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Alpine ski-boots — Requirements and test methods

Chaussures de ski pour skis alpins — Exigences et méthodes d'essai

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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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

ISO 5355 was prepared by Technical Committee ISO/TC 83, *Sports and other recreational facilities and equipment*, Subcommittee SC 4, *Snowsports equipment*.

This fifth edition cancels and replaces the fourth edition (ISO 5355:2005 and ISO 5355/Cor.1:2007), which has been technically revised. The main changes compared to the previous edition are as follows:

— new definition of material properties of a PTFE to test the dynamic friction of boot materials in 4.3.9.2.2;

— new clause 6 "information supplied by the manufacturer";

— added tolerance for sole length marking in 4.3.12.

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

Alpine ski-boots — Requirements and test methods

1 Scope

This document specifies the requirements, test methods and marking of ski-boots which are used with current systems of alpine ski-bindings with attachment at the boot toe and boot heel, the proper release function of which depends on the dimensions and design of the interfaces.

For ski-binding systems that function irrespective of the sole shape or that have different requirements for the sole dimensions, it is not always necessary for the ski-boot soles to comply with this document in order to achieve the desired degree of safety.

It applies to ski-boots of sizes 15,0 and larger [types A (for adults) and C (for children)] in the Mondopoint system (see Annex A).

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 527-1, *Plastics — Determination of tensile properties — Part 1: General principle*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications*

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

ISO 1183 (all parts), *Plastics — Methods for determining the density of non-cellular plastics*

ISO 2039-1, *Plastics — Determination of hardness — Part 1: Ball indentation method*

ISO 9407, *Shoe sizes — Mondopoint system of sizing and marking*

ISO 9462, *Alpine ski-bindings — Requirements and test methods*

ISO 13992, *Alpine touring ski-bindings — Requirements and test methods*

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
interface
part of the ski-boot intended to contact with the ski-binding

3.2
front interface
part of the ski-boot intended to contact with the front binding

3.3
rear interface
part of the ski-boot intended to contact with the rear binding

3.4
free space
space intended to avoid contact between ski-boot and binding, especially during step in/step out or release

3.5
median plane
middle plane of the sole, longitudinal and perpendicular to the bearing surface

3.6
bearing surfaces
front and rear surfaces of the boot sole which are in contact with a plane on which the boot is standing

3.7
ski-brake
device to stop the ski after release of the binding

4 Requirements and test methods

4.1 General

If no specific test methods are indicated, check the characteristics as appropriate, e.g. by measurement.

If not otherwise indicated, execute the testing under standard atmosphere 23/50 (see ISO 554) with ordinary tolerances.

4.2 Dimensions

4.2.1 Requirements

The boot toe and heel shall comply with Figures 1 and 2. Other boot dimensions need not correspond to the figures.

Fundamentally, all dimensions shall be within the indicated tolerances. However, relevance to safety varies in importance depending on the indicated dimensions.

Looking at several dimensions ("dimensions of the 2nd degree") deviations may be accepted, provided that the following requirements are respected.

a) The deviations shall remain exceptional.

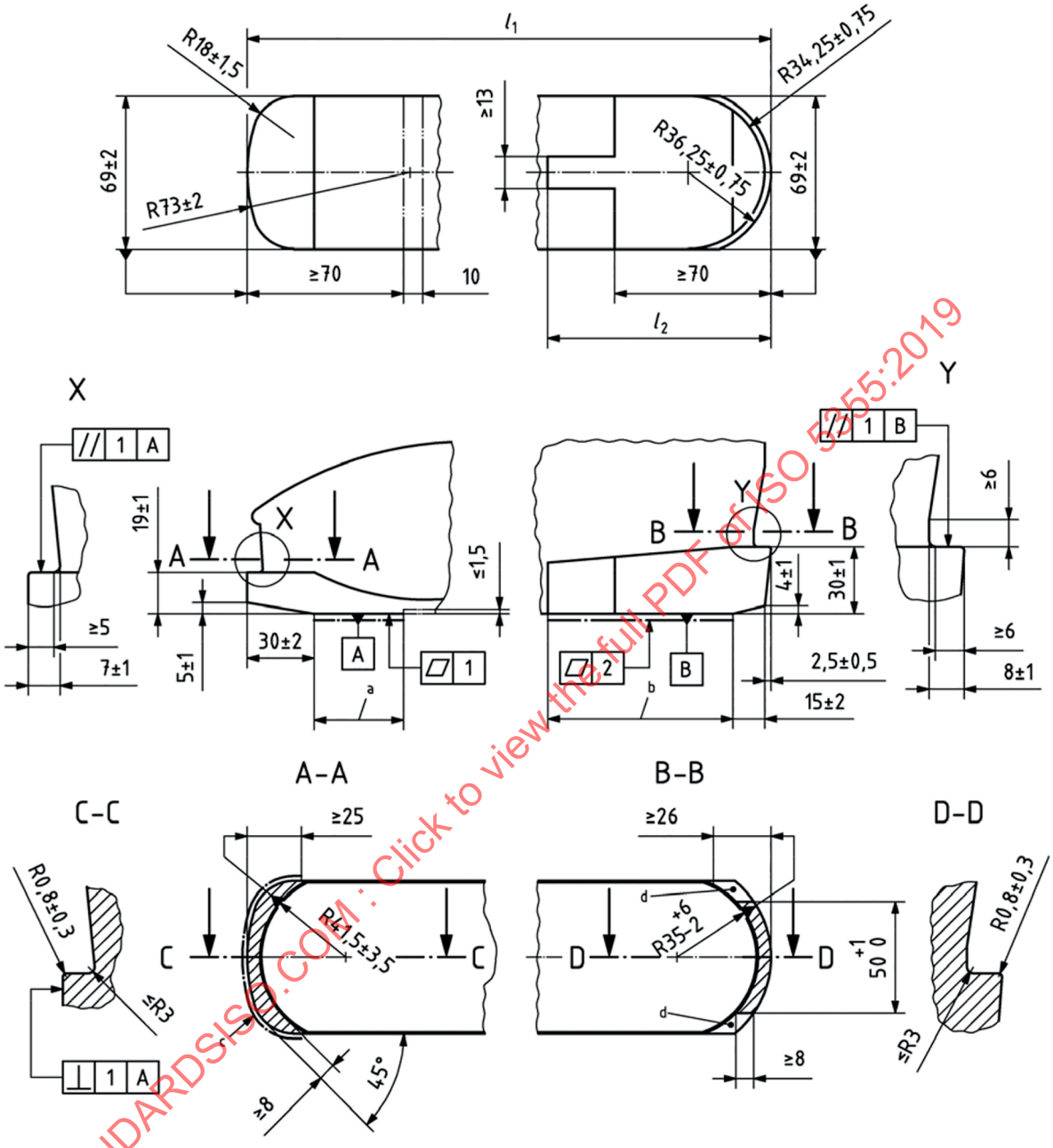
b) The deviations are small.

c) No limitations of function arise with all marketable and critical bindings.

d) The tolerances are respected at the next possible opportunity (e.g. reconstruction of a tool).

