DRAFT INTERNATIONAL STANDARD

ISO/DIS 7173

ISO/TC **136**

Secretariat: **UNI**

Voting begins on:
2022-05-19

Voting terminates on:
2022-08-11

Furniture — Chairs and stools — Determination of strength and durability

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

ICS: 97.140; 97.140

Reference number
ISO/DIS 7173:2022(E)

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Published in Switzerland

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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.

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

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

The main changes compared to the previous edition are as follows:

— Scope has been revised;

— Further terms and definitions were added;

— Further 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 International Standard specifies test methods for the determination of strength and durability of the structure of all types of seating without regard to use, materials, design/construction or manufacturing process.

This International Standard 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, such as upholstery filling materials and upholstery covers.

This International Standard does not include any requirements. Requirements for different end uses can be found in other Standards.

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 48-4:2018, *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 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 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

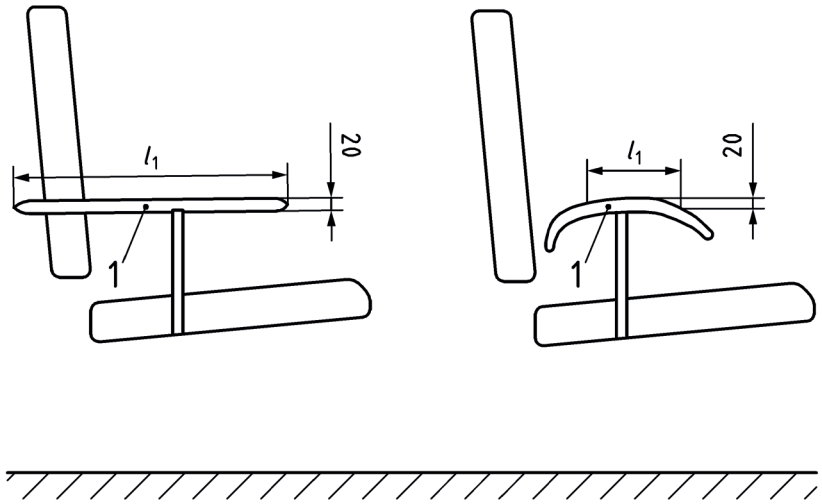
3.4
work chair
swivelling chair, with or without arm rests, for use by one adult in the office (for example working with a computer), whose upper part, which includes the seat and backrest, is supported on a single column and can rotate in the horizontal plane and is at least adjustable in height

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.



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 degrees or less to the horizontal, and a leg rest which is an integral part of the product and intended to support the full body weight of a user

Note 1 to entry: See 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 condition

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 test 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.

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.

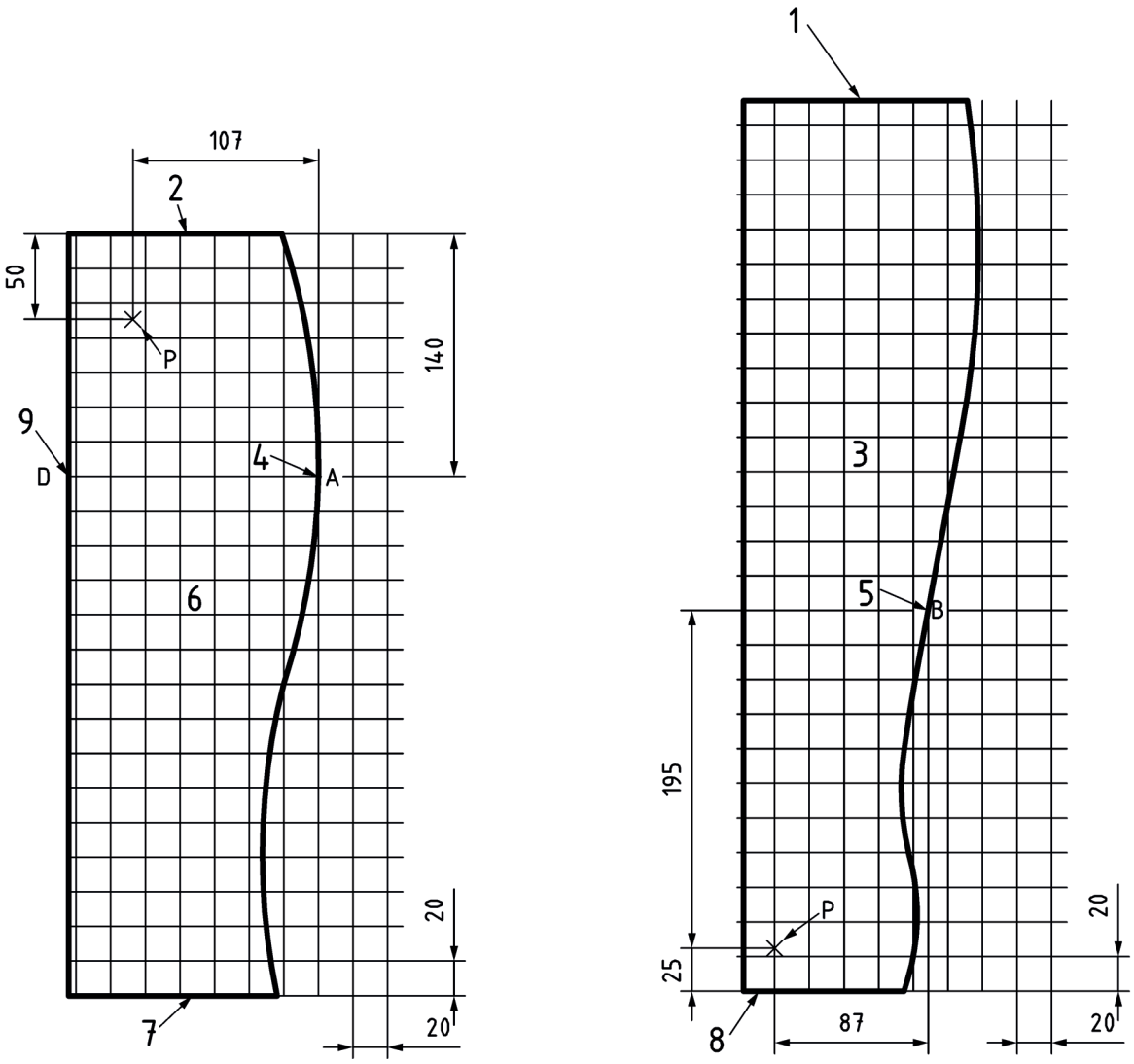
The weight distribution of different components of the template as shown in Table 1.

