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Furniture — Chairs and stools — Determination of strength and durability

Ameublement — Chaises et tabourets — Détermination de la résistance et de la durabilité

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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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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.

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

This second edition cancels and replaces the first edition (ISO 7173:1989), which has been technically revised.

The main changes are as follows:

— the scope has been revised;

— terms and definitions were added;

— test methods for work chairs and seating other than work chairs were added;

— new Annexes were added.

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.

Furniture — Chairs and stools — Determination of strength and durability

1 Scope

This document specifies test methods for the determination of strength and durability of the structure of all types of seating without specific regard to end use, materials, design/construction or manufacturing process.

This document does not apply to children's highchairs, table mounted chairs and bath seats.

Test methods for the assessment of ageing, degradation, ergonomics and electrical functions are not included.

The test methods are not intended to assess the durability of upholstery materials.

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 48-4, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 4: Indentation hardness by durometer method (Shore hardness)*

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
structure
load bearing parts of furniture such as the frame, seat, backrest and arm supports and suspension

3.2
legrest
extension of the seat area intended to support the legs of the user

Note 1 to entry: A legrest can or cannot be permanently attached to the structure of the item of seating and may not be suitable for use as an item of seating itself.

3.3
footrest
extension of the seat area, whether attached or not to the structure of the item of seating, intended to support the feet of the user

3.4
work chair
swivelling chair, with or without arm rests, for use by one adult for office work (for example working with a computer), whose upper part, which includes the seat and backrest, is supported on a single column and can rotate in the horizontal plane and is at least adjustable in height

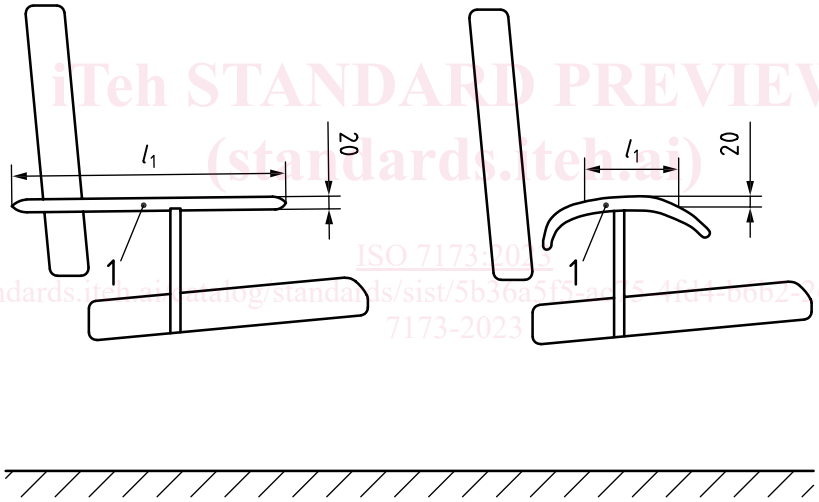
3.5
backrest
element that supports the back of the user higher than 200 mm above the seat loading point

3.6
armrest
part of the seating able to support the arms of the user when seated, 100 mm or higher above the height of the seat loading point

3.7
armrest length
horizontal distance along the armrest within an envelope down from the top of the armrest that is 20 mm deep

Note 1 to entry: See Figure 1.

Dimensions in millimetres



Key

1 armrest

l_1 armrest length

Figure 1 — Armrest length

[SOURCE: ISO 24496:2021, 3.3, modified – "horizontal" added and Note 1 to entry adapted to correct Figure number.]

3.8
multiple seating unit
unit with a seating surface wider/longer than 1 100 mm

3.9
lounger
item of seating intended for reclined posture with at least one backrest position such that backrest angle is 45° or less to the horizontal, and a leg rest which is an integral part of the product and intended to support the full body mass of a user

Note 1 to entry: See example in Figure 37.

3.10
single column seating
item of seating, whose upper part, which includes the seat, is mounted on a single support with a diameter of up to 120 mm at its narrowest point

4 General test conditions

4.1 Preliminary preparation

The furniture shall be tested as delivered. Knock-down furniture shall be assembled according to the instructions supplied with it. If the instructions allow the furniture to be assembled or combined in different ways, the most adverse combination shall be used for each test. Knock-down fittings shall be tightened before testing. Further tightening shall not take place.

For seating that is designed to be fixed to the structure of a building, the unit shall be mounted according to the manufacturer's instructions to a structure representative of the service installation. This structure shall be sufficiently strong and stiff to eliminate the possibility of it affecting the results of the test.

Unless otherwise specified by the manufacturer, the sample for test shall be stored in indoor ambient conditions for at least 24 h immediately prior to testing.