See Annex B.

Dimensions in millimetres



l_1	<300	≥300	Sole length
l_2	≥100	≥120	

a Low-friction zone/bearing surface.

b Bearing surface (see 3.6).

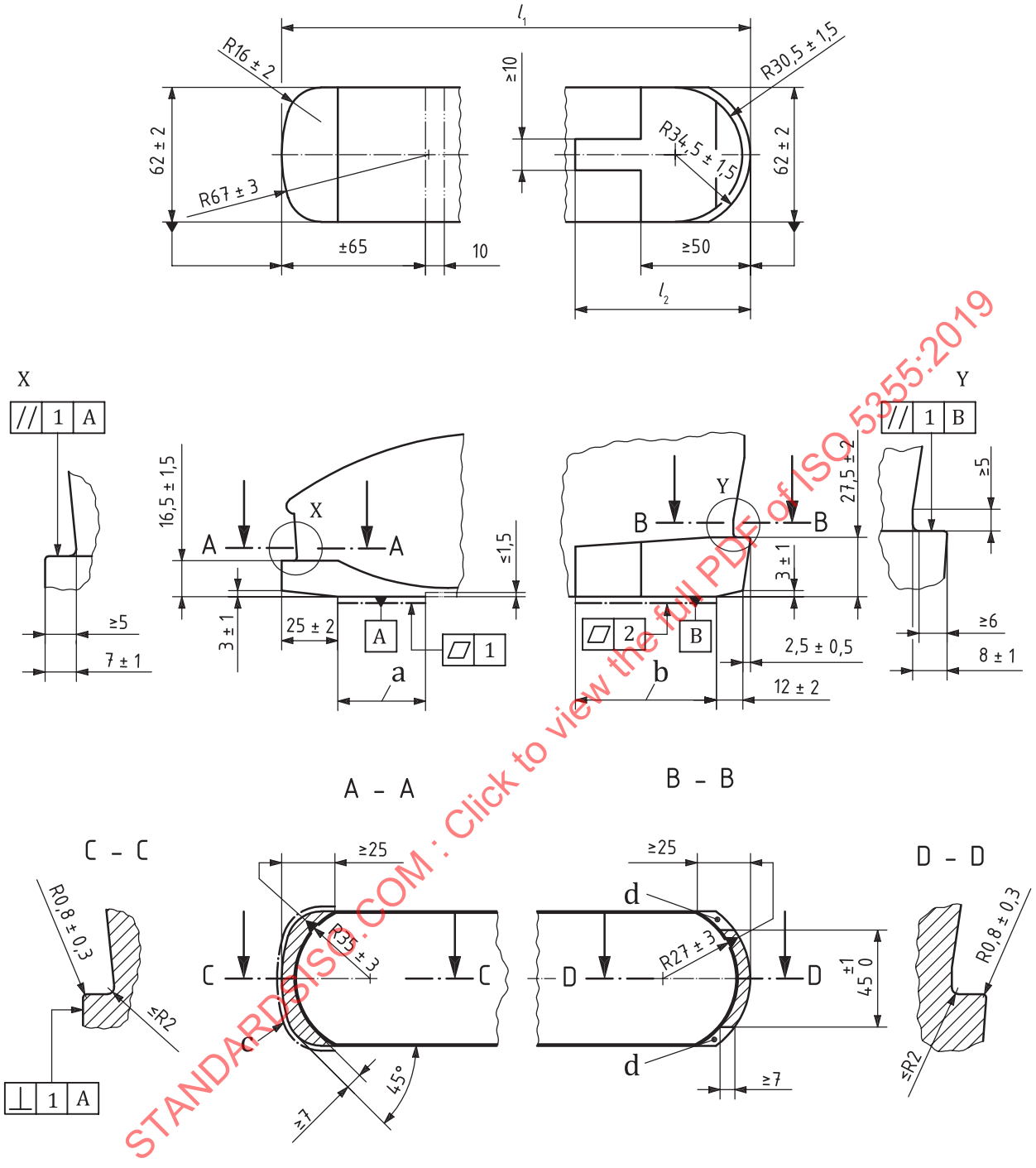
c Area in which the tolerance of perpendicularity is valid (see 4.3.3).

d Reserved areas for adjustment device.

NOTE Shaded areas including areas with index[d] are those in which the tolerances of evenness and the dimensions (19 ± 1) mm and (30 ± 1) mm are valid.

Figure 1 — Dimensions of boot toe and heel, type A

Dimensions in millimetres



l_1	<240	≥240	Sole length
l_2	≥80	≥90	

a Low-friction zone/bearing surface.

b Bearing surface (see 3.6).

c Area in which the tolerance of perpendicularity is valid (see 4.3.3).

d Reserved areas for adjustment device.

NOTE Shaded areas including areas with index[d] are those in which the tolerances of evenness and the dimensions (16,5 ± 1,5) mm and (27,5 ± 2) mm are valid.

Figure 2 — Dimensions of boot toe and heel, type C

4.2.2 Testing of evenness

4.2.2.1 When the front bearing surface rests on a plane, a gauge 1 mm thick and 10 mm wide shall not enter the AB area at any point. See Figure 3.

4.2.2.2 When the rear bearing surface rests on a plane, a gauge 1 mm thick and 10 mm wide shall not enter the CD area at any point. See Figure 4.

4.2.2.3 Before measuring the evenness of the bearing surfaces as described in Figure 5, apply a load of

— type A: 100 N;

— type C: 50 N

by inserting into the ski-boot itself a steel cylinder with a diameter of

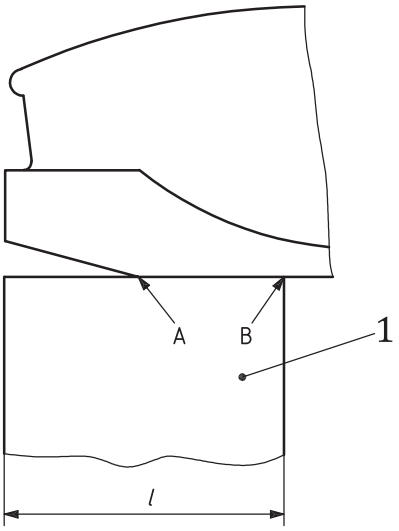
— type A: 80 mm;

— type C: 50 mm

the ends rounded with a 10 mm radius and having a corresponding mass. After 5 min, determine the flatness measurement as follows.

When the boot rests on the test plane (see Figure 5), check the maximum thickness of a 10 mm wide gauge which can enter the BC area anywhere (to a maximum of 2 mm). This gauge shall not enter the AB and CD areas.