Table 1 — Weight distribution of template components

Mass of the seat portion (kg)	Mass of the back portion (kg)	Mass of the additional mass (kg)	Total weight (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

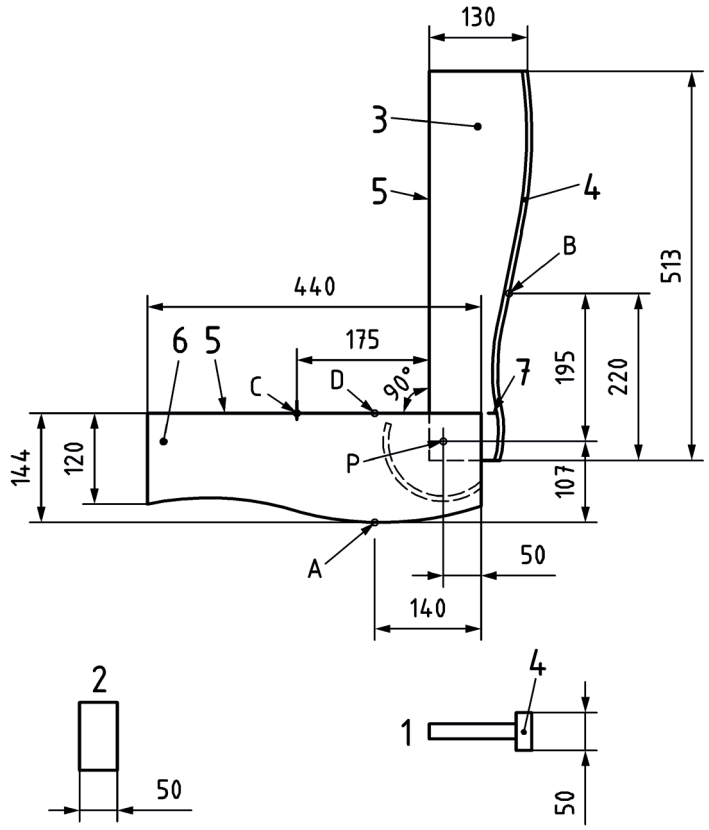


Key

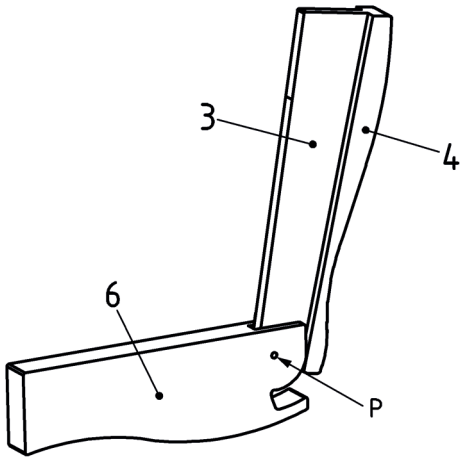
1	top of back portion	6	seat portion
2	rear of seat portion	7	front of seat portion
3	back portion	8	bottom of back portion
4	seat loading point (A)	9	loading point for additional load (D)
5	back loading point (B)	P	pivot point

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 48-4:2018.

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 shown in Figure A.1.

For details of design, see Annex A.

NOTE The CMD described in ISO 24496 is an alternative template.

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

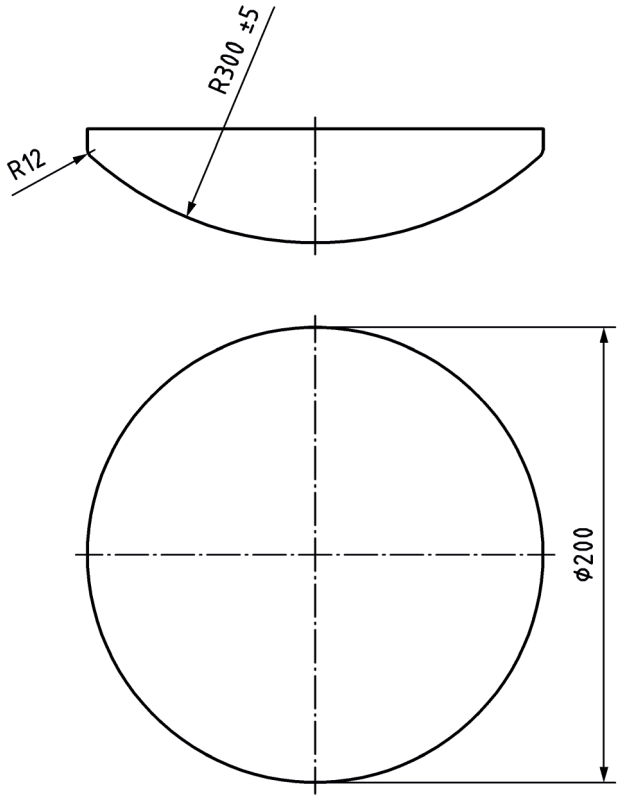


Figure 4 — Smaller seat loading pad

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

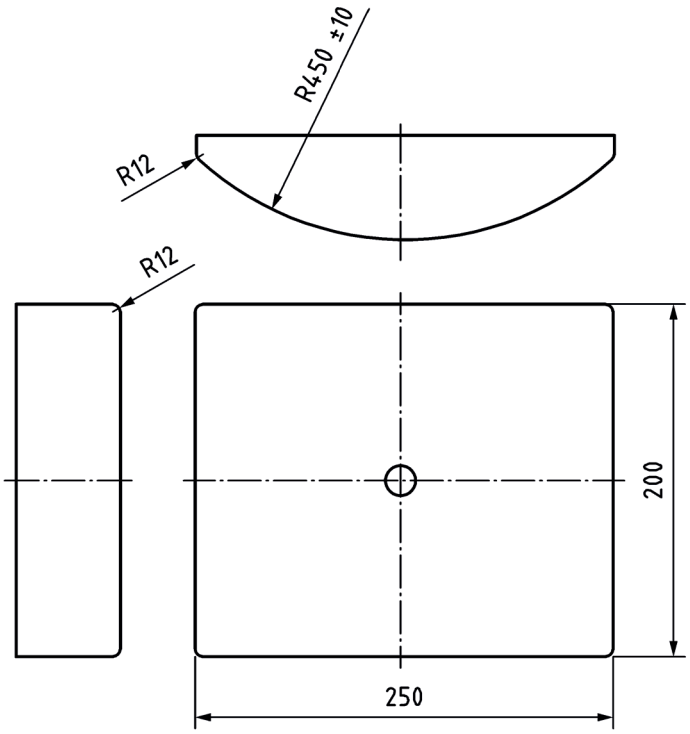


Figure 5 — Back loading pad

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 is a layer of flexible foam with a bulk density of (120 ± 25) kg/m^3, 25 mm or 10 mm thick. The foam shall be attached to the loading pads or alternatively positioned between the loading pad and the test structure.

5.10 Seat impactor

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

5.10.1 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.

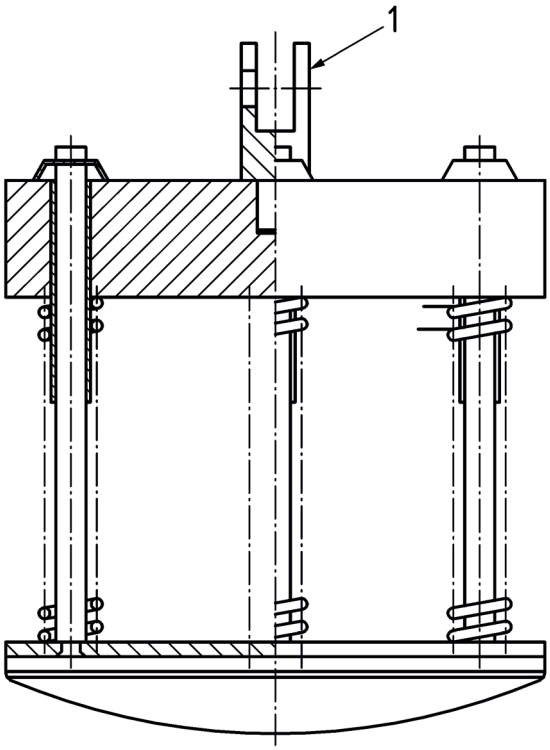
5.10.2 Springs

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.