The tests shall be carried out at indoor ambient conditions. However, if during a test the temperature is outside the range 15 °C to 27 °C, the maximum and/or minimum temperature shall be recorded in the test report.

4.2 Application of forces

The forces in durability and static load tests shall be applied sufficiently slowly to ensure that negligible dynamic load is applied. The forces in durability tests shall be applied sufficiently slowly to ensure that kinetic heating does not occur.

Unless otherwise stated, static forces shall be maintained for (10 ± 2) s. Unless otherwise stated, durability forces shall be maintained for (2 ± 1) s, not more than 20 times per min.

The forces may be replaced by masses. The relationship 10 N = 1 kg shall be used.

4.3 Tolerances

Unless otherwise stated, the following tolerances are applicable to the test equipment:

— Forces: ±5 % of the nominal force;

— Masses: ±1 % of the nominal mass;

— Dimensions: ±1 mm of the nominal dimension for dimensions 0 up to 200 mm;

±0,5 % of the nominal dimension for dimensions > 200 mm;

— Velocities: ±10 % of the nominal velocity;

— Angles: ±2° of the nominal angle.

Test forces, masses, dimensions, velocities and angle used to perform the test shall be targeted at the nominal values specified and shall be subjected to the above tolerances.

The accuracy for the positioning of loading pads and impact plates shall be ±5 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 equipment and apparatus

5.1 General

The equipment shall not inhibit deformation nor cause unnatural deformation of the unit/component, i.e. it shall be able to move so that it can follow the deformation of the unit/component during testing.

All loading pads shall be capable of pivoting in relation to the direction of the applied force. The pivot point shall be as close as practically possible to the load surface. The point of application of force shall be in the direction of the pivoting point of the loading pads.

If a loading pad tends to slide, use a slip resistant material between the loading pad and the foam for loading pads (5.9).

The tests may be performed using any suitable device because results are dependent upon correctly applied forces and not upon the apparatus. Exceptions include cases of impact tests where the apparatus described in 5.10 and 5.11 shall be used and the armrest durability test where the apparatus described in 5.12 shall be used.

5.2 Seat loading point template

The loading point template consists of two shaped members (see Figure 2) fastened together by a pivot at one end.

The contours of the shaped surfaces are so devised as to sink into the upholstery. For this purpose, the loading point template, with an additional mass applied at the seat loading point, shall be (20^{+1}_{0}) kg.

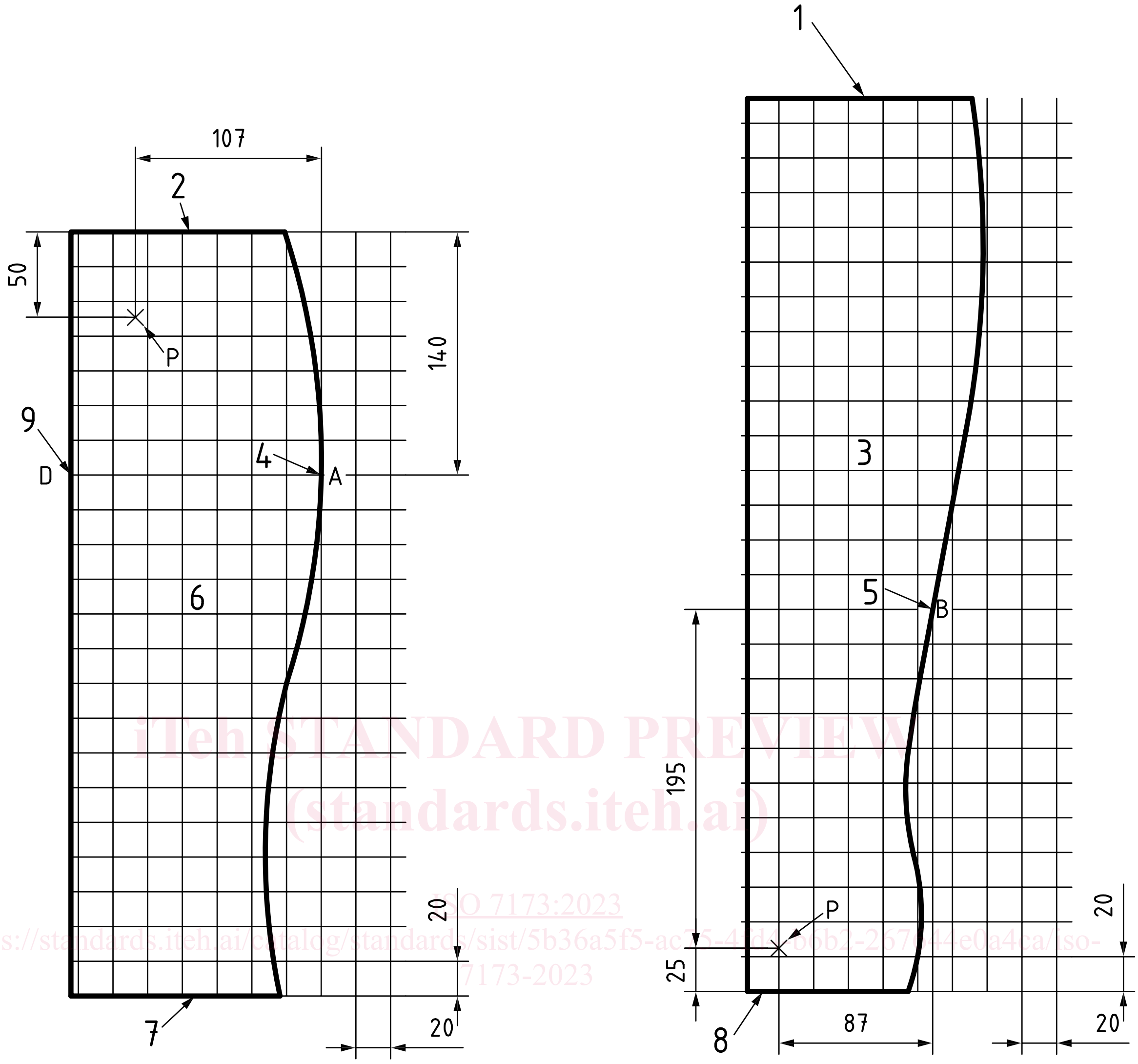
The mass distribution of different components of the template as shown in Table 1.

