INTERNATIONAL STANDARD

ISO 8782-5

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Safety, protective and occupational footwear for professional use —

Part 5: Additional requirements and test methods

Chaussures de sécurité, de protection et de travail à usage professionnel —

Partie 5: Exigences additionnelles et méthodes d'essai

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 8782 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 8782-5 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 3, *Foot protection*.

ISO 8782 consists of the following parts, under the general title *Safety, protective and occupational footwear for professional use*:

— *Part 1: Requirements and test methods*

— *Part 2: Specification for safety footwear*

— *Part 3: Specification for protective footwear*

— *Part 4: Specification for occupational footwear*

— *Part 5: Additional requirements and test methods*

— *Part 6: Additional specifications for safety footwear*

— *Part 7: Additional specifications for protective footwear*

— *Part 8: Additional specifications for occupational footwear*

Introduction

During the preparation of ISO 8782-1, it became apparent that there were a number of requirements and test methods which were needed for certain types of footwear for professional use, but which were not then at a sufficiently advanced stage for inclusion in that standard. Some of those items have now been included in this part of ISO 8782, which is intended to supplement the contents of ISO 8782-1 and to be used with it, in conjunction with parts 6, 7 and 8 of ISO 8782, as appropriate. Further work is still being undertaken with respect to slip resistance properties, protection against chemical hazards and the development of a mechanical method for the determination of water resistance. A separate standard for insulating footwear is also being prepared.

Safety, protective and occupational footwear for professional use —

Part 5:
Additional requirements and test methods

1 Scope

This part of ISO 8782 specifies requirements and test methods relating to properties of footwear for professional use additional to those specified in ISO 8782-1. It covers water resistance, protection against cutting by hand held chain saws, resistance to fire fighting hazards (footwear for fire fighters), metatarsal protection and cut resistance.

This part of ISO 8782 can only be used in conjunction with parts 6, 7 and 8 of ISO 8782, which specify requirements for footwear relating to specific levels of risk.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 8782. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 8782 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 6940, *Textile fabrics — Burning behaviour — Determination of ease of ignition of vertically oriented specimens.*

ISO 6942, *Protective clothing — Protection against heat and fire — Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat.*

ISO 8782-1:1998, *Safety, protective and occupational footwear for professional use — Part 1: Requirements and test methods.*

ISO 8782-2:1998, *Safety, protective and occupational footwear for professional use — Part 2: Specification for safety footwear.*

ISO 8782-3, *Safety, protective and occupational footwear for professional use — Part 3: Specification for protective footwear.*

ISO 8782-4, *Safety, protective and occupational footwear for professional use — Part 4: Specification for occupational footwear.*

ISO 8782-6, *Safety, protective and occupational footwear for professional use — Part 6: Additional specifications for safety footwear.*

ISO 8782-7, *Safety, protective and occupational footwear for professional use — Part 7: Additional specifications for protective footwear.*

ISO 8782-8, *Safety, protective and occupational footwear for professional use — Part 8: Additional specifications for occupational footwear.*

ISO 11393-3, *Protective clothing for users of hand-held chain-saws — Part 3: Test methods for footwear.*

EN 388:1994, *Protective gloves against mechanical risks.*

3 Terms and definitions

For the purposes of this part of ISO 8782, the terms and definitions given in ISO 8782-1 apply.

4 Requirements for whole footwear

4.1 Sampling and conditioning

The minimum number of samples (i.e. separate items of footwear) to be tested in order to check compliance with the requirements specified in this clause, together with the minimum number of test pieces taken from each sample, is given in Table 1.

Wherever possible, test pieces shall be taken from the whole footwear unless otherwise stated.

If it is not possible to obtain a large enough test piece from the footwear, then a sample of the material from which the component has been manufactured can be used instead and this should be noted in the test report.

Where samples are required from each of three sizes, these shall comprise the largest, smallest and a middle size of the footwear under test.