Dimensions in millimetres



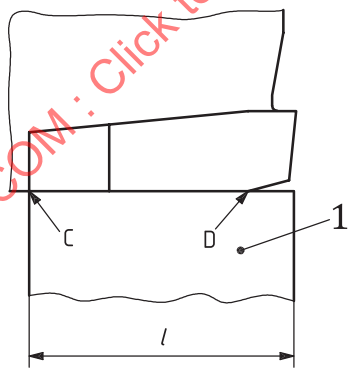
Dimension	Type	
	A	C
l	70	65

Key

1 test plane

Figure 3 — Testing of evenness at the front

Dimensions in millimetres



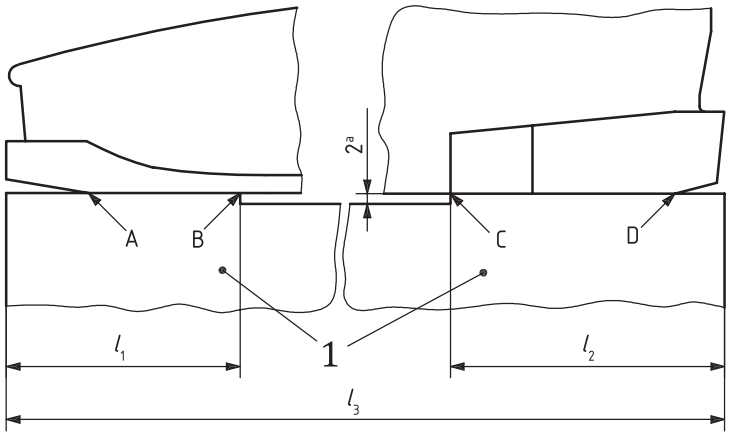
Dimension	Type	
	A	C
l	100	80

Key

1 test plane

Figure 4 — Testing of evenness at the rear

Dimensions in millimetres



Dimension	Type	
	A	C
l_1	70	65
l_2	100	80
l_3	Test plane length = Sole length	

Key

1 test plane

a Cut-out in the test surface.

Figure 5 — Testing of evenness of the whole boot

4.3 Design

4.3.1 Sole length

The sole lengths of the two ski-boots in a pair shall not differ by more than 2 mm.

4.3.2 Symmetry

The sole dimensions in the toe and heel interface areas shall be symmetrical about the median plane within an admissible deviation of 1 mm.

4.3.3 Side walls at boot toe

The side walls of the sole at the boot toe, up to a distance of at least 25 mm from the toe end, shall be perpendicular to the bearing surface within an admissible inward-outward deviation of 1 mm.

If the side walls of the sole are built in two parts, it shall be ensured that no part of the lower area of the sole protrudes beyond the upper profile.

4.3.4 Side walls at boot heel

The lateral side walls of the sole at the boot heel, up to a distance of at least

— type A: 70 mm;

— type C: 50 mm

from the heel end, shall be perpendicular to the bearing surface, or tapered inwards — outwards between 0° and 10° up to a height of 14 mm.

No part of the sole shall project beyond the 10° side wall limitation up to a height of 14 mm, between

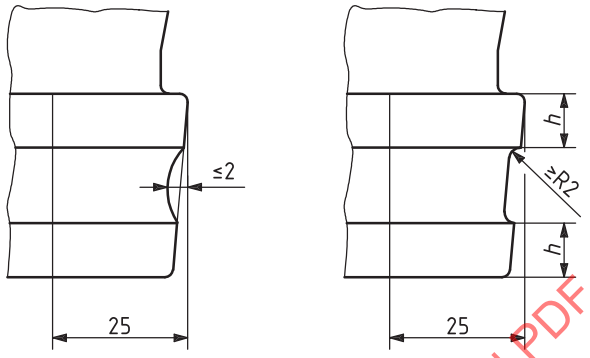
— type A: 70 mm and 85 mm;

— type C: 50 mm and 65 mm.

If lateral grooves of more than 2 mm depth are present at the heel, see Figure 6, supports at least complying with Figure 7 shall remain.

Other configurations of grooves are allowed if they are within the given dimensions in Figure 6 and Figure 7.