Table 1 — Mass distribution of template components

Mass of the seat portion (kg)	Mass of the back portion (kg)	Mass of the additional mass (kg)	Total mass (kg)
(2 ± 1)	(1,7 ± 0,7)	(16 ± 1,5)	(20^{+1}_{0})

The loading point template is marked as shown in Figure 3 a). An example of loading point template assembly is shown in Figure 3 b).

Dimensions in millimetres

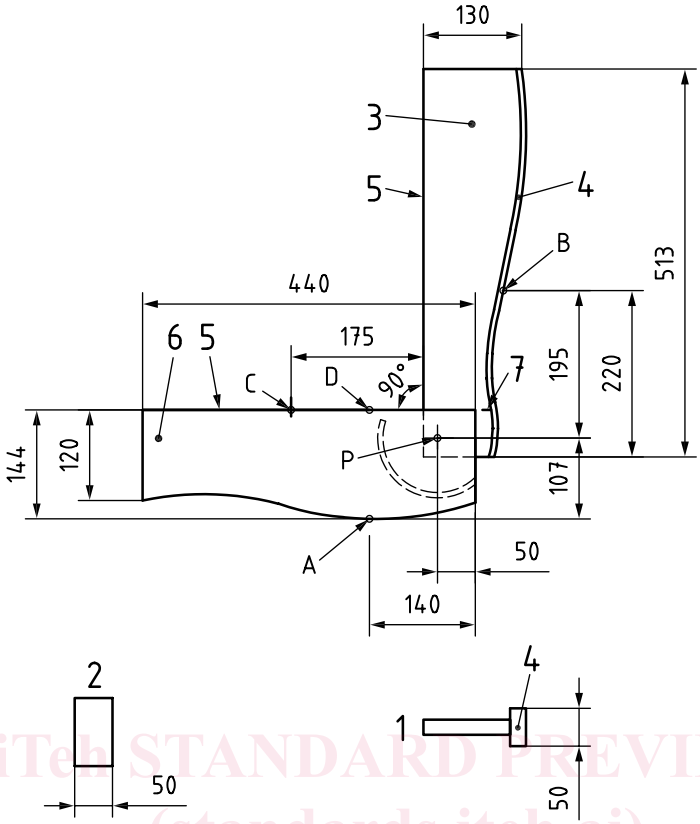


Key

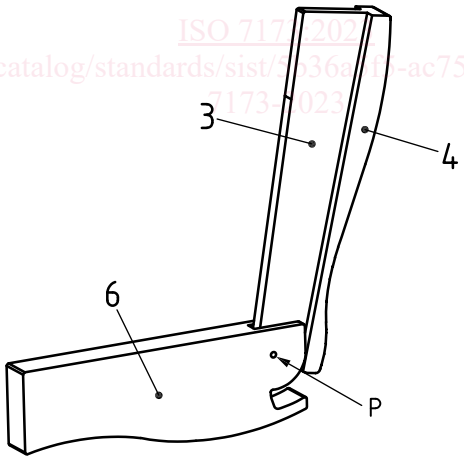
1 top of back portion
2 rear of seat portion
3 back portion
4 seat loading point (A)
5 back loading point (B)
6 seat portion
7 front of seat portion
8 bottom of back portion
9 loading point for additional load (D)
P pivot point