All test pieces shall be conditioned in a standard atmosphere of (20 ± 2) °C and (65 ± 5) % relative humidity for a minimum of 48 h before testing, unless otherwise stated in the test method.

The maximum time which shall elapse between removal from the conditioning atmosphere and the start of testing shall be not greater than 10 min, unless otherwise stated in the test method.

Each test piece shall individually satisfy the specified requirement, unless otherwise stated in the test method.

Table 1 — Minimum number of samples and test pieces

Requirements	Clause reference	Number of samples	Number of test pieces from each sample
Water resistance	4.2	3 pairs	1 pair
Resistance to chain saw cutting	4.3.3	3 pairs size 42	1 pair
Flex resistance of metal penetration resistant inserts	4.3.4 4.4.3	1 pair from each of three sizes	1 pair
Contact heat	4.4.5.1	1 pair	1 pair
Radiant heat	4.4.5.2	1 pair	two from 1 pair
Flame	4.4.5.3	1 pair	two from 1 pair
Impact resistance of metatarsal protective device	4.5.2	1 pair from each of three sizes	1 pair
Resistance to cutting	4.6.3	1 pair from each of three sizes	4 from each pair

4.2 Water resistance

When tested in accordance with the method described in 5.1, the total area of water penetration after 100 trough lengths shall be not greater than 3 cm^2.

4.3 Protection against cutting by a hand-held chain saw

4.3.1 Design

Only footwear of design C, with an upper of height greater than 195 mm, and designs D and E, as described in 4.2.1 of ISO 8782-1:1998 shall be used.

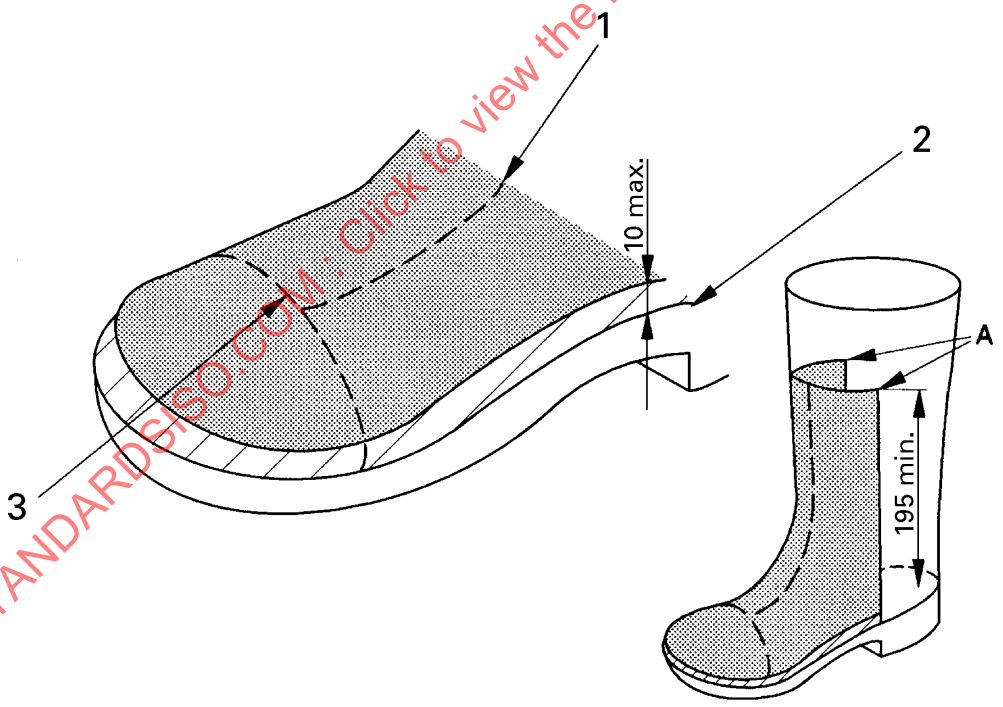
4.3.2 Construction

Footwear shall have a continuous protective area, as shown in Figure 1, comprising the vamp, tongue and toe area of the footwear. This includes the following:

a) the safety toecap;

b) the area immediately behind the toecap back edge, up to two vertical lines 70 mm on either side of the footwear centre line, measured at points A as shown in Figure 1, and vertically a maximum of 10 mm above the feather line to 195 mm above the insole, measured between the insole top edge in the middle of the seat at points A as shown in Figure 1.

