rigid wedge (4.10), set the face of specimen S96 at a contact angle of (7 ± 0,5)° to the test surface (4.5 or 4.6, Figure C.1). The backing plate, with specimen S96 attached, shall be lowered onto the wedge under its own weight and adjusted until specimen S96 sits flat on the angled face of the wedge with ≈4 mm of the wedge extending beyond the rearmost contact point of specimen S96 with the face of the wedge.

Dimensions in millimetres



Key

F_n normal force
F forward movement of specimen S96 relative to the surface
1 specimen S96
2 rigid wedge
3 test surface
4 marked line

Figure C.1 — Orientation and contact angle of specimen S96

C.4.4 Mount the test surface (4.5 or 4.6) and lubricate with detergent solution (4.12 and 8.6).

NOTE Other floors and lubricants may be used in order to provide additional information.

C.4.5 Apply the test conditions specified in Clause 6 for the forward heel slip mode, applying a 500 N normal force.

C.4.6 Carry out the test procedure as specified in 8.1 to 8.8. Then:

— for Eurotile 2 (4.5 and Annex B) and other hard surfaces (4.6), make two further consecutive measurements (CoF_2 and CoF_3) and report the third measurement (CoF_3) as the CTV. No treatments shall be applied between the three consecutive test measurements except for replenishing the lubricant (4.12) if required to maintain the correct coverage (8.6).

C.4.7 For Eurotile 2, if the CTV is outside the specified range (Annex B), reject the tile.

C.4.8 For Eurotile 2, if the CTV is within the specified range (Annex B), accept the tile and record the CTV value obtained.

C.4.9 For other surfaces (4.6), unless specifications are given elsewhere, record the CTV value obtained.

C.4.10 Clean (C.3.1) and dry specimen S96 and the test floor before returning to storage.

Bibliography

[1] ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

[2] ISO 20344, *Personal protective equipment — Test methods for footwear*

[3] EN 10088-2:2005, *Stainless steels — Part2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

[4] Instructional video on carrying out tests in accordance with ISO 13287[6)]

[5] ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2 Basic method for the determination of repeatability and reproducibility of a standard measurement method*

[6] ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

[7] ISO/IEC Guide 98-4, *Uncertainty of measurement — Part 4: Role of measurement uncertainty in conformity assessment*

[8] JCGM 100:2008*Evaluation of measurement data — Guide to the expression of uncertainty in measurement (published by the Bureau International des Poids et Mesures — BIPM*

6) For details of a suitable supplier of the instructional video please visit http://isotc.iso.org/livelink/livelink?func=ll&objId=8867539&objAction=browse&sort=name.

(*Continued on third cover*)

Part 27 Flex resistance of outsoles

Part 28 Top piece retention strength heels and top pieces

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions and terminologies are, however, not identical to those used in Indian Standards. Attention isparticularly drawn to the following:

a) Wherever the words `International Standard' appear referring to this standard, they should be read as 'Indian Standard'; and

b) Comma (,) has been used as a decimal marker in the International Standard, while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 4287 Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters (Since withdrawn and superseded by ISO 21920-2 : 2021)	IS 18432 (Part 2) : 2023/ ISO 21920-2 : 2021 Geometrical product specifications (GPS) — Surface texture — Profile: Part 2 Terms, definitions and surface texture parameters	Identical
ISO 4662 Rubber vulcanized or thermoplastic — Determination of rebound resilience	IS 3400 (Part 11) : 2021/ ISO 4662 : 2017 Methods of test for vulcanized rubber: Part 11 Determination of rebound resilience (*second revision*)	Identical

In this adopted standard, reference appears to certain International Standards where the standard atmospheric conditions to be observed are stipulated which are not applicable to tropical/subtropical countries. The applicablestandard atmospheric conditions for Indian conditions are (27 ± 2) °C and (65 ± 5) percent, relative humidity andshall be observed while using this standard.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numericalvalues (*second revision*)'

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This Indian Standard has been developed from Doc No.: CHD 19 (24198).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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