5.10.3 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 radius with a 12 mm front edge radius.



Key

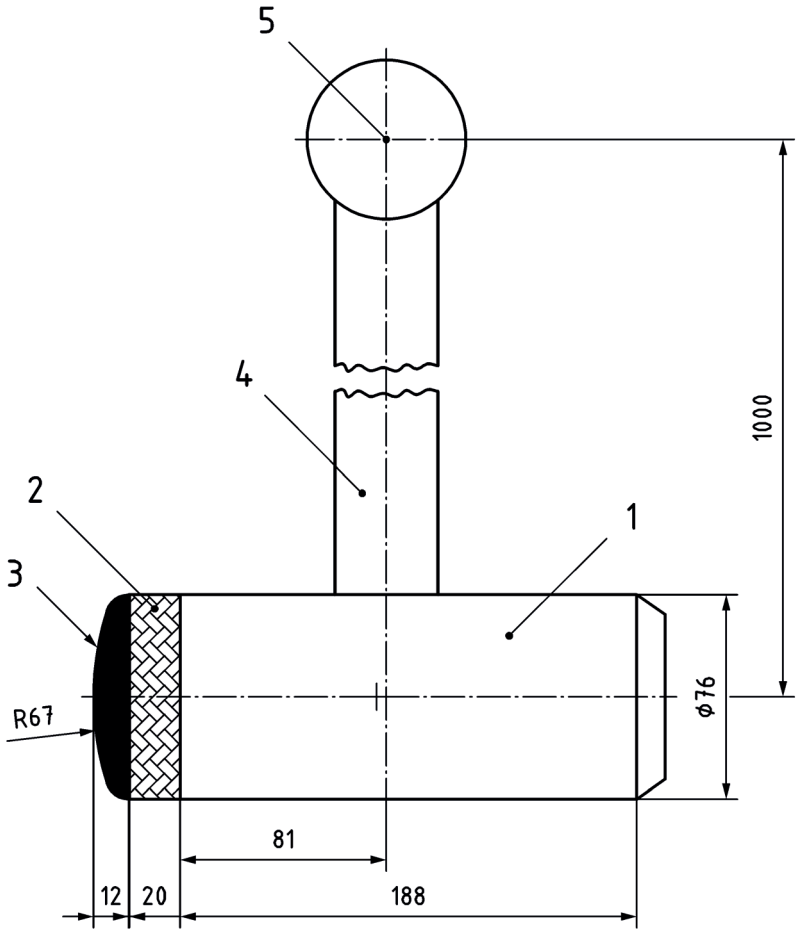
1 joint of lifting device not inhibiting free fall

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).

Dimensions in millimetres



Key

1 pendulum head, steel mass 6,4 kg
2 hard wood
3 rubber (50 ± 10) Shore A according to ISO 48-4:2018
4 pendulum arm, length 950; steel tube Ø 38 x 2; mass 2 kg ± 0,2 kg
5 pivot point
Mass of assembly 1 + 2 + 3 = (6,5 ± 0,07) kg

Figure 7 — Impact hammer

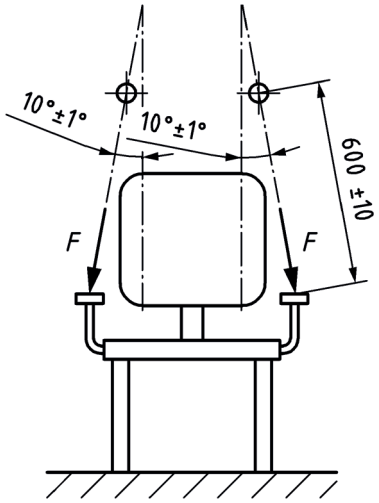
5.12 Armrest durability test apparatus

Test apparatus capable of applying a cyclic force simultaneously to both armrests of a seat (see Annex B).

The forces shall be applied through an armrest loading device in principle operating as shown in Figure 8.

The apparatus shall be capable of applying forces at varying angles to the vertical. It shall be adjustable both vertically and horizontally, and set as specified in 6.20. The apparatus shall be capable of freely following the deformation of the armrests during testing. The length of the loading pad shall be 100 mm with the force acting through the centre of its length.

Dimensions in millimetres



Key

F force

Figure 8 — Armrest durability test – Armrest loading device

5.13 Test surface for castor testing

Test surface, which is a horizontal, flat, smooth and rigid steel surface.

5.14 Front load locator device

Used for locating the loading points for the front stability test, front static load test and front durability test.

The device shall be as specified in Annex C.

5.15 Loading discs

Discs with a mass of 10 kg each, with a diameter of 350 mm and a thickness of 48 mm. The centre of gravity shall be the centre of the disc. The surface friction of the disc (disc to disc) shall be such that the force to initiate movement shall be 31 N ± 9 N.

6 Test procedures – Seating other than work chairs

6.1 General

Unless otherwise specified, the tests shall be carried out in the configuration most likely to cause failure.

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

Except in the case of test 6.13, a layer of foam (5.9) shall be positioned between the loading pads and the test structure.

If a test cannot be carried out as specified, the test shall be carried out as closely as possible to that specified. Any modification to the test method shall be technically justified and shall be recorded in the test report.

6.2 Determination of seat and back loading points

6.2.1 General

The seat and back loading points shall be determined using the template as specified in 5.2 in the manner specified in 6.2.2 or 6.2.3.

In some cases, it may not be possible to determine the loading points by means of the template.

In such cases, the seat loading point shall be 175 mm forward of the seat/backrest junction or at the point closest to this that allows the seat force to be applied.

Where the geometry of the seating unit does not allow the back force to be applied at the point defined by the above method, the force shall be applied at the nearest applicable point (up or down the backrest). The bending moment, as calculated in Formula (1), shall remain constant.

$$M = F \cdot I \tag{1}$$

where

M is the bending moment, Nm;

F is the back force, N;

I is the vertical distance between seat and back loading points, m.

If the number of seats in the item is not obvious, divide the total seat length (in mm) by 600 mm and round to the nearest whole number to determine the number of seats. Divide the total seat length into seats of equal length.

6.2.2 Seating with a backrest

For seating with adjustable backrests, set the backrest to its most upright position.

Adjust the template such that the angle between the seat and back portions is 90°.

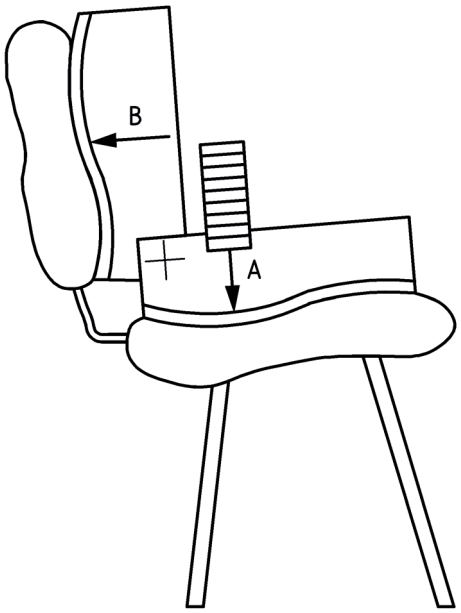
Position the loaded template (5.2) on the centreline of the seat as far towards the rear as possible without applying force to the backrest. For upholstered and flexible seating, adjust the position of the template by pushing the back loading portion into the back of the seating so that it is fully in contact with the backrest, allowing the shape of the seat portion of the template to correlate with that of the seat (see Figure 9 a)).