Dimensions in millimetres



Protective area

Additional protective area for class 3 footwear

Key

1 Footwear centre line
2 Feather line
3 Toecap back edge

Figure 1 — Minimum protective area

For class 3 footwear (see 4.3.3) there shall be no gap between the protective area and the feather edge.

NOTE The feather line is the line of a shoe where the upper meets the bottom, the part of the bottom involved being the welt, rand or sole, depending on the method of shoe construction.

There shall be no gaps between the toecaps and the protective material.

All chain-saw protective material shall be permanently attached to the footwear. If different chain-saw protective materials are used, either they shall be fixed to each other or there shall be an overlap.

If the footwear is designed to provide protection over a larger area than that specified, all parts shall have the same protective quality.

4.3.3 Resistance to cutting by a chain saw

When tested in accordance with the method described in ISO 11393-3, using the test chain speed specified in Table 2 for the appropriate class of footwear, no cut-through shall occur.

Table 2 — Test chain speeds

Class of footwear	Test chain speed m/s
0	16
1	20
2	24
3	28

4.3.4 Flex resistance of metal penetration-resistant inserts

When metal penetration-resistant inserts in all types of footwear are tested in accordance with the method described in C.2.2 of ISO 8782-1:1998, they shall show no visible signs of cracking after being subjected to 10^6 flexes.

4.4 Resistance to fire fighting hazards (footwear for fire fighters)

4.4.1 Design

Footwear shall not be of design A, as described in 4.2.1 of ISO 8782-1:1998.

4.4.2 Construction

In classification I footwear (see clause 4 of ISO 8782-2:1998), the upper shall be made of grain leather.

4.4.3 Flex resistance of metal penetration-resistant inserts

When metal penetration-resistant inserts in all types of footwear are tested in accordance with the method described in C.2.2 of ISO 8782-1:1998, they shall show no visible signs of cracking after being subjected to 10^6 flexes.