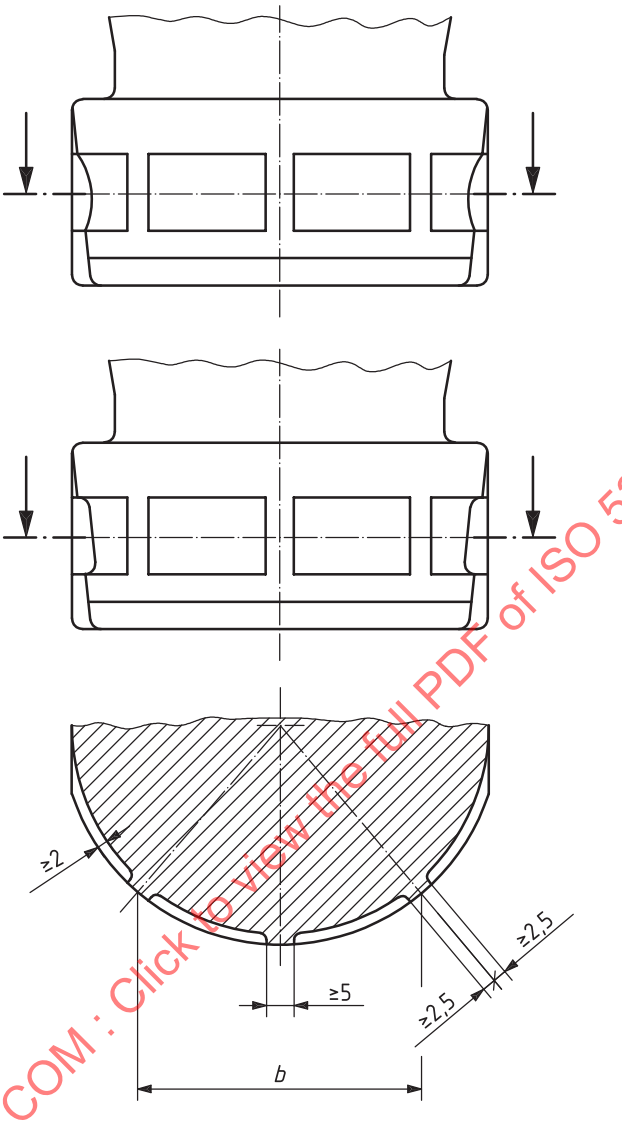
Dimensions in millimetres



Dimension	Type	
	A min.	C min.
h	9	7

Figure 6 — Lateral grooves at heel

Dimensions in millimetres



Dimension	Type	
	A	C
b	45 ± 1	40 ± 1

Figure 7 — Lateral supports at heel

4.3.5 Free spaces

4.3.5.1 Requirements

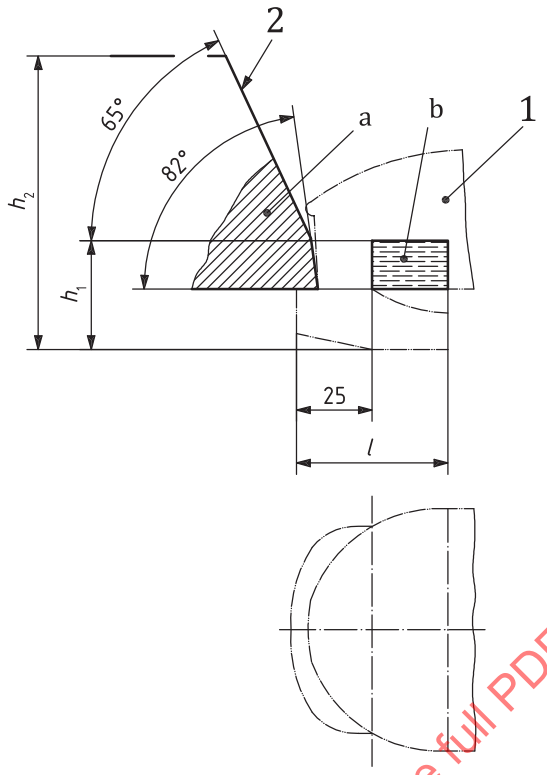
4.3.5.1.1 The boot shell in the front of the boot along the arcs with a radius of

— type A: (41,5 ± 3,5) mm;

— type C: (35 ± 3) mm

shall lie outside free space 1 (see Figure 8).

Dimensions in millimetres



Dimension	Type A min.	Type C min.
h_1	33	29
h_2	100	80
l	50	44

Key

1 sample boot
2 cone
a Free space 1.
b Free space 2.

Figure 8 — Free spaces at boot toe

4.3.5.1.2 Within free space 2 (see Figure 8), the arcs with radius of

— type A: 41,5 mm ± 3,5 mm;

— type C: 35 mm ± 3 mm

(see Figure 1 and Figure 2, section A-A) shall be continued as an arc without discontinuity, providing a smooth transition to the sides of the shaft, between

— type A: 25 mm and 50 mm;

— type C: 25 mm and 44 mm

condition is fulfilled when the curvature of the shell within free space 2 remains convex (according to Figure 9) in both horizontal and vertical planes. However, discontinuities are acceptable provided that they do not hinder the releasing movement of the binding.

Symmetry between both sides of the same boot is not required.

Dimensions in millimetres

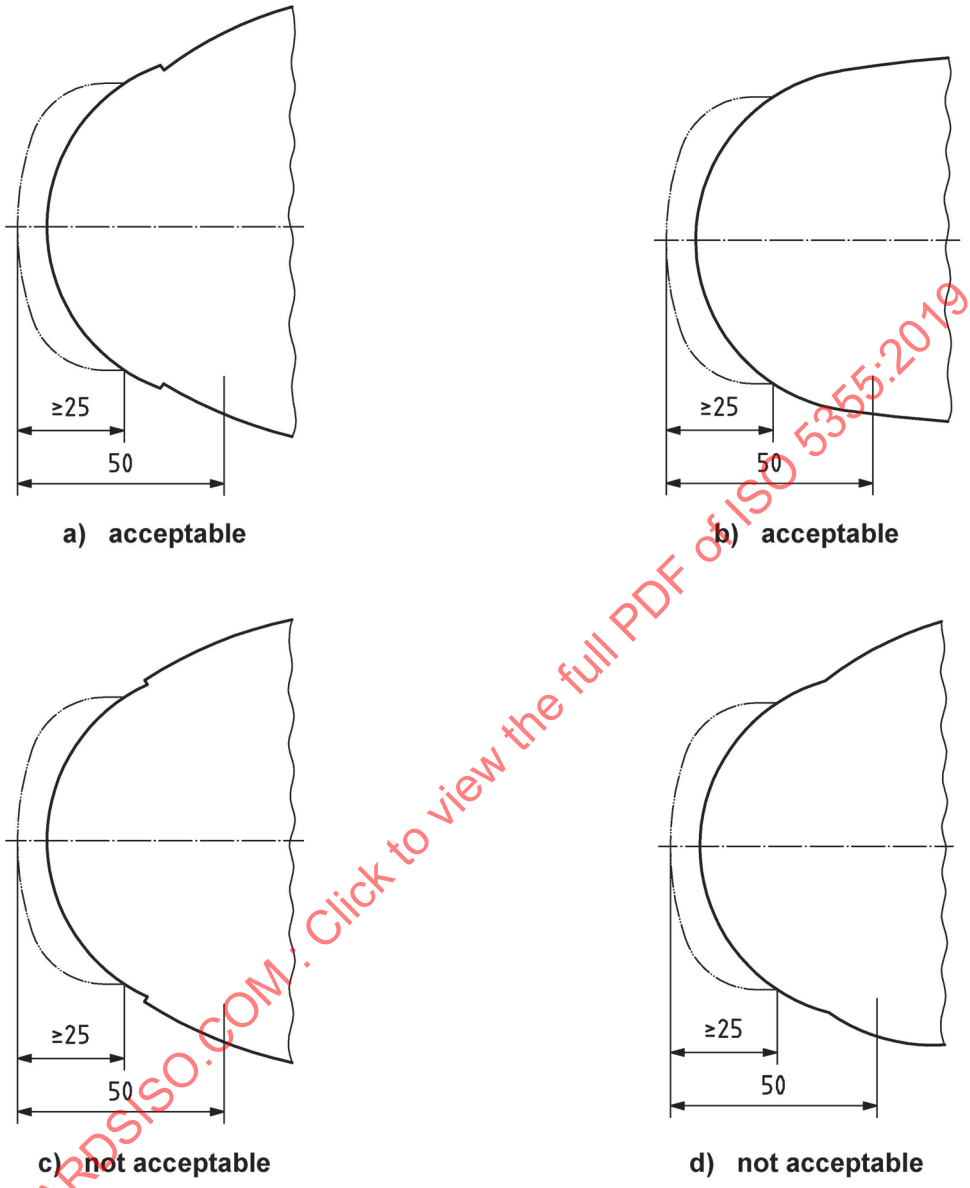


Figure 9 — Examples of curvature of the shaft in free space

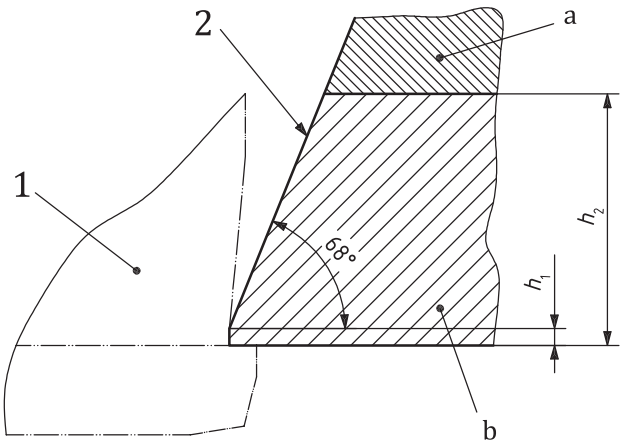
4.3.5.1.3 The boot shell at the rear of the boot along the arcs with a radius of

— type A: $\left(35^{+6}_{-2}\right)$ mm;

— type C: (27 ± 3) mm

shall lie outside free spaces 3 and 4 (see Figure 10) available for ski-binding and for handling boot and binding.