For rigid seating, adjust the position of the template by pushing the back loading portion into the back so that it is in contact with the backrest whilst ensuring that point A on the template is in contact with the seating surface (see Figure 9 b)).

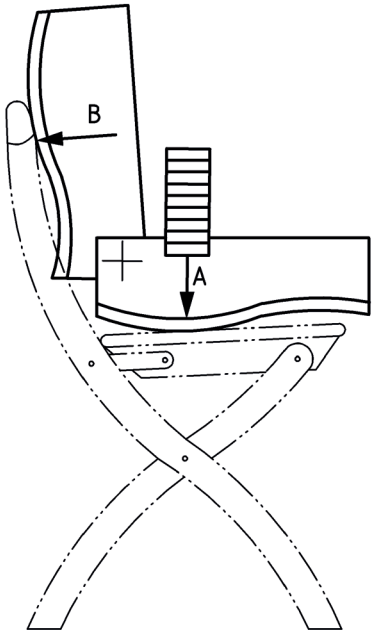
In cases where the template can be settled in more than one position, the position having the smallest angle between the seat and back portions of the template shall be used. The angle shall in no cases be less than 90°. Mark the required loading positions from the template. If relevant, repeat the procedures on the other seat(s).

6.2.3 Seating without a backrest

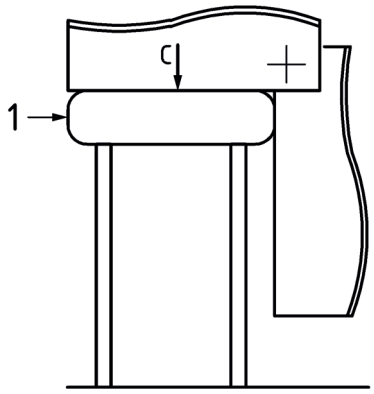
Set up the template (5.2) at 90° with the aid of the mark C as shown in Figure 3. Place it on each seating position as shown in Figure 9 c). Mark the required loading point from the template.



a) Upholstered/flexible seating with a backrest



b) Rigid seating with a backrest



c) Seating without a backrest/stools

Key

1 front of stool

A seat loading point – seating with backrests

B back loading point

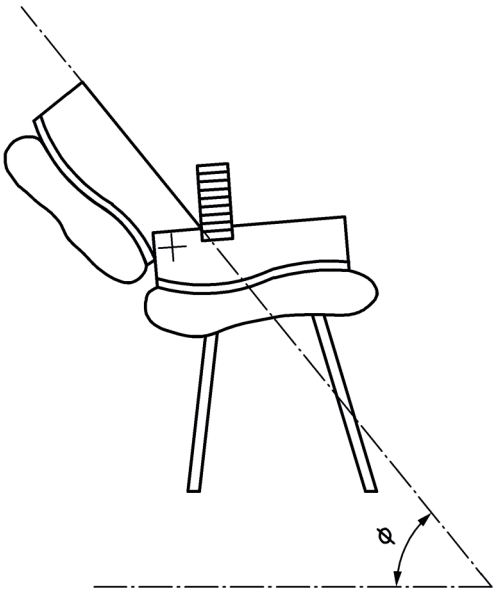
C seat loading point – seating without backrests

Figure 9 — Determination of seat and back loading point

6.3 Determination of angle of backrest inclination

The angle of inclination of the backrest from the horizontal (Ø) shall be measured by determining the slope of the straight edge of the relevant portion of the seat loading point template when it is correctly positioned (see Figure 10).

For chairs without backrest recline locks, position the backrest to its tilt stop position when measuring reclined angle.



Key

Ø angle of inclination of the backrest from the horizontal

Figure 10 — Determination of the angle of backrest inclination

6.4 Seat static load and backrest static load test

Only the vertical seat static load shall be applied to items without a backrest.

The test shall be carried out at the following positions:

a) on the seat of an item with a single seat;

b) simultaneously on both positions for an item with two seats;

c) simultaneously on two adjacent seats in most adverse combination for an item with three or more seats. If the most adverse position cannot be determined the test shall be carried out at a maximum of two locations.

During the test, load the seat(s) that are not being tested with the specified seat load. For parts not undergoing the test, the load shall be applied at the seat loading position.

Seating with a fixed backrest position, and seating with reclining mechanisms that cannot be locked into a fixed position, shall be tested for the number of cycles specified.

Seating fitted with a tilting mechanism that has a tension adjustment, shall be tested with the tension adjusted to its maximum value.

Seating with rocking runners or with spring rocking action base shall be tested for half the number of cycles specified in its upright position and half the number of cycles in its reclined position.

Upright position shall be determined by the following procedure:

i) Place the seating on the floor (5.3);

ii) Let the seating achieve its balanced position;

iii) Prevent seating from moving by any suitable means, e.g. stops in 5.4;

iv) Apply the loading template (5.2) and determine the backrest inclination as described in 6.3.

Reclined position shall be determined by the following procedure:

v) Place the seating on the floor (5.3);

vi) Load the seating with 8 loading discs (5.15) so that the discs are firmly settled against the backrest;

vii) Let the seating achieve its new balanced position;

viii) Prevent seating from moving by any suitable means, e.g. stops in 5.4;

ix) Remove the discs;

x) Apply the loading template (5.2) and determine the backrest inclination as described in 6.3.

Seating with reclining mechanisms that can be set or locked in a number of positions shall be tested for half the number of cycles specified in the most upright position, and half the number of cycles specified in the most adverse reclined position.

NOTE The most adverse position is normally considered to be 10° above the fully reclined position for fully adjustable mechanisms, or one position up from fully reclined position for seating with multi-position backrests.

Prevent the item from moving rearwards by placing stops (5.4) behind the rear legs, feet or castors (see Figure 11).

Position the seat loading pad(s) (5.5) at the seat loading position(s) determined by the loading point template (5.2).

If the item has a backrest, position the centres of the back loading pad(s) (5.7), either at the back loading position as determined by the loading point template or at 100 mm below the top of the backrest, whichever is lower.

All adjustable backrests shall be set in the most adverse position.

The angle of backrest inclination Ø (6.3), in degrees shall be measured.

Table 2 — Determination of seat and backrest force

Angle of backrest inclination Ø	Seat force F_1 N	Backrest force F_2 N
Backrest set to an angle 70° or more to the horizontal	Specified seat force	Specified backrest force
Backrest set to an angle of less than 70°, but not less than 55° to the horizontal	Specified seat force × Sin Ø	((Ø/60°) – 0,166 6) × Specified seat force × Cos Ø
Backrest set to an angle of less than 55° to the horizontal	0,75 × Specified seat force	0,75 × Specified seat force × Cos Ø

Apply the downward force F_1 (determined in Table 2) per seat loading pad (5.5) to the seats (see 6.4 a), b) and c)).

With the seat force maintained, apply the backrest force F_2 (determined in Table 2) per back loading pad (5.7). When fully loaded, the backrest force shall act at (90 ± 10)° to the backrest plane.