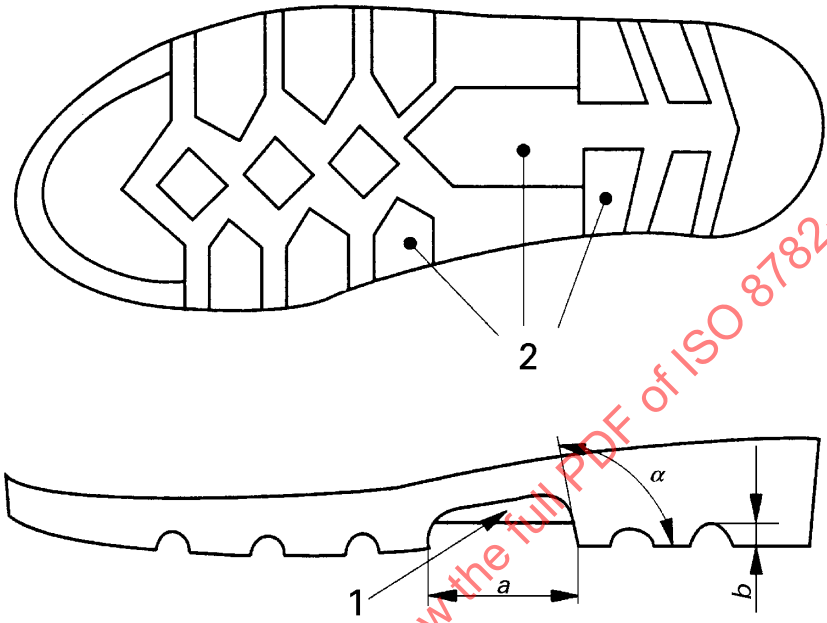
4.4.4 Outsole

4.4.4.1 The cleating design shall be such that there are no continuous linear transverse valleys across the sole.

4.4.4.2 The outsole shall have a cleat height of at least 1,5 mm in the waist area.

4.4.4.3 The outsole shall have an inclined-breast heel. Distance a shall be at least 35 mm, angle α shall be greater than 90° and less than 120°, and dimension b shall be at least 10 mm. (See Figure 2.)

4.4.4.4 Footwear shall have a steel shank unless it is provided with a metal penetration resistant insert.



Key

1 Cleat profile

2 Cleats

Figure 2 — Outsole dimensions

4.4.5 Thermal behaviour

4.4.5.1 Contact heat

When tested in accordance with the method described in 5.2.1, the bottom shall display no signs of serious damage.

4.4.5.2 Radiant heat

When tested in accordance with the method described in 5.2.2, the upper shall display no signs of serious damage.

4.4.5.3 Flame

When tested in accordance with the method described in 5.2.3, the upper shall display no signs of serious damage, nor shall the specimen be permitted to flame more than 2 s (afterflame time) or to glow more than 5 s (afterglow time) after removal of the flame.

4.5 Metatarsal protection

4.5.1 Construction

4.5.1.1 The metatarsal protective device shall be made from suitable materials and shall be of a suitable shape, such that under impact the resulting forces are distributed over the sole, the toecap and as large a surface of the foot as possible.

4.5.1.2 The metatarsal protective device shall be attached to the footwear in such a manner that it cannot be removed without damaging the footwear.

4.5.1.3 The metatarsal protective device shall fit the shape of the footwear at the inner and outer side of the foot and shall be designed so as not to impair normal foot movement.

4.5.2 Impact resistance of metatarsal protective device

When tested in accordance with the method described in 5.3, the minimum clearance at the moment of impact shall be not less than the appropriate values given in Table 3.

Table 3 — Minimum clearance at impact

Footwear sizes		Minimum clearance after impact
Paris points	**English**	mm
36 and below	3 and below	37,0
37 and 38	4 and 5	38,0
39 and 40	6	39,0
41 and 42	7 and 8	40,0
43 and 44	9 and 10	40,5
45 and over	11 and over	41,0

4.6 Cut resistance

4.6.1 Design

Footwear shall not be of design A, as described in 4.2.1 of ISO 8782-1:1998.

4.6.2 Construction

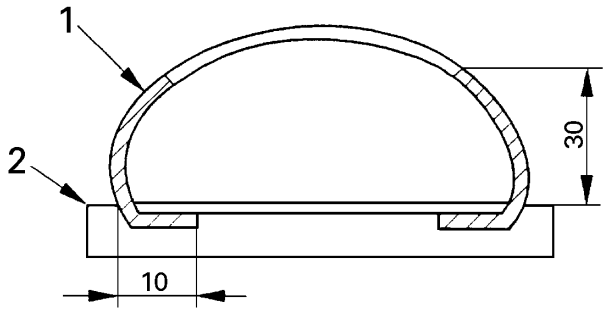
Footwear shall have a protective area extending from the feather edge to at least 30 mm above it, and from the toecap to the heel end of the footwear. It shall extend beyond the feather edge by at least 10 mm.

There shall be no gap between the toecap and the protective material. The protective material shall be permanently attached to the footwear. If different materials are used for protection against cutting, they shall either be attached to each other or shall overlap. (See Figure 3.)

