INTERNATIONAL STANDARD

ISO 23769

First edition
2021-11

Furniture — Mattresses — Test methods for the determination of functional characteristics

Ameublement — Matelas — Méthodes d'essai pour la détermination des caractéristiques fonctionnelles

Reference number
ISO 23769:2021(E)

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Published in Switzerland

Contents

Page

Foreword

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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).

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

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

Introduction

This document does not give any product requirements. Where no requirements document is available the desired functional characteristics should be determined by the specifier.

Furniture — Mattresses — Test methods for the determination of functional characteristics

1 Scope

This document specifies test methods for the determination of the durability, height loss and hardness of mattresses with a height ≥100 mm (and mattress pads when they form a unit with the mattress).

This document applies to adult mattresses for domestic and non-domestic use. It does not apply to water mattresses, air mattresses or standalone mattress pads.

Test methods for the assessment of aging, degradation, fire resistance and electrical functions are not included.

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.

EN 1334, *Domestic furniture — Beds and mattresses — Methods of measurement and recommended tolerances*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

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

3.1
load curve
deflection curve
curves that are obtained by pressing a load pad into the mattress and measuring the associated value of indentation and force simultaneously

3.2
hardness value
H
determined from load/deflection measurement, in N/mm

3.3
firmness rating
H_s
number (1 decimal) on a scale from 1 to 10 which expresses the firmness of a mattress

3.4
height loss
change in the height of a mattress, in mm, as a result of the durability test

3.5
mattress pad
product, comprising a cover and filling(s), or filling material(s) alone, used in conjunction with a mattress or upholstered bed base

Note 1 to entry: This product is not intended to be used separately.

4 General test conditions

4.1 Preliminary preparation

The tests shall be carried out in indoor ambient conditions at a temperature between 15 °C and 25 °C. If during a test the temperature is outside of the range of 15 °C to 25 °C, the maximum and/or minimum temperature shall be recorded in the test report.

All conditioning shall be carried out in a standardised climate of (23 ± 2) °C and (50 ± 5) % relative humidity (RH).

During conditioning and handling, mattresses shall be kept flat and unloaded.

If a test cannot be carried out as specified, e.g. because a loading pad cannot be used for the application of a force due to the design of product, the test shall be carried out as far as possible as specified.

If necessary, mattress pads shall be prevented from moving during testing by a suitable means, e.g. adhesive tape or pins.

If the product information states that the mattress has a soft side and a firm side, both sides shall be tested using separate mattresses.

4.2 Tolerances

Unless otherwise stated the following tolerance are applicable to the test equipment:

a) all forces shall have an accuracy of ±5 % of the nominal force;

b) all masses an accuracy of ±0,5 % of the nominal mass;

c) all dimensions less than 200 mm shall have an accuracy of ±1 mm of the nominal dimension; the other dimensions shall have an accuracy of ±0,5 %;

d) the tolerance for position of loading pads shall be ±5 mm;

e) the tolerance for measuring point shall be ±20 mm.

NOTE For the purposes of uncertainty measurement, test results are not considered to be adversely affected when the above tolerances are met.

5 Test apparatus

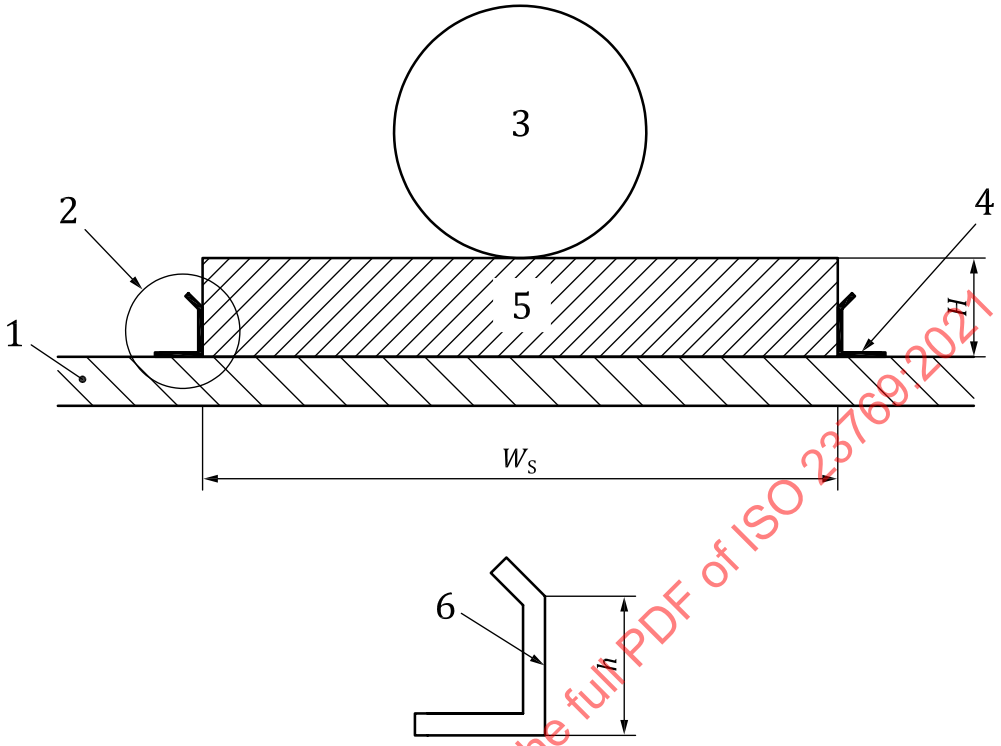
5.1 Standard test bed base for mattresses