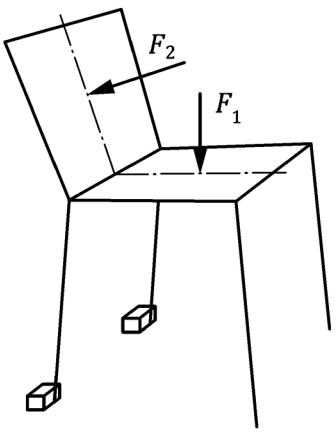
If the item tends to overturn, reduce F_2 to a magnitude that just prevents rearwards overturning. F_2 shall not be reduced below the minimum specified force. If the item tends to overturn at this force, the F_1 shall be increased until this tendency ceases.

Report the force(s) used.

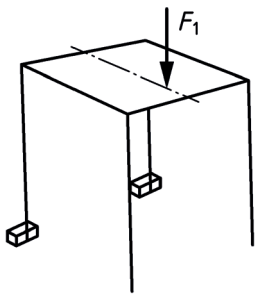
Remove F_2 and then F_1. This constitutes one cycle.

F_1 shall be maintained as long as necessary for F_2 to be applied (4.2).

Where the design of the chair does not allow the transfer of force(s) from the loading pad to the load-bearing structure/surface, then a bridging device may be used to span the load-bearing structure/surface.



a) Example of chairs



b) Example of stools

Key

F_1 seat force

F_2 backrest force

Figure 11 — Seat and backrest static load test

6.5 Seat front edge static load test

Apply the specified force using the seat loading pad (5.5) at a point on the seat centreline 100 mm inwards from the front edge of the structure. The front edge should be determined by using the front load locator device (5.14).

For multiple seating units, the seat front edge static load test shall be carried out simultaneously on the same seats as used for the seat and backrest static load test (6.4). During the test, load the seat(s) that are not being tested with the specified seat load for parts not undergoing test, applied at the seat loading position.

If the seating tends to overturn, reduce the force(s) to a magnitude that just prevents overturning.

Record the actual force(s) used.

6.6 Vertical load test on backrests

The test is only applicable for chairs with a height of the backrest that is or can be adjusted to < 950 mm above ground.

For chairs where the height of the backrest is adjustable by any means, the test shall be carried out with the backrest height set at the worst position below 950 mm.

Apply the specified seat load to the seat loading point and maintain for the duration of the test.

Apply the specified downwards static force to the top of the backrest, on the centre point of the backrest. Apply the force through the seat loading pad (5.5). If it is not possible to use the seat loading pad, apply the force with the smaller seat loading pad (5.6). When necessary, the loading pads may be constrained from pivoting.

For multiple seating units, the downwards static force shall be applied simultaneously on the same positions as used for the seat and backrest static load test (6.4). During the test, load the seat(s) that are not being tested with the specified seat load for parts not undergoing test, applied at the seat loading position.

If the seating tends to overturn, reduce the downwards static force(s) on the backrest to a magnitude that just prevents overturning.

Record the actual force(s) used.

This test does not apply to backrests where there is no loadbearing structure, between the sides of the backrest that supports the top of the backrest, e.g. flexible materials such as textiles, leather.

6.7 Horizontal forward static load test on backrests

This test is only applicable to seating fixed to the floor.

Apply the specified horizontal static force on the backrest at a point 50 mm below the centre of the top of the backrest. Apply the force through the smaller seat loading pad (5.6) (see Figure 12).

NOTE In order to apply the load at the correct loading position a smaller loading pad can be used.

For multiple seating units, the horizontal static force test shall be applied simultaneously to the same positions as used for the seat static load test (6.4).

Where the design of the chair does not allow the transfer of force(s) from the loading pad to the load-bearing structure/surface, then a bridging device may be used to span the load-bearing structure/surface.

Dimensions in millimetres

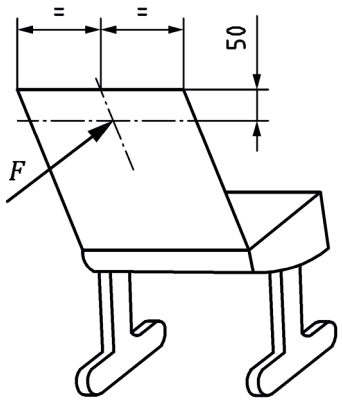
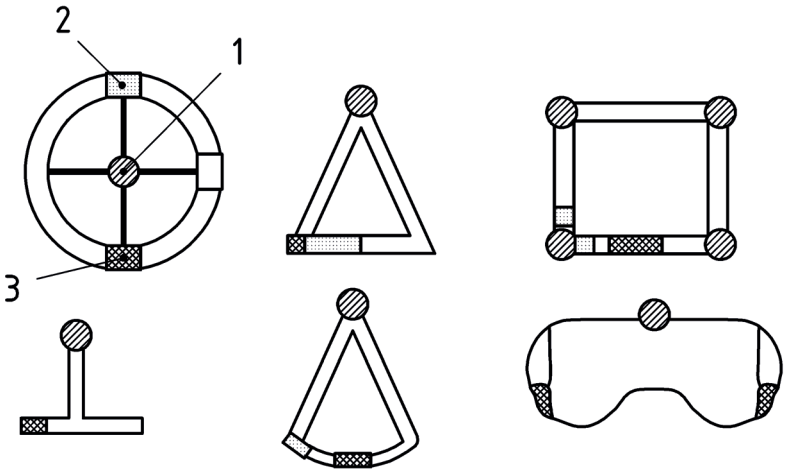


Figure 12 — Horizontal forward static load test on backrests

6.8 Footrest static load test

Apply the specified downward force to the seat at the seat loading point.

For footrests with a depth of 80 mm or less the force shall be applied at the centre of its depth. For footrests with a depth > 80 mm the force shall be applied 60 mm from the front edge, see Figure 13.



Key

1 support point
2 possible load application points
3 points most likely to cause failure

Figure 13 — Examples for footrests and static loading points – vertical

Apply a vertical force by means of the local loading pad (5.8).

If the seating tends to overturn, increase the load on seat to a magnitude that just prevents overturning and record the load used.

6.9 Legrest static load test

This test is only applicable to legrests designed to support the full weight of the user, such as those with additional support to the floor under the legrest.

Apply the specified downward force to the seat at the seat loading point.

Using the seat loading pad (5.5), apply the specified force 100 mm inwards from the outer edge of the legrest at the point most likely to cause failure.

If the seating tends to overturn, increase the load on seat to a magnitude that just prevents overturning and record the load used.

6.10 Armrest sideways static load test

For seating with one armrest, apply an outward force as specified to the armrest at the point along the armrest most likely to cause failure, but not less than 100 mm from the end of the armrest structure. Apply the force using the local loading pad (5.8).

If the item tends to overturn, apply a load on the side of the seat opposite to the armrest under test large enough to prevent the item from overturning.

For seating with two armrests, apply an outward force as specified to each armrest of the unit simultaneously at the point along the armrests most likely to cause failure, but not less than 100 mm from either end of the armrest structure, (see Figure 14). Apply the force using the local loading pad (5.8).

For seating with three or more armrests, carry out the test on one pair of adjacent armrests. All different armrest designs shall be tested.