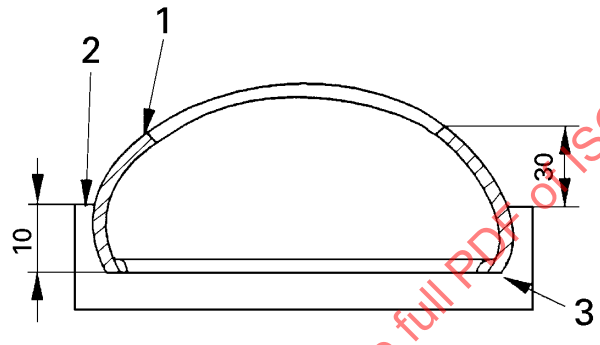
4.6.3 Resistance to cutting

When tested in accordance with the method described in 5.4, the factor I shall be not less than 2,5.

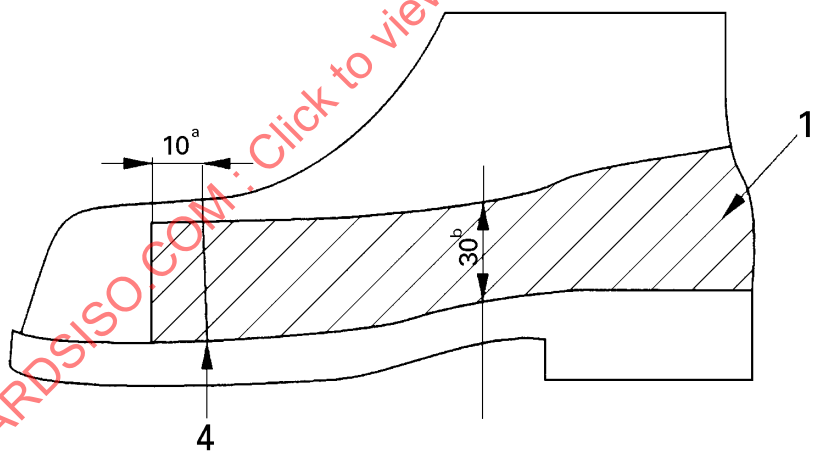
Dimensions in millimetres



a) Traditional cement lasted



b) Vulcanized or injection-moulded



c) Side view

Key

1 Protective area
2 Feather line
3 Strobel construction
4 Rear edge of toecap

a Overlap over toecap
b Minimum height above featherline

Figure 3 — Coverage of protective area

5 Test methods

5.1 Determination of resistance to water

5.1.1 Principle

A pair of footwear is worn whilst a measured number of paces are walked over a surface flooded with water to a measured depth. The extent of water entry is determined by inspection.

5.1.2 Testers

Choose the tester(s) so that the footwear fits the tester reasonably comfortably.

5.1.3 Apparatus

5.1.3.1 **Horizontal watertight trough**, having the following essential features (see also Figure 4):

a) a moveable platform near each end, high enough to enable the tester to step up and turn around above the water level;