Rigid, horizontal, flat and smooth.

5.2 Side support profile

The mattress shall be prevented from moving during durability test by two side support profiles as illustrated in Figure 1. The internal distance between the supports (W_s) shall be equal to the width of the mattress measured according to EN 1334, ±10 mm. The height of the support profiles (h) shall

not exceed one third of the mattress thickness (H), measured according to EN 1334. The length of the support profiles shall be at least equal to the length of the test unit.



Key

1	standard test bed base	4	side support profile
2	side support profiles	5	mattress
3	roller	6	enlargement of side support profiles (2)
H	height of mattress	h	height of support profiles
W_S	distance between supports		

Figure 1 — Side support profile

5.3 Standard table/test board (measuring)

Horizontal, flat and smooth surface, large enough to fully support the mattress in any measuring position. At the loading position, the deflection shall not exceed 1 mm under 1 000 N load. The overall flatness tolerance of the test board shall be 2 mm/1 000 mm.

5.4 Loading pad

Rigid circular object 355 mm in diameter the face of which has a convex spherical curvature of (800 ± 20) mm radius with a 20 mm front edge radius (see Figure 2).

The loading pad shall have a smooth surface and shall be mounted to the loading system of the test machine (5.5) by a ball joint as close as possible to the indenter surface (see Figure 2).