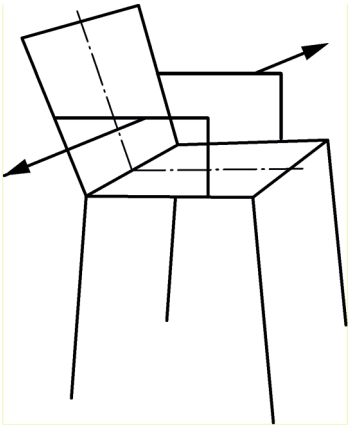


Figure 14 — Armrest sideways static load test

6.11 Arm rest downwards static load test

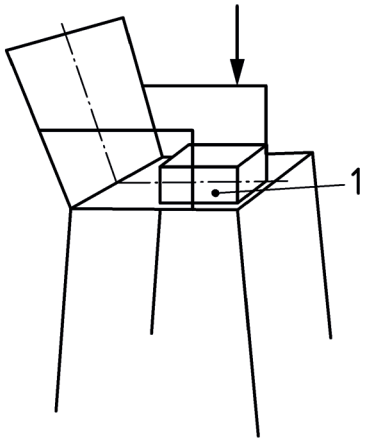
For seating which only has one armrest, or which has two armrests where the distance between the centre of the armrests is more than 1 000 mm, apply the specified vertical force at the points along the armrest most likely to cause failure (see Figure 15), but not less than 100 mm from the end of the armrest structure.

If the chair tends to overturn, apply a load on the side of the seat opposite to the armrest under test large enough to prevent the chair from overturning.

For seating with two armrests, where the distance between the centre of the armrests is 1 000 mm or less, apply the specified vertical force simultaneously to both armrests at the points along the armrest most likely to cause failure, but not less than 100 mm from either end of the armrest structure.

For seating with three or more armrests, carry out the test on one pair of adjacent armrests. All different armrest designs shall be tested.

Apply the force through the smaller seat loading pad (5.6) or the local loading pad (5.8). The load shall follow the movement of the armrest during the test.



Key

1 balancing load

Figure 15 — Armrest downward static load test

6.12 Headrest static load test

Prevent the item from moving rearwards by placing stops behind the rear legs, feet or castors.

Seating with reclining mechanisms that can be set or locked in a number of positions shall be set to the most upright position.

Adjustable headrests shall be set to their highest position.

Apply the specified rearwards force at the centre of the headrest. Apply the force through the local loading pad (5.8). When fully loaded, the specified force shall act at (90 ± 10)° to the headrest plane.

If the seating tends to overturn, place a load on seat with a magnitude that just prevents overturning and record the load used.

6.13 Vertical upwards static load test on armrests

6.13.1 Seating which can be moved when occupied

This test is only applicable to seating where the manufacturer specifically states that the chair is suitable for lifting an occupied chair by the armrests.

Place the seat load specified at the seat loading point.

Apply an upwards force simultaneously to both arms, at the balance point, sufficient to lift the seating. Lower the chair so that it rests on the floor.

6.13.2 Stacking seating

This test applies only to stacking seating units where the stack is moved by lifting by the armrests. Normally this test does not apply when the manufacturer supplies devices for moving the seating or when the information for use includes instructions for moving the stack of chairs without lifting by the armrests.

Load the chair with the specified load at the seat loading point.

Apply an upwards force sufficient to lift the seating simultaneously to both arms at the balance point. Lower the seating unit so that it rests on the floor.

6.14 Vertical static load test on auxiliary writing surfaces

Load the chair with the specified load at the seat loading point.

Apply the specified downwards force, by means of the local loading pad (5.8) to the point on the writing surface furthest from any support, but not less than 100 mm from any edge of the writing surface.

If the seating tends to overturn, increase the load on seat to a magnitude that just prevents overturning and record the load used.

6.15 Leg forward static load test

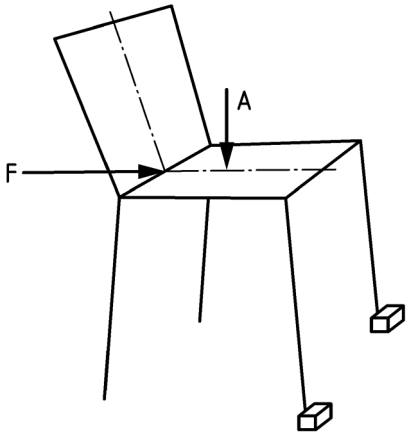
Prevent the unit from movement by stops (5.4) against the front legs.

Apply the specified seat load at the seat loading position determined by the loading point template (5.2) to all seat positions.

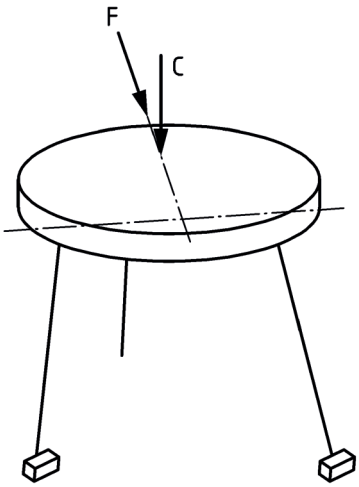
For seating with a single seat, apply a horizontal force centrally to the rear of the seat, at a height that is equal to the bottom of the load pad (5.5) when the load is applied to seat, in a forward direction, (see Figure 16 a)), by means of the local loading pad (5.8).

For seating with multiple seating positions, apply the horizontal force centrally to the rear of the most adverse seat position, a height that is equal to the bottom of the load pad (5.5) when the load is applied to seat, in a forward direction, by means of the local loading pad (5.8) (see Figure 16 c)). For seating with only three legs, one foot on the fore and aft centre line of the item of seating and one other foot shall be restrained by stops (see Figure 16 b)).

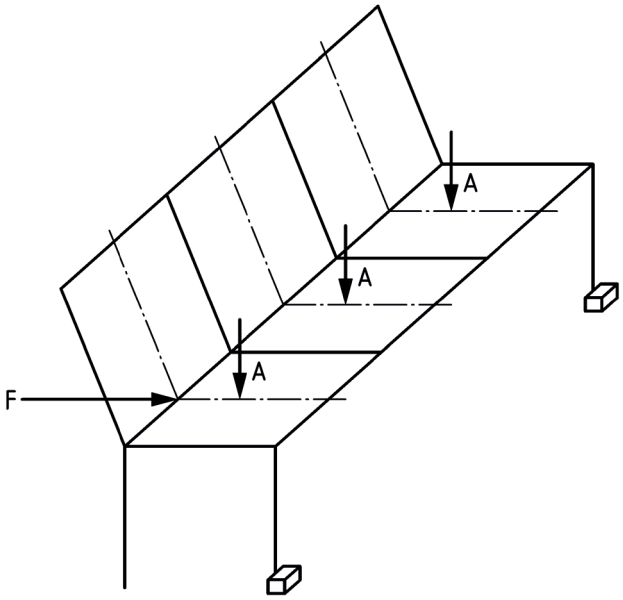
If the item tends to overturn before the specified horizontal force is reached, reduce the horizontal force to a magnitude that just prevents forward overturning, but not lower than the minimum specified horizontal force. Record the actual force used.



a) Example – four-leg chair



b) Example – three-leg chair



c) Example – multiple seating

Key

A seat loading point (chair, multiple seating)

C seat loading point (stool)

F force

Figure 16 — Leg forward static load

6.16 Leg sideways static load test

Prevent the unit from movement by stops (5.4) placed against one pair of front and rear feet.