Figure 2 — Loading surface curves for seat and back loading point template

Dimensions in millimetres



a) Marking of the loading point template



b) Example of loading point template assembly

Key

1	typical section of back portion	7	mark to fix 90°
2	typical section of seat portion	A	seat loading point (chairs)
3	back portion	B	back loading point (chairs)
4	flange (rigid)	C	seat loading point (stools)
5	straight edge for the determination of seat or backrest inclination	D	loading point for additional load
6	seat portion	P	pivot point

Figure 3 — Loading point template

A line is drawn on the back portion, so that the template can be positioned easily with the two members at 90° to each other.

5.3 Floor

The floor shall be horizontal, flat and rigid with a smooth surface. For the back and arm rest impact tests (6.25 and 6.26), the drop test (6.27) and the backward fall test (6.28), the floor shall be faced with a 2 mm thick layer of rubber with a tests hardness of Shore A according to ISO 48-4 or a steel plate with a minimum thickness of 5 mm, placed directly on the floor.

5.4 Stops

Stops are used to prevent the item from sliding but not tilting, no higher than 12 mm, except in cases where the design of the item necessitates the use of higher stops, in which case the lowest that will prevent the item from moving shall be used.

5.5 Seat loading pad

The seat loading pad is a naturalistically shaped rigid indenter with a hard, smooth surface having overall dimensions within the limits according to Figure A.1 and Figure A.2.

The design of the seat loading pad shall be in accordance with Annex A.

5.6 Smaller seat loading pad

The smaller seat loading pad is a rigid circular object 200 mm in diameter, the loading surface of which has a convex spherical curvature of 300 mm ± 5 mm radius with a 12 mm front edge radius (see Figure 4).

Dimensions in millimetres

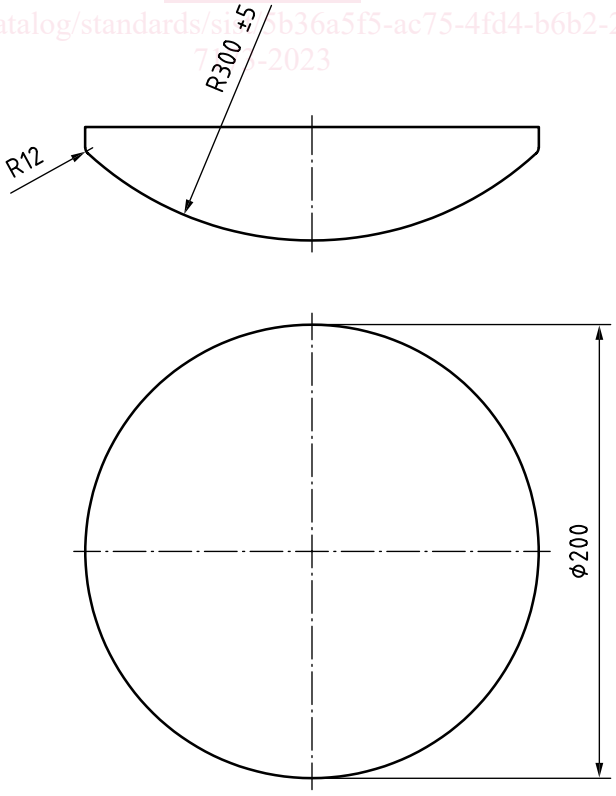


Figure 4 — Smaller seat loading pad

5.7 Back loading pad

The back loading pad is a rigid rectangular object 200 mm high and 250 mm wide, the loading surface of which is curved across the width of the pad with a convex cylindrical curvature of (450 ± 10) mm radius and with a 12 mm radius on all front edges (see Figure 5).