Dimensions in millimetres

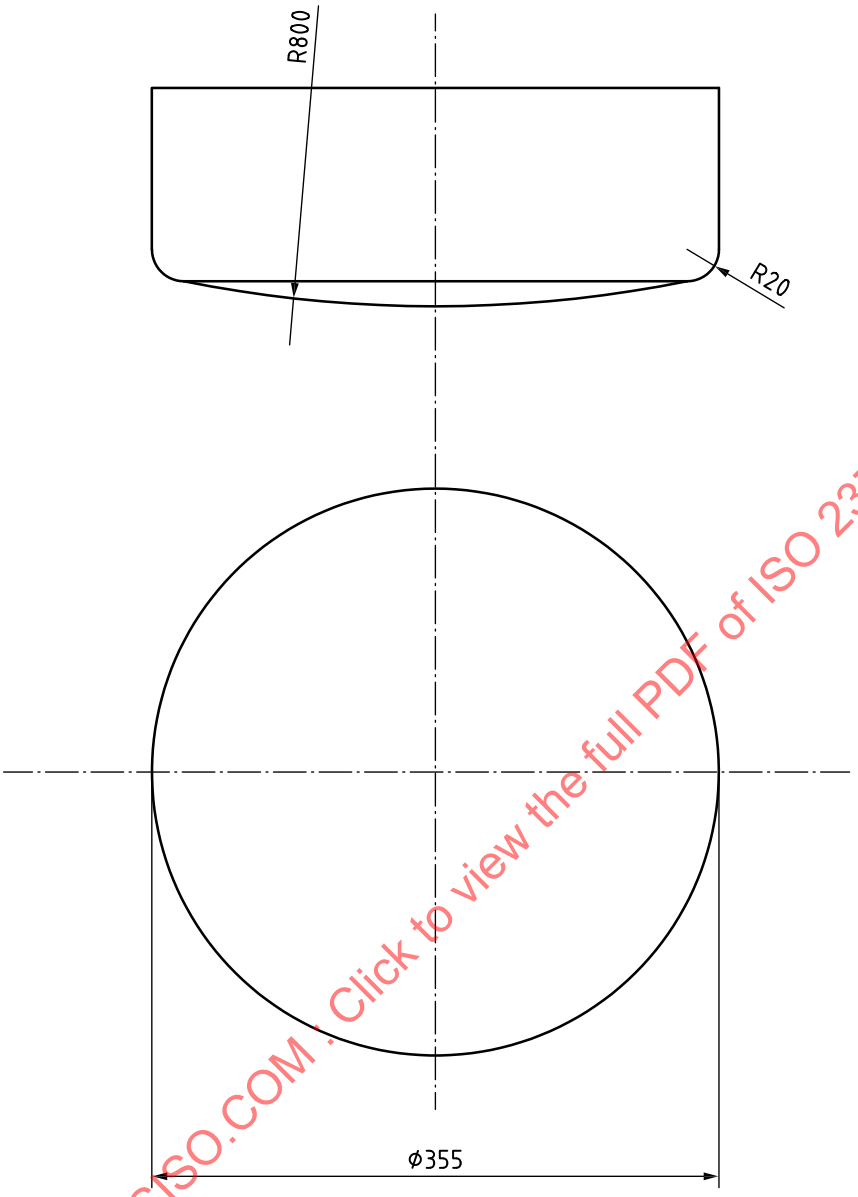


Figure 2 — Loading pad

5.5 Equipment for recording the load/deflection curves

The equipment for recording the load/deflection curves shall be loading pad (5.4) and a testing machine capable of applying a vertical downward load up to 1 000 N.

The travel speed for both loading and unloading shall be (90 ± 5) mm/min.

Load and height with reference to a fixed datum shall be measured.

The accuracy of the height measuring system shall be ±0,5 mm or better.

The accuracy of the load measuring system shall be ±1 % of the max load (1 000 N) or better.

The equipment shall be so that horizontal forces do not influence the measurement.

5.6 Equipment for the durability test

The equipment consists of a roller with dimensions and a shape illustrated in Figure 3 and a mechanism capable of relative horizontal movement of the roller on the unit surface.

The roller surface shall be hard, smooth and without scratches or other surface defects.

The total rolling system shall apply a load of (1 400 ± 7) N measured in the static condition.

The roller shall have a rotation moment of inertia of 0,5 kgm^2 ± 0,05 kgm^2. The roller shall be free to pivot along its longitudinal and lateral axis relative to the horizontal.

The roller shall be capable of following the surface of the mattress, and it shall be free to move up and down to follow the mattress surface.

The forces on the roller shall act horizontally at the centre point. The motion shall be approximately sinusoidal (within ±10 %) and symmetrical along the longitudinal symmetry axis of the unit. The frequency shall be (16 ± 2) cycles per minute.