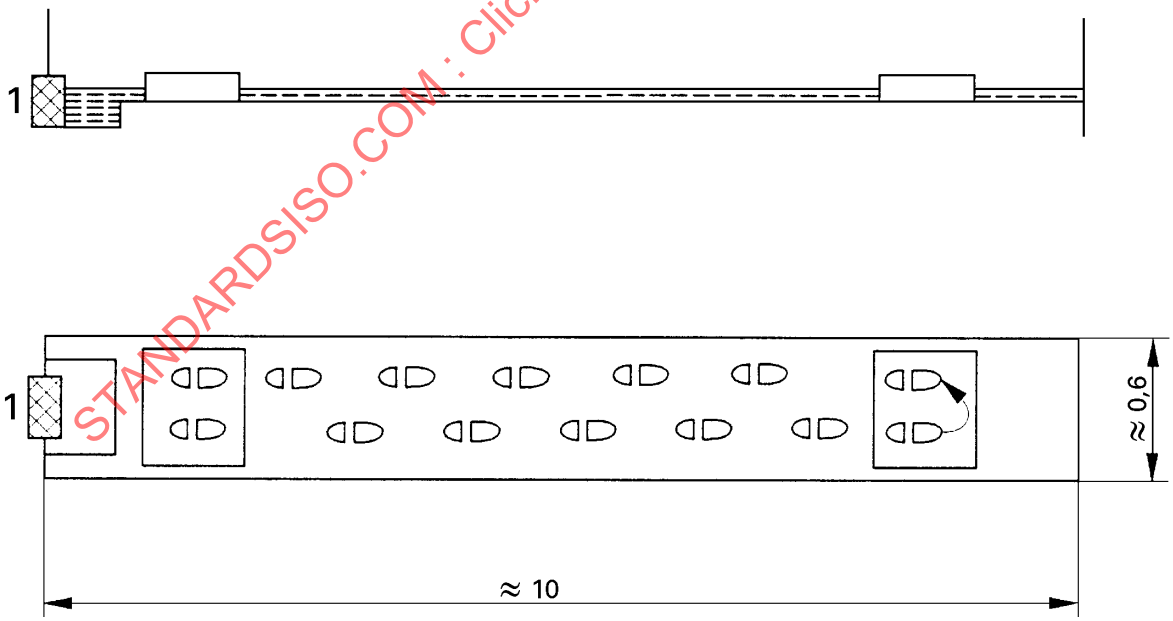
b) sufficient length to allow the tester to take 10 normal paces in the water between the platforms;

c) width of approximately 0,6 m;

d) a plug to enable the water to be drained away.

NOTE It is obviously desirable for the trough to have a piped water supply so that it can readily be filled to the appropriate depth.

Dimensions in metres



Key

1 Plug

Figure 4 — Trough

5.1.4 Procedure

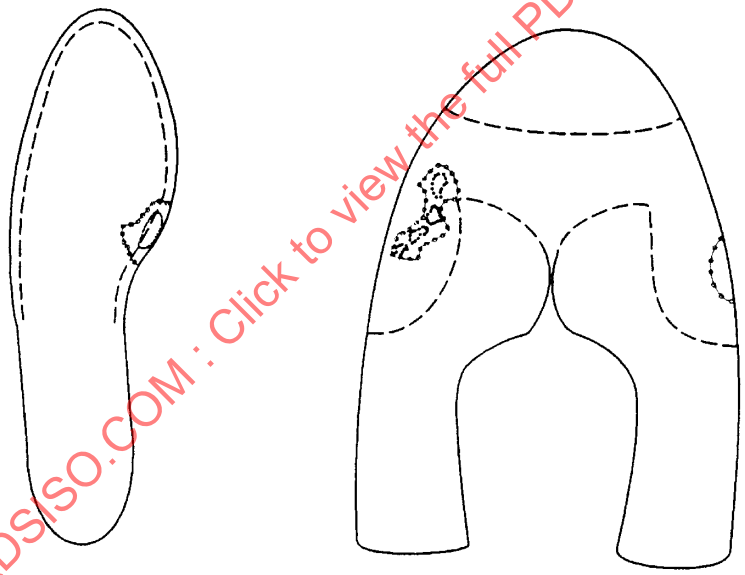
With the trough empty of water, position the turning platforms so that the tester takes 11 paces walking from one to the other with a normal length of stride (i.e. so that each foot is placed on the floor of the trough five times). Determine point A (see Figure 18 in ISO 8782-1:1998) in accordance with the method described in 5.3.2.1 of ISO 8782-1:1998 and mark the footwear 5 mm above the feather line. Fill the trough to a water level 5 mm above the feather line.

NOTE The feather line is the line of a shoe where the upper meets the bottom, the part of the bottom involved being the welt, rand or sole, depending on the method of construction of the shoe.