Dimensions in millimetres



Dimension	Type	
	A	C
h_1	6 min.	5 min.
h_2	105	90
Width symmetrical to the median plane	50	45

Key

1 sample boot

2 cone

a Free space 3, for handling boot and binding.

b Free space 4, for ski-binding.

Figure 10 — Free space and rear interface for ski-binding at boot heel

4.3.5.2 Test methods

4.3.5.2.1 Measuring free space at boot toe

Place the boot with its front part

— type A: min. 80 mm;

— type C: min. 75 mm

on a measuring plane. Slide the test body (see Figures 11 and 12) on this plane from the front over the front interface.

Check whether the sole height exceeds the maximum value of

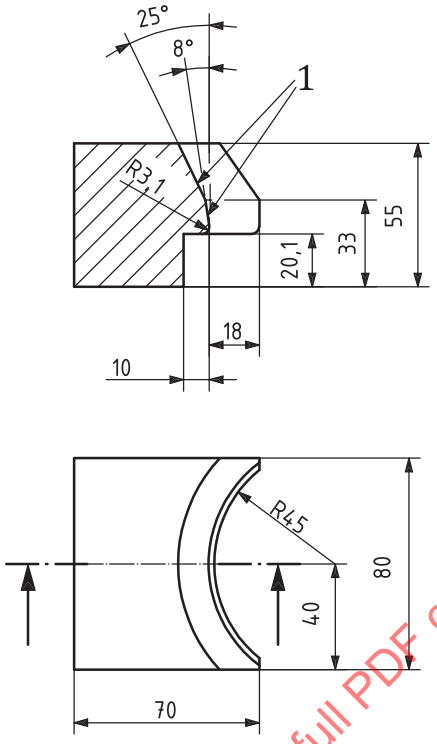
— type A: (19 ± 1) mm;

— type C: (16,5 ± 1,5) mm

and whether the requirement for free space for the binding is met.

Where the requirements are not met, ensure that the upper edge of the boot sole is in contact with the lower side of the horizontal height-recess (e.g. by placing distance-plates under the low-friction zone of the boot).

Dimensions in millimetres

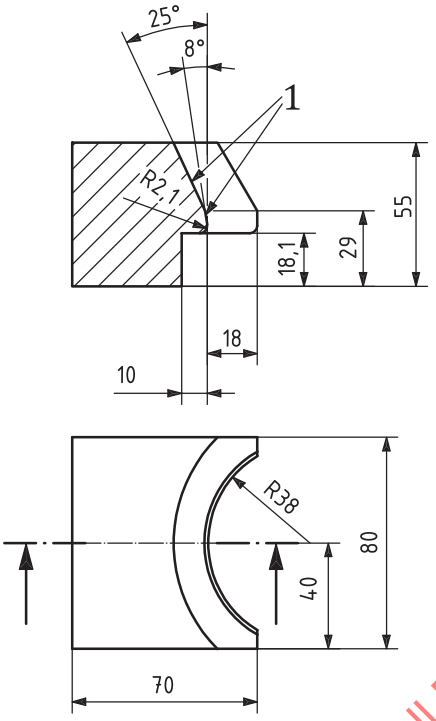


Key

1 concentric cones

Figure 11 — Test body for the free space at boot toe, type A

Dimensions in millimetres



Key

1 concentric cones

Figure 12 — Test body for free space at boot toe, type C

4.3.5.2.2 Measuring free space at rear of boot

Place the boot with its rear part

— type A: min. 100 mm;

— type C: min. 80 mm

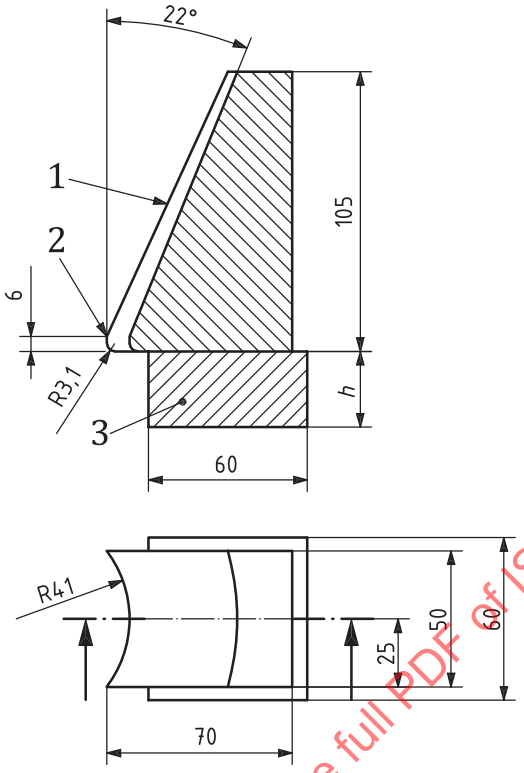
on the measuring plane. Set the test body (see Figures 13 and 14) on a supporting block. Use such blocks that correspond to the set value and to the tolerance limits of the rear sole height

— type A: (30 ± 1) mm;

— type C: (27,5 ± 2) mm

and check if this dimension is met.

Dimensions in millimetres



Key

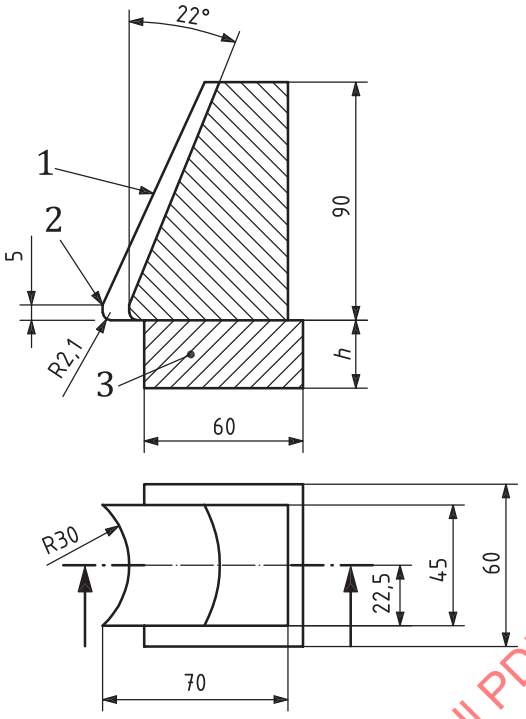
1 cone (concentric with the cylinder)

2 cylinder

3 supporting blocks, where h = 29,1; 30,1; 31,1

Figure 13 — Test body for free space at rear of boot, type A

Dimensions in millimetres



Key

1 cone (concentric with the cylinder)

2 cylinder

3 supporting blocks, where h = 25,6; 27,6; 29,6

Figure 14 — Test body for free space at rear of boot, type C

4.3.6 Interfaces

4.3.6.1 Material

4.3.6.1.1 Hardness

The hardness of the material at the toe and heel binding interfaces for adult boots (see Figure 15 and 16) shall not be less than Shore D hardness 50, measured at a temperature of (23 ± 2) °C.