Apply the vertical seat load specified in a transverse plane on the seat but not more than 150 mm from the unloaded edge of the seat (see Figure 17).

Determine the seat loading point with the seat loading point template (5.2). Apply a horizontal force

— to the side of the seat in line with the seat loading point;

— at a point equal to the height of the bottom of the seat loading point template (5.2);

— to the unrestrained side of the seat;

— in a direction towards the restrained feet (see Figure 17).

If necessary, a bridging device may be used to apply the force.

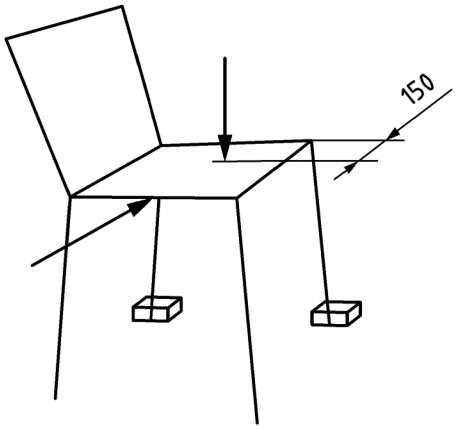
The force shall continuously be applied in the initial direction chosen.

For seating with only three legs, one foot on the fore and aft centre line of the item of seating and one other foot shall be restrained by stops.

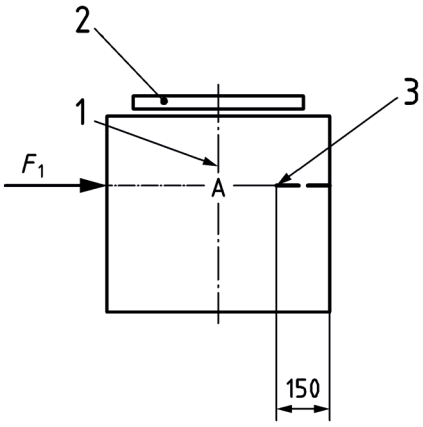
If the item tends to overturn with the vertical seat load in its furthermost position from the unloaded edge, reduce the horizontal force to a magnitude that just prevents sideways overturning, but not lower than the minimum specified force. Record the actual force used.

For seating with multiple seating positions, apply the specified seat load at the seat loading position determined by the loading point template (5.2) to all seat positions.

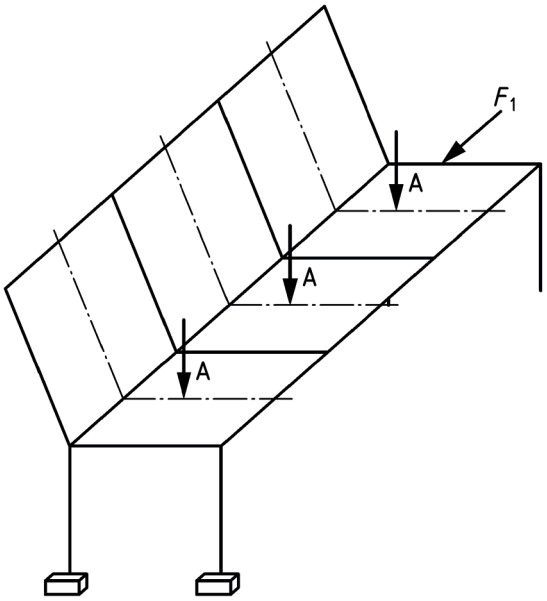
Dimensions in millimetres



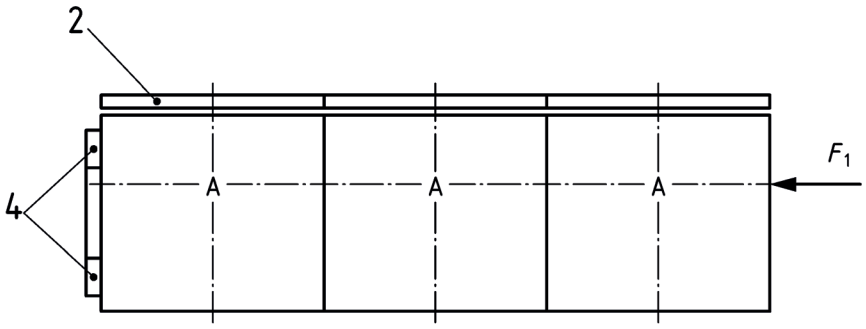
a) Single seat – front view



b) Single seat – top view



c) Multiple seating – front view



d) Multiple seating – top view

Key

1 median plane
2 backrest
3 vertical seat load
4 stops (5.4)
A seat loading point
F_1 horizontal force

Figure 17 — Leg sideways static load test

6.17 Combined seat and backrest durability test

Only the vertical seat durability force shall be applied to items without a backrest.

The test shall be carried out on the same positions as used for the seat static load test (6.4).

During the test, load the seat(s) that are not being tested with the specified seat load for parts not undergoing test; the load shall be applied at the seat loading position.

Seating with a fixed backrest position, and seating with reclining mechanisms that cannot be locked into a fixed position, shall be tested for the number of cycles specified.

Seating fitted with a tilting mechanism that has a tension adjustment, shall be tested for the number of cycles specified with the tension adjusted to its maximum value.

Seating with rocking runners or with spring rocking action base shall be tested for half the number of cycles specified in its upright position and half the number of cycles in its reclined position.

Upright position shall be determined by the following procedure:

a) Place the seating on the floor (5.3);

b) Let the seating achieve its balanced position;

c) Prevent seating from moving by any suitable means, e.g. stops in 5.4;

d) Apply the loading template (5.2) and determine the backrest inclination as described in 6.3.

Reclined position shall be determined by the following procedure:

e) Place the seating on the floor (5.3);

f) Load the seating with 8 loading discs (5.15) so that the discs are firmly settled against the backrest;

g) Let the seating achieve its new balanced position;

h) Prevent seating from moving by any suitable means, e.g. stops in 5.4;

i) Remove the discs;

j) Apply the loading template (5.2) and determine the backrest inclination as described in 6.3.

For seating with reclining mechanisms that can be set or locked in a number of positions

1) set the backrest to its most upright position and all other adjustments in their most adverse position.

Perform half the required cycles

2) set the backrest to its most rearward position and perform the remaining cycles.

NOTE The most adverse position is normally considered to be 10° above the fully reclined position for fully adjustable mechanisms, or one position up from fully reclined position for seating with multi-position backrests.

Prevent the item from moving rearwards by placing stops (5.4) behind the rear legs, feet or castors (see Figure 18).

Position the seat loading pad(s) (5.5) at the seat loading position(s) determined by the loading point template (5.2).

If the item has a backrest, position the centres of the back loading pad(s) (5.7), either at the back loading position as determined by the loading point template or at 100 mm below the top of the backrest, whichever is the lower

All adjustable backrests shall be set in the most adverse position.

The angle of backrest inclination Ø (6.3), in degrees shall be measured.

Table 3 — Determination of seat and backrest force

Angle of backrest inclination Ø	**Seat force** F_3 N	**Backrest force** F_4 N
Backrest set to an angle 70° or more to the horizontal	Specified seat force	Specified backrest force

Table 3 *(continued)*

Angle of backrest inclination Ø	Seat force F_3 N	Backrest force F_4 N
Backrest set to an angle of less than 70°, but not less than 55° to the horizontal	Specified seat force × Sin Ø	((Ø/60°) – 0,166 6) × Specified seat force × Cos Ø
Backrest set to an angle of less than 55° to the horizontal	0,75 × Specified seat force	0,75 × Specified seat force × Cos Ø

Apply the downward force F_3 (determined in Table 3) per pad to the seats (see 6.4 a), b) and c)).