Ensure that the footwear is thoroughly dry. Put on the dry footwear over normal hose using a legging or guard to cover the topline, and stand on one of the platforms. Walk 100 trough lengths in the water using the platforms when turning. Take great care to make sure that no water is splashed over the topline of the footwear. To avoid this splashing, walk at a slower pace than normal, if necessary, but preferably not slower than one pace per second.

After 100 trough lengths, step out of the trough, remove the footwear carefully, and examine the inside visually and by touch for signs of water penetration. If any penetration has occurred, record its position and extent on diagrams (Figure 5 shows a suitable form of diagram) for each boot or shoe.

Repeat the test with the other two pairs of footwear.



a) Insole **b) Upper**

Key

– – – – – Seams in upper and insole ••••••••• First areas of penetration ooooooo Extended areas of penetration

Figure 5 — Suitable form of diagram for a shoe, with example of recorded penetration

5.2 Determination of thermal behaviour of footwear

5.2.1 Behaviour when in contact with a hot surface

Test in accordance with the method described in 5.8 of ISO 8782-1:1998, subject to the following deviations:

a) a temperature measuring point is not required;

b) the sandbath shall be set at (250 ± 5) °C.

After heating over a period of 40 min and cooling to ambient temperature, inspect the test piece for signs of serious damage, such as is caused by burning, dripping, melting or foaming of the material, or deformation and disbonding of the outsole. Where the test piece material exhibits signs of carbonization or cracks, the sample shall be deemed to have failed if the damage extends to the inner face of the test piece or, when whole footwear is tested, the sample is no longer fit for use.

5.2.2 Behaviour when exposed to radiant heat

Take two test pieces not less than 70 mm by 170 mm in size from the upper of a pair of footwear. Test them in accordance with method A of ISO 6942 with a heat flux, q_o, of 2 W/cm^2 and exposing the outer surface of each test piece to the radiant heat for 3 min. Inspect the test pieces for any signs of serious damage, as described in 5.2.1.

5.2.3 Burning behaviour

Test in accordance with ISO 6940, subject to the following deviations:

a) two test pieces 80 mm by 80 mm in size shall be taken from the upper of a pair of footwear;

b) the test pieces shall be positioned horizontally with the outer surface of the test piece (test surface) pointed downwards;

c) the burner shall be arranged so that the flame strikes the test piece in the middle.

After exposure to the flame for 15 s, examine the test piece to see whether it flames and measure the afterflame time or afterglow time. On completion of the test, inspect the test piece for any signs of serious damage, as described in 5.2.1.