Dimensions in millimetres

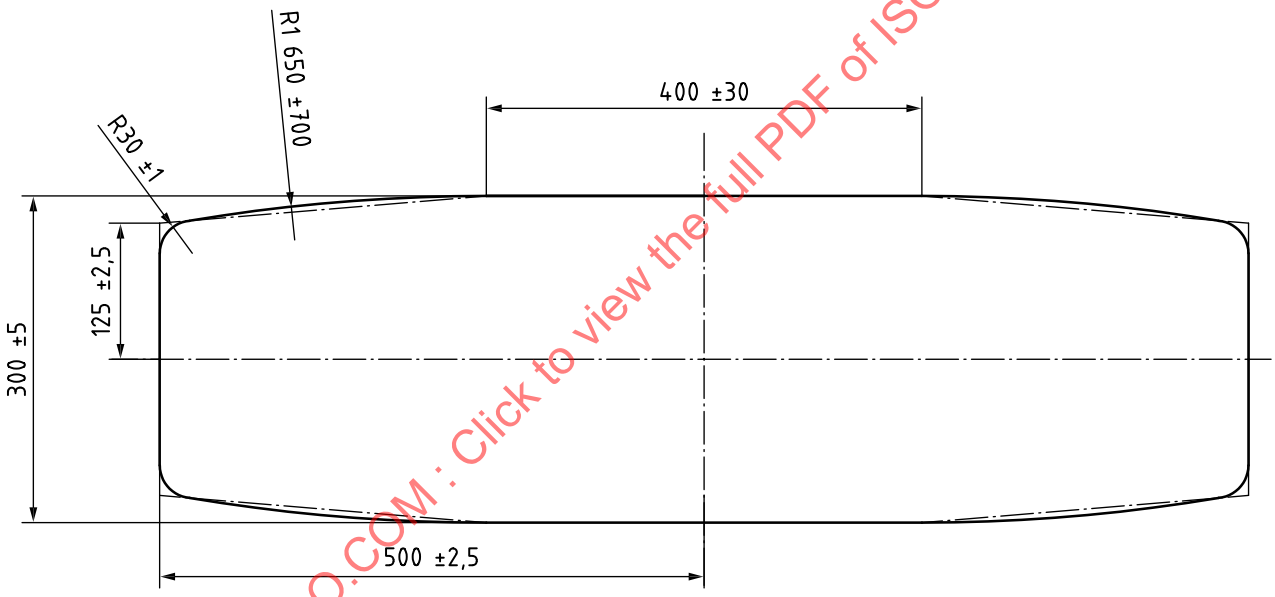


Figure 3 — Roller

5.7 Edge loading pad

The edge loading pad is a naturalistically shaped rigid indenter with a hard, smooth surface having overall dimensions within the limits shown in Figure A.1.

For details of design, see Annex A.

6 Test procedure

6.1 General

All tests shall be carried out on the same mattress and in the sequence as the clauses are numbered in this document.

The mattress shall be tested for durability with the standard test bed base for mattresses (5.1) with side support profiles (5.2).

The mattress shall be visually inspected before and after the durability tests (6.2 and 6.3) in order to detect changes caused by the test.

Special attention shall be given to tears in seams, seam splits, displacement or lumpiness in filling materials, broken springs, protrusion of the springs as well as holes and tears in ticking material in the mattress surface inflicted by the durability tests. Internal inspection shall be carried out only at the end of the test and after all measurements have been taken.

Annex B (informative) provides further information about optional additional impact test.

6.2 Durability of mattress surface

This test is only applicable to the mattress which is bigger than 1 000 mm (measured parallel to the roller axis) × 750 mm (measured perpendicular to the roller axis) when measured in accordance with EN 1334.

The test shall be carried out with the roller apparatus (5.6). Before beginning the test, adjust the roller mechanism so that:

— The driving forces act horizontally (-0°, +2°) when the roller rests on the centre line of the sleeping area.

— The length of travel of the roller shall be 250 mm on either side of the longitudinal centre line of the sleeping area and perpendicular to its longitudinal axes.

One cycle includes one travel back and forth.

Unless otherwise specified by the manufacturer, the mattress shall be conditioned for at least 72 h in the standardised climate (according to 4.1) before testing. The test shall be carried out in the following sequence:

a) durability: 100 cycles;

b) conditioning, at least 5 h in the standardised climate (according to 4.1);

c) carry out the preload (according to 7.2) beginning within 5 min from moving the mattress from the standardised climate (according to 4.1);

d) measurement of the mattress height (according to 7.4) and hardness measurement (according to 7.3 and 7.5);

e) durability test: 29 900 cycles;

f) conditioning, at least 5 h in the standardised climate (according to 4.1);

g) carry out the preload (according to 7.2) beginning within 5 min from moving the mattress from the standardised climate (according to 4.1);

h) measurement of the mattress height (according to 7.4) and hardness measurement (according to 7.3 and 7.5);

i) determination of hardness value (according to 7.5), firmness rating (7.6) and height loss (according to 7.4) between 100 cycles and after the test.

6.3 Durability of mattress edge

This test is not applicable to mattresses which cannot be separated from the bed bases.

Apply a force of 1 000 N for 5 000 cycles by means of the edge loading pad (5.7).

Testing shall be carried out on one edge at the middle of the length.

The load application point shall be 200 mm from the edge of the top surface of the mattress.

During each application maintain the force for (2 ± 1) s.

The test shall be carried out in the following sequence:

a) durability test: 100 cycles;

b) conditioning, at least 5 h in the standardised climate (according to 4.1.);

c) carry out the preload (according to 7.2) beginning within 5 min from moving the mattress from the standardised climate (according to 4.1);

d) measurement of the mattress height (according to 7.4) at 100 cycles;

e) durability test: 4 900 cycles;

f) conditioning, at least 5 h in the standardised climate (according to 4.1.);

g) carry out the preload (according to 7.2) beginning within 5 min from moving the mattress from the standardised climate (according to 4.1);

h) measurement of the mattress height and height loss (according to 7.4) between 100 cycles and after the test.

7 Functional characteristics

7.1 General

The measurable functional characteristics are determined or calculated before and after the durability test and are based on the load/deflection curve as in 7.2.