The hardness of the material in contact with the antifriction device of children's boots shall not be less than Shore D hardness 50.

The hardness of the binding interface (see Figure 15 and 16) for children's boots shall not be less than Shore D hardness 45.

Testing shall be in accordance with ISO 868.

4.3.6.1.2 Antifriction

4.3.6.1.2.1 Requirement

The coefficient of dynamic friction at the toe (see Figure 15) and heel binding interfaces (see Figure 16) between the boot material and a low-friction element of polytetrafluoroethylene (PTFE) shall be ≤0,1.

If the material is identical to the material of the low friction zone, no testing is necessary.

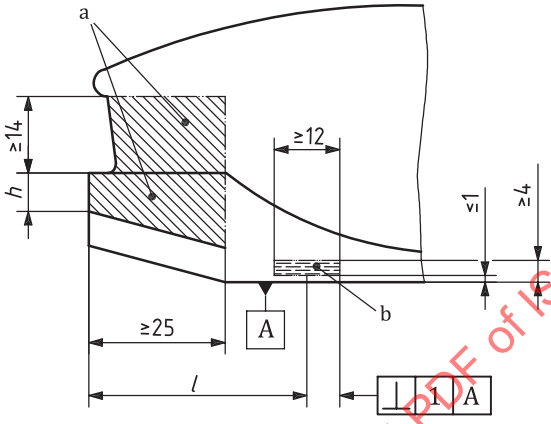
If the materials are different, test in accordance with 4.3.6.1.2.2.

4.3.6.1.2.2 Test method

Use a test specimen in the form of a plate (dimensions greater than or equal to those of the low friction zone) of the diverging material.

Test the coefficient of friction according to 4.3.9.2.3.

Dimensions in millimetres



Dimension	Type	
	A	C
l	45 ± 1	40 ± 1
h	9 min.	7 min.

a Front interface.

b Interface location for adjustment device pushing rod test.

Figure 15 — Front interface and interface location for adjustment device pushing rod test

4.3.6.2 Front interface

At the front interface (see Figure 15),

a) no material in the sole shall protrude perpendicular to the vertical surfaces;

b) the profile of the shell in the 82° to 90° space may be straight or convex in any vertical plane.

4.3.6.3 Interface for the toe locking mechanism of the adjustment device

On both sides of the boot soles, an interface for the adjustment device pushing rod as shown in Figure 15 (footnote b) shall be available.

This area shall be parallel to the median plane and shall lie at the same height on both sides of the sole.

Bindings for which the release adjustment test can be carried out by applying a lateral force on the surface should be conceived so as not to interfere with the application of this force.

NOTE This test method is only one among many.

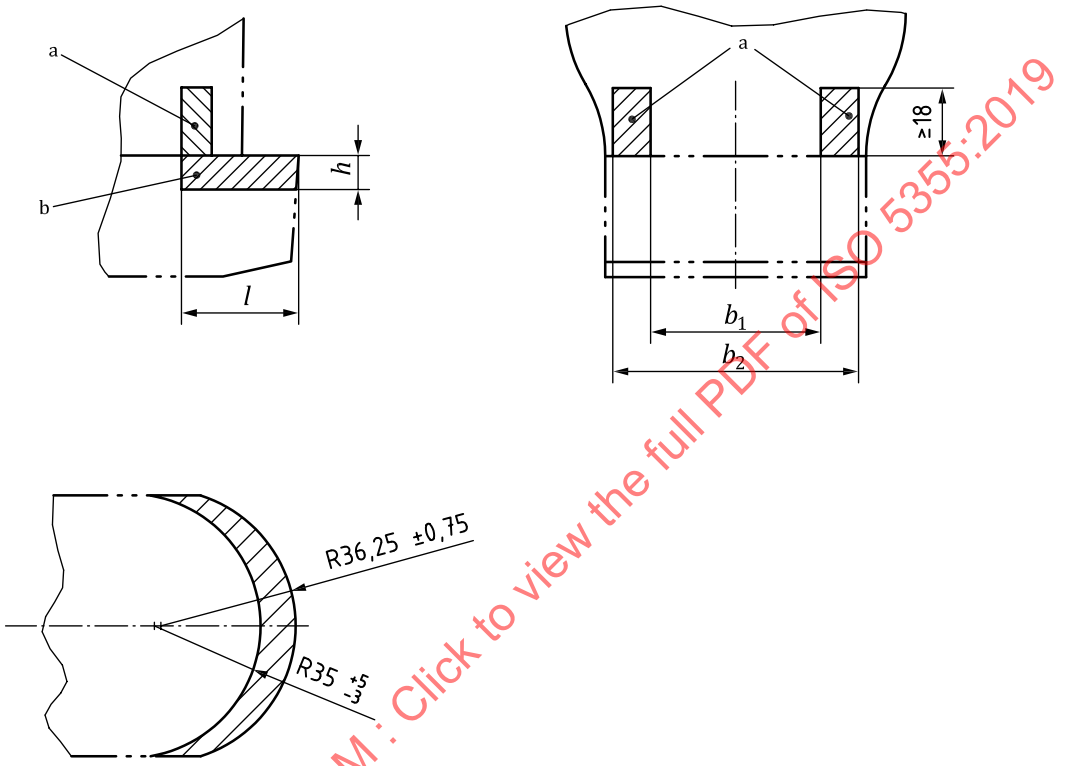
4.3.6.4 Interface for the heel locking mechanism of the adjustment device

On both sides of the boot shell an interface for the locking mechanism of the adjustment device as shown in Figure 16 shall be available.

NOTE This method for locking the binding by means of a mechanism is only one among many.

The shaded areas in Figure 16 shall correspond to the outer shell of the ski boot, but shall not contain any edges or contain any protruding or set back areas.

Dimensions in millimetres



Dimension	Type	
	A	C
b_1	45^{+1}_{0}	45^{+1}_{0}
b_2	65^{+1}_{0}	59^{+1}_{0}
l	26 min.	25 min.
h	9 min.	7 min.

a Interface location for locking mechanism of adjustment device.

b Rear interface.

Figure 16 — Interface location for locking mechanism of adjustment device and low friction zone of rear interface

4.3.7 Bevelled areas

A tread pattern is permitted in the front area and the rear bevelled area.

4.3.8 Bearing surface at heel

4.3.8.1 Closing at the heel part

4.3.8.1.1 Requirements

The bearing surface shall be suitable for closing the heel part and shall allow longitudinal elastic travel of the binding.