5.3 Determination of impact resistance of metatarsal protective devices

5.3.1 Apparatus

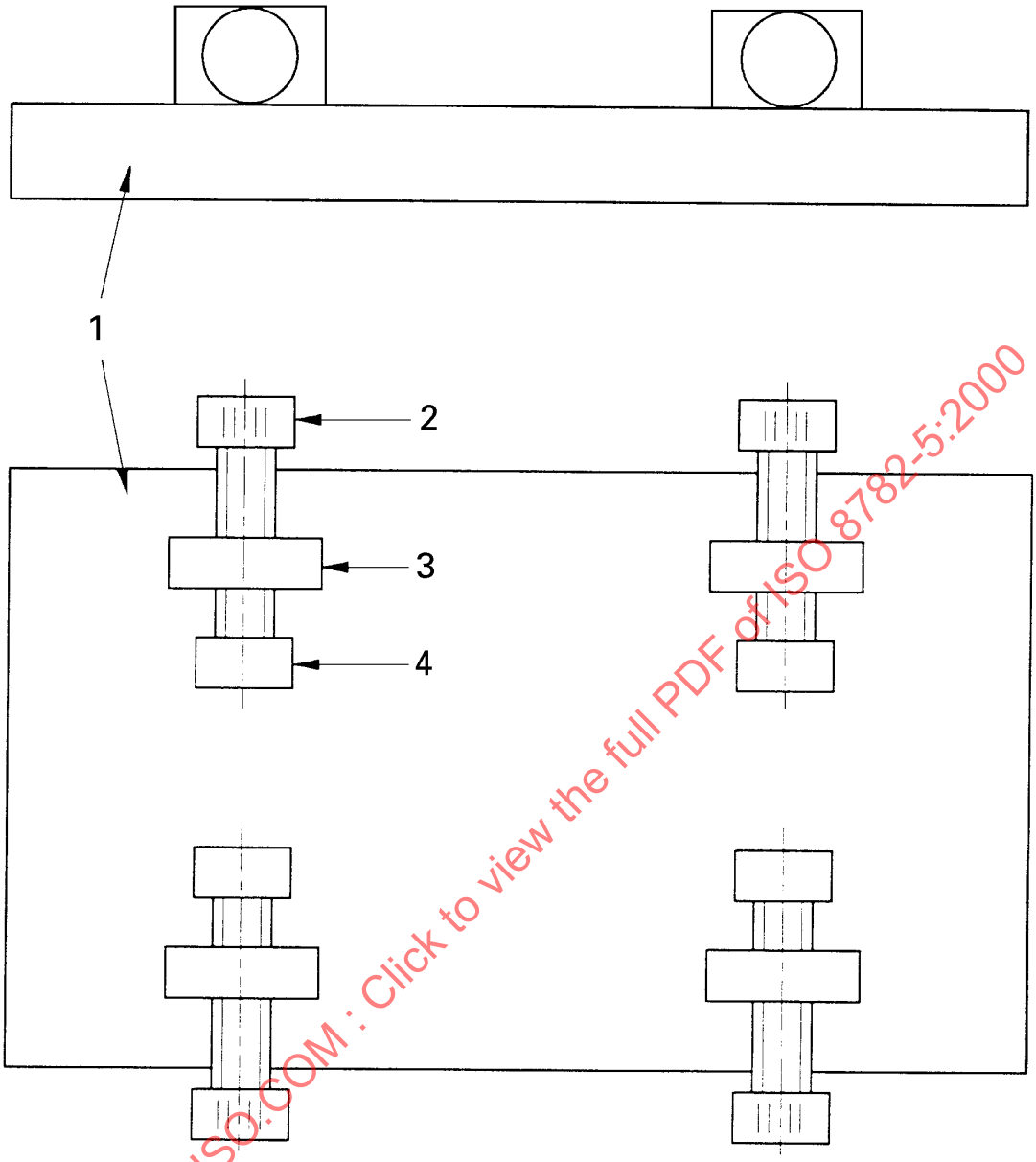
5.3.1.1 Impact apparatus, incorporating a steel striker of mass 20 kg ± 0,2 kg adapted to fall freely on vertical guides through a predetermined height to give the required impact energy, calculated as potential energy

The striker shall consist of a wedge at least 60 mm long, the faces of which subtend an angle of 90° ± 1° and with a minimum hardness of 60 HRC. The apex where the faces meet shall be rounded to a radius of 3 mm ± 0,1 mm. During the test the apex shall be parallel to the surface of the clamping device to within ±17'.

The base of the apparatus shall have a mass of at least 600 kg and a metal block of dimensions at least 400 mm × 400 mm × 40 mm deep shall be bolted to it.

The apparatus shall be free-standing on a flat and a level floor which is sufficiently massive and rigid to support the test equipment.

5.3.1.2 Clamping device, consisting of a smooth steel plate at least 19 mm thick of a minimum 60 HRC with a clamp for clamping the heel of the shoe. (See Figure 6.)



Key

1 Base plate
2 Screw
3 Threaded lug
4 Clamping plate

Figure 6 — Clamping device

5.3.1.3 **Dial gauge,** with hemispherical foot of 3,0 mm ± 0,2 mm radius, exerting a force of not greater than 250 mN.

5.3.1.4 **Wax test form,** which represents the inside of the footwear and which is used to measure the deformation of the metatarsal region during impact.