For the assessment of the load/deflection curves, the mattress shall be placed on the standard table/test board (5.3).

7.2 Preload

Load the measuring point with 1 000 N using the equipment specified in 5.4 and 5.5 and unload. Repeat the load and unload sequence a further 2 times, with the time between each preload cycle not exceeding 30 s.

For durability of mattress surface test (6.2), the measuring point shall be in the centre (± 20 mm) of the roller tested area. For durability of mattress edge test (6.3), the measuring point shall be the centre (±20 mm) of the area where the edge loading pad (5.7) contacts with the mattress surface.

7.3 Load/deflection curve

The load/deflection curve shall be obtained using the equipment specified in 5.4 and 5.5.

The initial measurement shall be taken after 100 cycles of durability (see 6.2).

The measuring point shall be in the centre (±20 mm) of the roller tested area (see 6.2).

The measurement shall begin within 30 s of the end of the last preload cycle (7.2).

The measurement shall consist of paired observations of deflection and load, while the load is increased up to 1 000 N.

When logging data for the load deflection curve, there should be no less than 250 points from 0 to 1 000 N. From 0 to 450 N, the distance between the points should not be more than 2 N. When calculating

the slopes, this can be done by taking 5 points above and 5 points below each measuring valve and calculating the slopes by linear regression.

It may be of interest to record the Hysteresis curve by taking load/deflection measurement with the load decreasing from 1 000 N to 0.

7.4 Determination of height loss

The height of the mattress shall be measured by equipment for the assessment of the load/deflection curve (see 5.4 and 5.5). The height is the distance in mm from the standard table/test board (5.3) or floor surface (5.1) to a point on the top surface of the mattress, where the force, acting on the mattress from the loading pad (5.4), equals 50 N.

The measurement shall begin within 30 s of the end of the last preload cycle (7.2).

For durability of mattress surface test (6.2), the measuring point shall be in the centre (±20 mm) of the roller tested area. For durability of mattress edge test (6.3), the measuring point shall be the centre (±20 mm) of the area where the edge loading pad (5.7) contacts with the mattress surface.

The height loss is the difference between the initial measurement at 100 cycles and after testing.

7.5 Determination of hardness value

The hardness value (H), in N/mm, is the average of the slopes of the load/deflection curves at 210 N, 275 N and 340 N (see Figure 4) as shown in Formula (1):

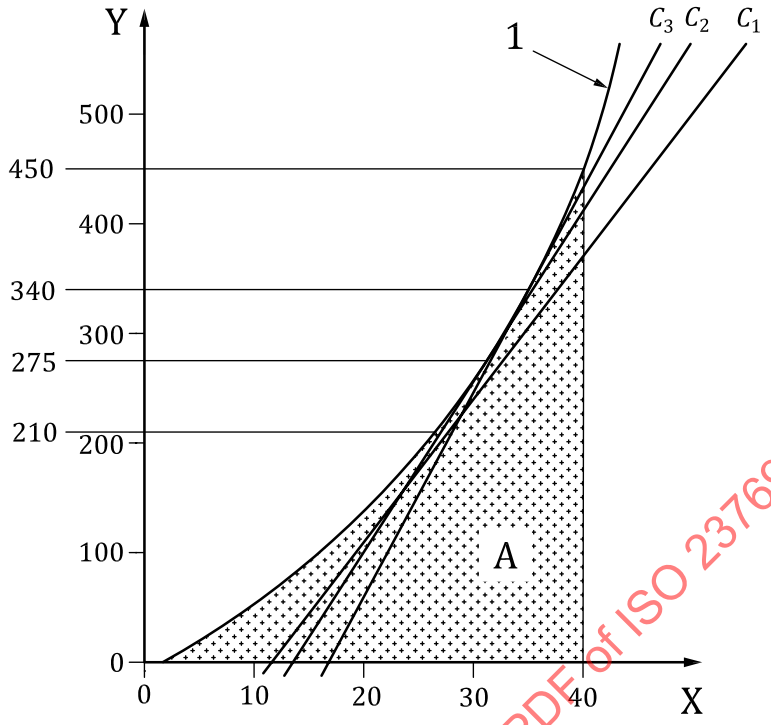
$$H = \frac{C_1 + C_2 + C_3}{3} \tag{1}$$

where

C_1 is the slope at 210 N load

C_2 is the slope at 275 N load

C_3 is the slope at 340 N load



Key

X indentation depth [mm]
Y force [N]
1 load/deflection curve
A area under the load/deflection curve

Figure 4 — Determination of hardness value

7.6 Determination of firmness rating

The firmness rating (H_s) is a number (1 decimal) on a scale from 1 to 10 which expresses the firmness of a mattress.