4.3.8.1.2 Test method (penetration test)

Bring a test cylinder, length 40 mm and diameter 20 mm, on to the heel bearing surface. Set the zero with unloaded cylinder and apply a load of

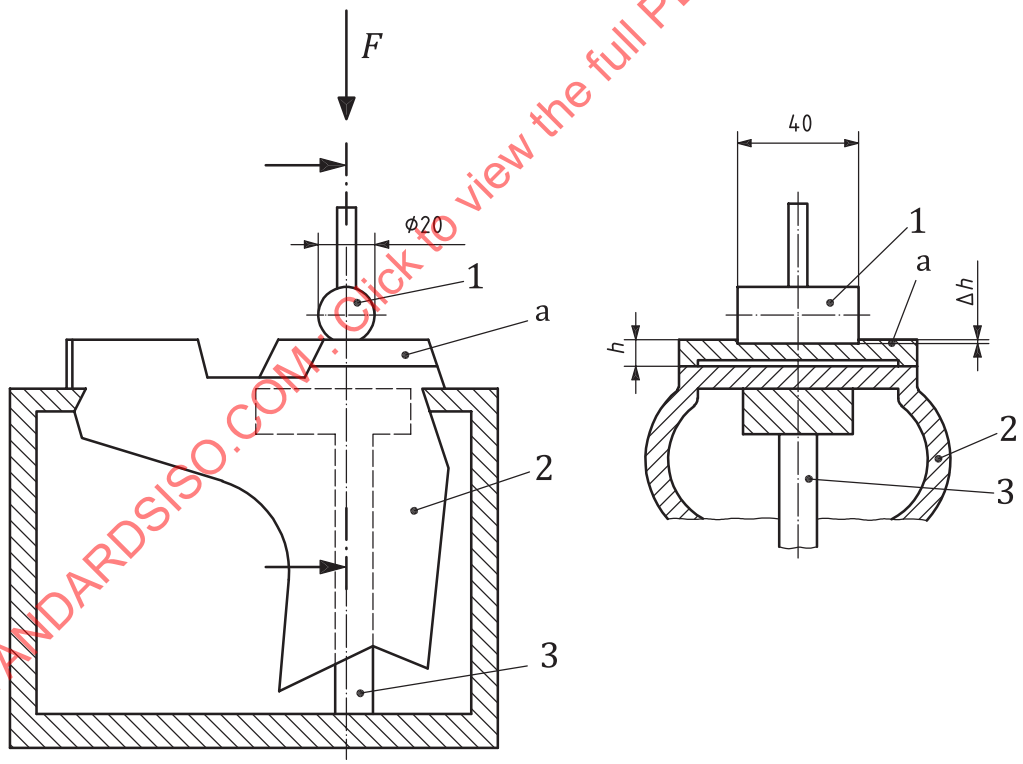
— type A: 400 N;

— type C: 250 N

perpendicular to the boot (see Figure 17).

After 60 s the cylinder shall not have penetrated into the surface more than 2,5 mm.

Dimensions in millimetres



Key

1 test cylinder
2 sample boot
3 support to avoid sole bending
F test load
a Heel-bearing surface.

Figure 17 — Penetration test

4.3.8.2 Correct fit

4.3.8.2.1 Requirements

The bearing surface shall provide a correct fit on the bearing plate of the binding.

4.3.8.2.2 Test methods

4.3.8.2.2.1 Penetration test

This is carried out in accordance with 4.3.8.1.2.

4.3.8.2.2.2 Cylinder test

Move a test cylinder of 10 mm diameter and 20 mm length within the peripheral zone of

— type A: 13 mm;

— type C: 10 mm

see Figure 20 and 21. The test shall not reveal a variation in height greater than 1,5 mm in the longitudinal axis of the boot.

4.3.8.3 No hindrance to sideways movement

4.3.8.3.1 Requirements

There shall be no hindrance to sideways movement of the sole if the binding releases.

4.3.8.3.2 Test methods

Penetration test, carried out in accordance with 4.3.8.1.2.

4.3.8.4 Proper function of ski-brakes

4.3.8.4.1 Requirements

There shall be no interference with proper functioning of ski-brakes.

4.3.8.4.2 Test method

4.3.8.4.2.1 Penetration test

This is carried out in accordance with 4.3.8.1.2.

4.3.8.4.2.2 Cylinder test

Move a test cylinder of 5 mm diameter and of length greater than the breadth of the sole along the longitudinal axis of the boot and later a test cylinder of 5 mm diameter and a length of 35 mm in the area between

— type A: 25 mm and the value of dimension l_2 of Figure 1;

— type C: 25 mm and the value of dimension l_2 of Figure 2

from the heel end. Both tests shall not reveal a variation in height greater than 1,5 mm along this axis.

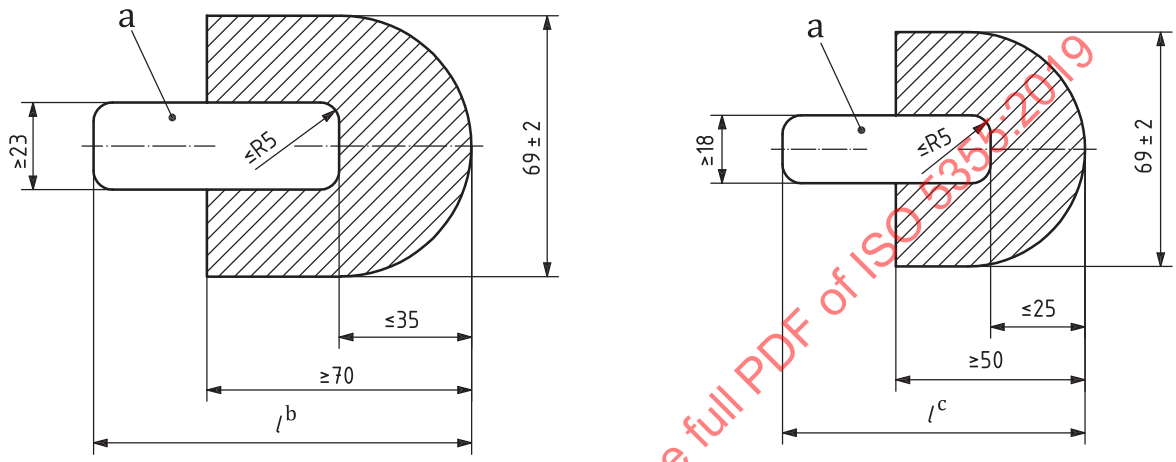
4.3.8.5 Material other than TPU

4.3.8.5.1 Requirements

If a material other than TPU (thermoplastic polyurethane) is used in the heel part of the boot, there shall be at least one longitudinal low friction area to act as a bearing surface for the ski-brake as shown in Figure 18.

These boots shall fulfil the requirements of 4.3.9.1.1.