Dimensions in millimetres

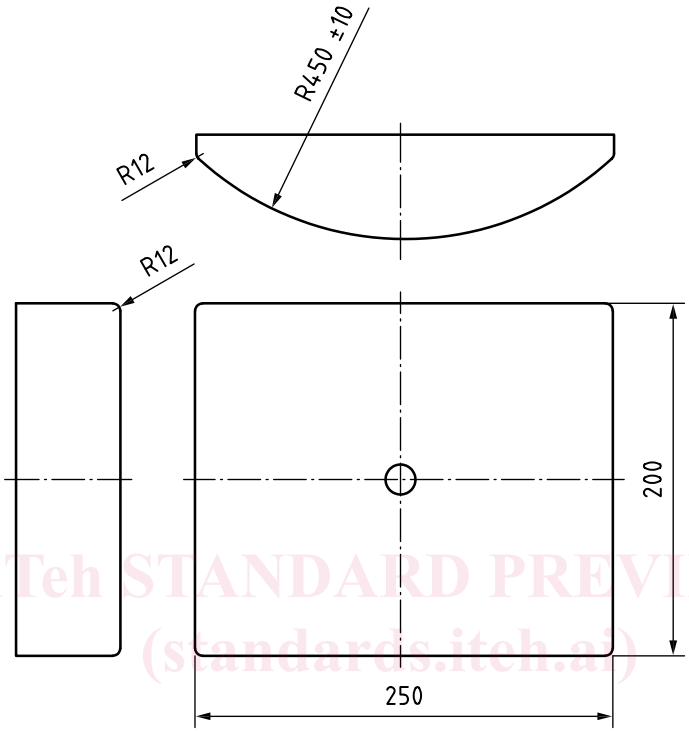


Figure 5 — Back loading pad

5.8 Local loading pad

The local loading pad is a rigid cylindrical object 100 mm in diameter, with a flat face and a 12 mm edge radius.

5.9 Foam for use with loading pads

The foam for use with loading pads shall be a foam sheet with a thickness of 25 mm and a bulk density of (120 ± 25) kg/m^3. The foam shall be attached to the loading pads or alternatively positioned between the loading pad and the test structure.

NOTE When the foam is used with loading pads it is attached to the loading pads or alternatively positioned between the loading pad and the test structure.

5.10 Seat impactor

5.10.1 General

The seat impactor is shown in Figure 6. The impactor is comprised of the following elements.

5.10.2 Circular body

The circular body is 200 mm in diameter, separated from the striking surface by helical compression springs and free to move relative to it on a line perpendicular to the plane of the central area of the

striking surface. The body and associated parts minus the springs shall have a mass of (17 ± 0,1) kg and the whole apparatus, including mass, springs and striking surface, shall have a mass of (25 ± 0,1) kg.

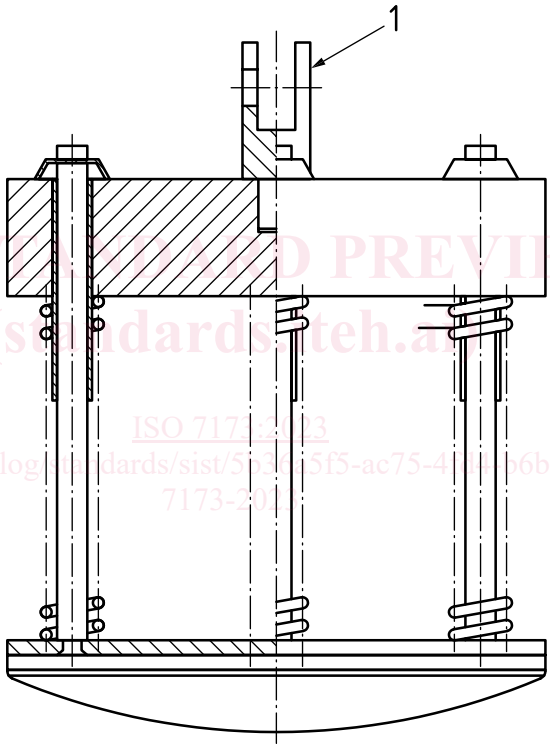
5.10.3 Springs

The springs shall be such that the nominal spring rate of the combined spring system is (7 ± 2) N/mm and the total friction resistance of the moving parts is less than 1 N.

The spring system shall be compressed to an initial force of (1 040 ± 5) N (measured statically) and the amount of spring compression movement available from the initial compression point to the point where the springs become fully closed shall be not less than 60 mm.

5.10.4 Striking surface

The striking surface shall be a rigid circular object, 200 mm in diameter, the face of which has a convex spherical curvature of 300 mm ± 5 mm radius with a 12 mm front edge radius.



Key

1 joint of lifting device not inhibiting free fall

Figure 6 — Seat impactor

5.11 Impact hammer

Hammer with a cylindrical pendulum head having a mass of (6,5 ± 0,07) kg, supported from a pivot by a steel tube of 38 mm in diameter and with a wall thickness of 2 mm having a mass of (2 ± 0,2) kg. The pendulum arm shall be pivoted by a low friction bearing (see Figure 7).