H_s = 1 is a firm mattress

H_s = 10 is a soft mattress

H_s is determined by Formula (2):

$$H_S = 10\left(1 - \exp^{-(ka+b)}\right)^2 \tag{2}$$

where

a = 5,92 × 10^{-4}

b = 0,148

k is calculated from the load/deflection curve by Formula (3):

$$k = \frac{A}{H} \tag{3}$$

where

A is the area under the load/deflection curve (under the load curve from 0 to 450 N)

H is the hardness value

8 Test report

The test report shall include at least the following information:

a) a reference to this document, i.e. ISO 23769:2021;

b) name and address of the laboratory;

c) name and address of the client;

d) description and identification of the item tested, e.g. product type and photos etc.;

e) details of defects observed before testing;

f) any variation from the specified temperature range;

g) date of issue of the report;

h) test results.

Annex A
(normative)

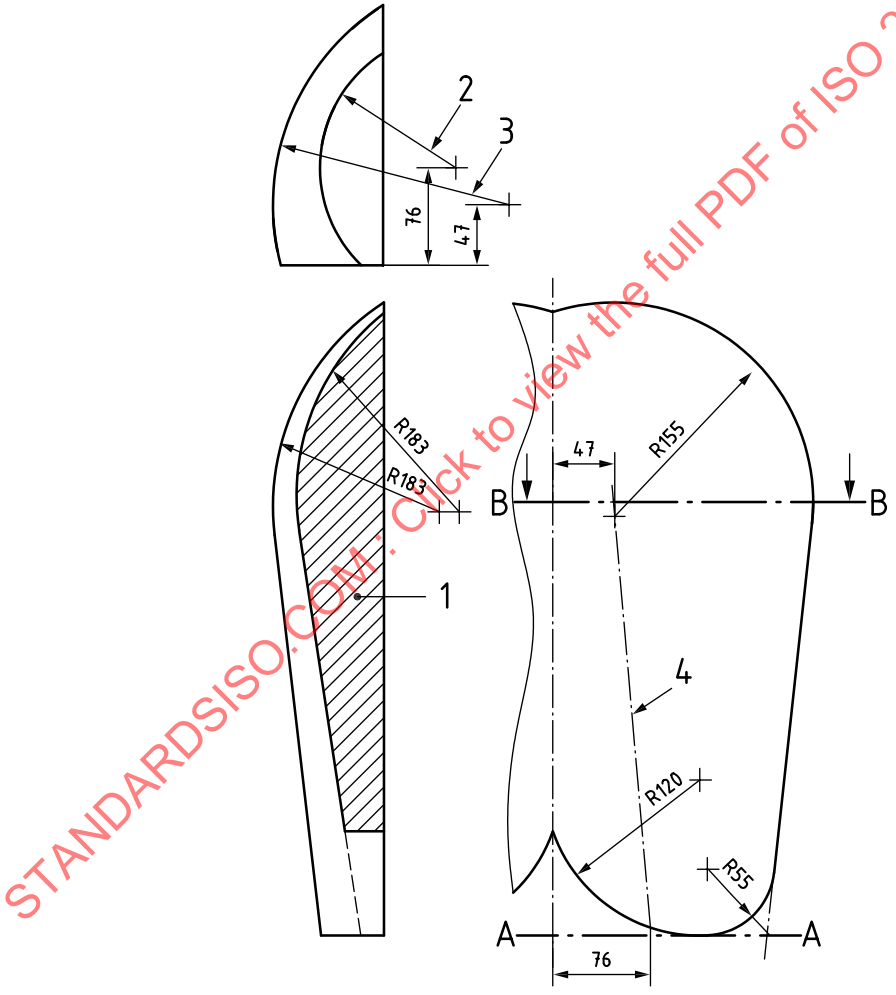
Edge loading pad data

The edge loading pad specified in 5.7 currently exists in two versions:

— machined edge loading pad, as shown in Figure A.1;

— moulded edge loading pad, as shown in Figure A.2.

Dimensions in millimetres
All dimensions: ±5 mm



Key

1 centre section cross hatched
2 R 105 (section A-A, see the top view)
3 R 183 (section B-B, see the top view)
4 axis of the cone

Figure A.1 — Edge loading pad geometry — Machined construction