Dimensions in millimetres



a Non-profiled area may be 0,5 mm maximum deeper than profiled area and shall have the properties of 4.3.9.

b See Figure 1.

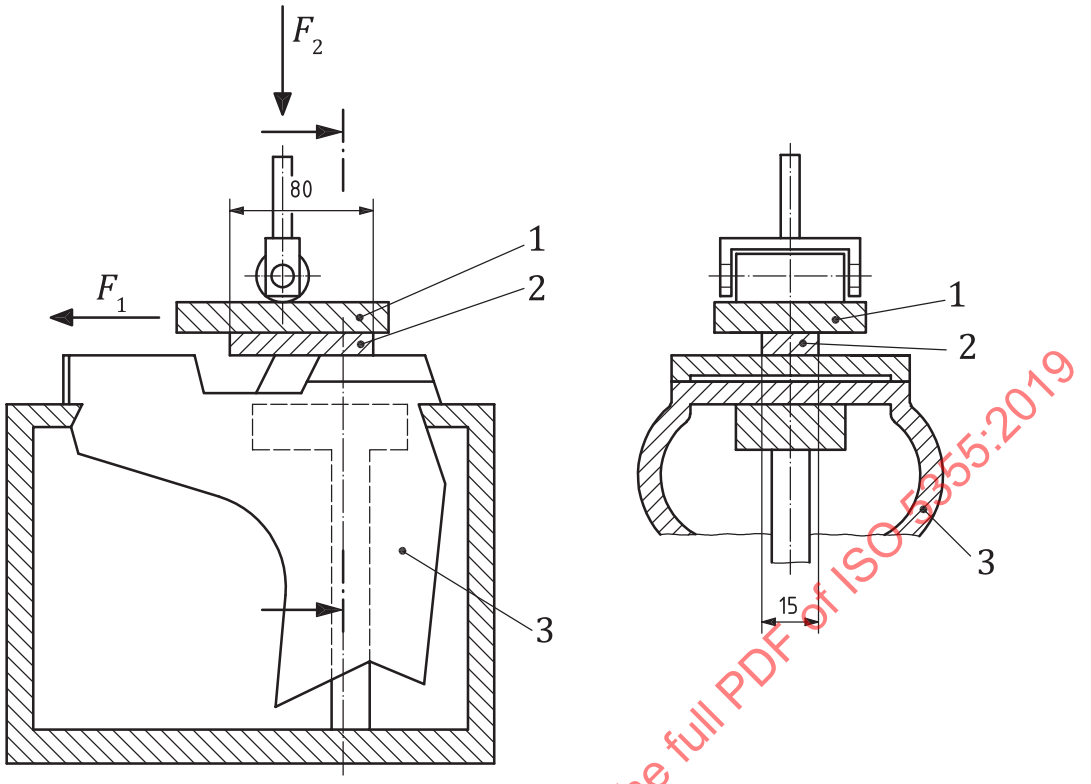
c See Figure 2.

Figure 18 — Bearing surfaces at the heel

4.3.8.5.2 Test method

These boots shall undergo the test in accordance with Figure 19.

Dimensions in millimetres



Key

1 support of low-friction element

2 low-friction element [same characteristics as 4.3.9.2.2 b) except wide and long dimensions which are respectively 15 mm and 80 mm]

3 sample boot

F_1 force necessary to move a low-friction element over the low-friction zone

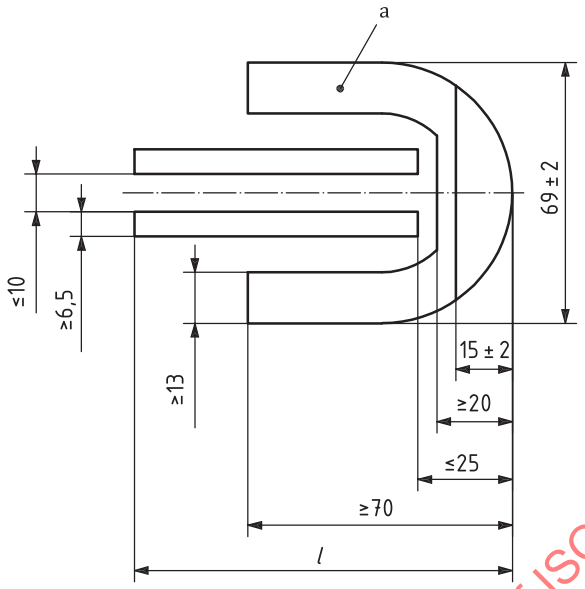
F_2 force applied to the low-friction element

Figure 19 — Low-friction test

4.3.8.6 Horseshoe-shaped bearing surfaces

Horseshoe-shaped bearing surfaces shall comply with Figure 20 and 21.

Dimensions in millimetres

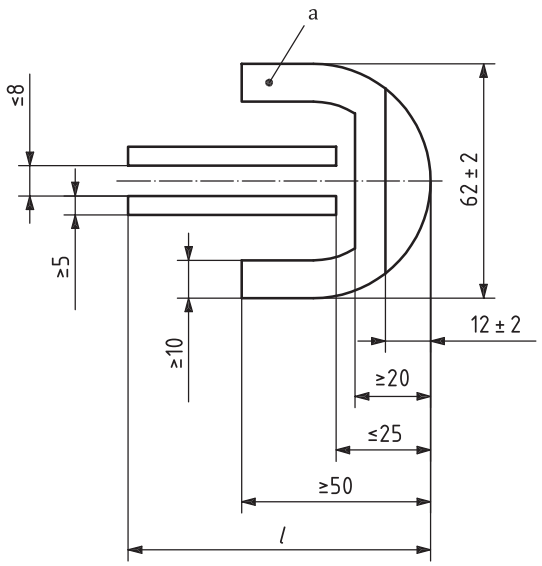


Dimension	Sole length	
	<300	≥300
l	100 min.	120 min.

a Peripheral zone.

Figure 20 — Example of minimum bearing surface at heel, type A

Dimensions in millimetres



Dimension	Sole length	
	<240	≥240
l	80 min.	90 min.

a Peripheral zone.

Figure 21 — Example of minimum bearing surface at heel, type C

4.3.9 Low-friction zone

4.3.9.1 Requirements

4.3.9.1.1 The coefficient of dynamic friction between the low-friction zone of the boot and a low-friction element of polytetrafluoroethylene (PTFE) shall have a maximum value of 0,10 rounded off to two decimal places.

4.3.9.1.2 No material that would interfere with side-to-side movement of the boot shall protrude below the low-friction zone.

4.3.9.2 Test method

4.3.9.2.1 Principle

The coefficient of dynamic friction is determined by the ratio of the force F_1, necessary to move a low-friction element over the low-friction zone of the boot, to the test load F_2, which is applied to the low-friction element.

4.3.9.2.2 Test equipment and conditions

The following test equipment and conditions shall be required.

a) Six sample boots of at least three different sizes, stored for at least 14 d with the last 12 h of storage before the test under standard atmosphere.