With the seat force maintained, apply the backrest force F_4 (determined in Table 3) per pad. When fully loaded, the backrest force shall act at (90 ± 10)° to the backrest plane.

If the item tends to overturn, reduce F_4 to a magnitude that just prevents rearwards overturning. F_4 shall not be reduced below the minimum specified force. If the item tends to overturn at this force, the F_3 shall be increased until this tendency ceases.

If the flexibility and movement of the seating components do not allow load application within the time requirement given in 4.2 the application of the force shall take precedence over the load application time.

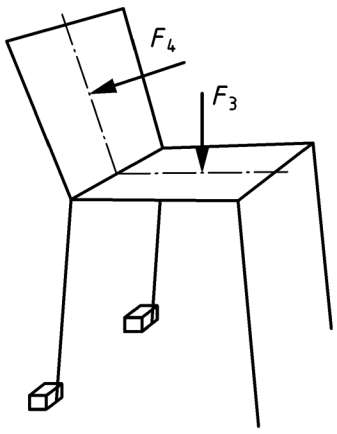
Report the force(s) used.

Remove F_4 and then F_3. This constitutes one cycle.

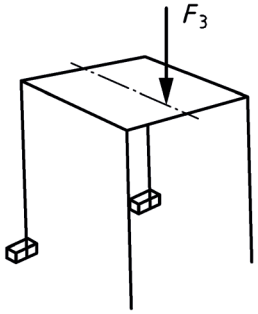
F_3 shall be maintained as long as necessary for F_4 to be applied (4.2).

For designs where it is not possible to carry out the above test procedure the seat and backrest test may be performed by carrying out the seat test followed by the backrest test with a static load on the seat.

Where the design of the chair does not allow the transfer of force(s) from the loading pad to the load-bearing structure/surface, then a bridging device may be used to span the load-bearing structure/surface.



a) Example for chairs



b) Example for stools

Key

F_3 seat force

F_4 backrest force

Figure 18 — Seat and backrest durability test

6.18 Seat front edge durability test

Restrain the item by use of stops (5.4).

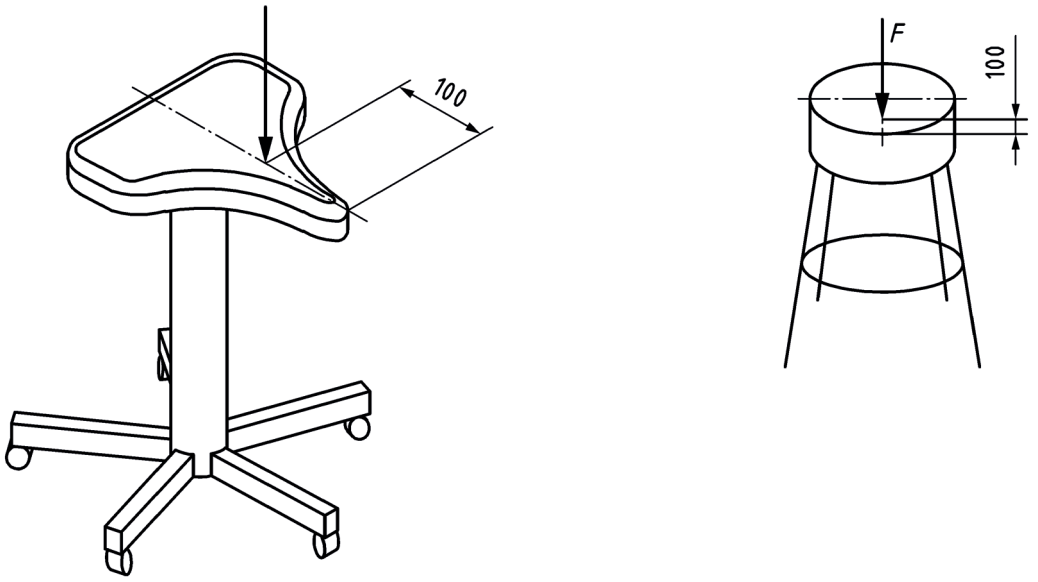
Front edge should be determined by using the front load locator device (5.14), see Figures in Annex C.

Apply the vertical seat durability force specified using the smaller seat loading pad (5.6) alternately on two points each 100 mm from the front edge of the seat structure and as near as possible to either side of the seat but not less than 100 mm from the edges. One cycle is one application of the specified force to each load position.

NOTE In some instances it can be appropriate to apply the force through the local loading pad (5.8).

For seating where it is not possible to apply the force at two points, the force shall be applied to a single position on the longitudinal axes at a point 100 mm from the front edge of the seat structure. One cycle is two applications of the specified force.

Examples of items of seating requiring one application point are shown in Figure 19.



a) Stool with saddle seat **b) Stool with round seat**

Key

F seat force

Figure 19 — Examples of seatings where a single force is required

For multiple seating units, the seat front edge durability test shall be carried out as above on one end seat. The test shall be repeated, with a single vertical seat durability force applied to one intermediate seat at the point defined in the seat static load test (6.4).

If the item tends to overturn, reduce the force to a magnitude that just prevents overturning. Report the actual force used.

6.19 Durability test on outdoor seating with a multi-position backrest

This test is applicable to seating with backrests that manually adjust to three or more discrete reclined positions (stops).

Place the seating in normal use position, with the backrest in the most adverse position. Prevent the item of seating from moving rearwards by placing stops (5.4) behind the rear feet, legs or castors.

Apply the specified load using the loading pad (5.6) to the seat loading point.

The height of the backrest loading points shall be either 100 mm above the back loading point (6.2) or 100 mm below the top of the backrest, whichever is lower. They shall also be 50 mm inwards from the right and left outer edges of the backrest.

Apply rearwards alternating forces perpendicularly to the backrest, as specified.

One cycle is one application of force on the right side and one application of force on the left side.

Carry out the test for the number of cycles specified.

Where the design of the chair does not allow the transfer of force(s) from the loading pad to the load-bearing structure/surface, then a bridging device may be used to span the load-bearing structure/surface.

6.20 Armrest durability test

Place the chair on the test floor with stops (5.4) against the outside of the legs, feet or castors. The test forces shall be applied simultaneously on each armrest, at the point most likely to cause failure, but not less than 100 mm from the front or rear edge of the armrest length (3.6) and through the centre of the width of the armrest, but not more than 100 mm from the inner edge of the armrest. The load shall follow the movement of the armrest during the test.

Using the armrest durability test apparatus (5.11), adjust the apparatus so that with no load applied to armrests the angle of load application arms is (10 ± 1)° to the vertical and the distance between the low friction pivots and the horizontal surface of the arm loading devices is (600 ± 10) mm. With the apparatus set as above, apply the specified load for the required number of cycles to both armrests simultaneously for seating with only one seating position and to one armrest only for seating with multiple seating positions.

Height adjustable chairs should be set at their lowest height.

6.21 Footrest durability test

Apply the specified downward force to the seat at the seat loading point.

Apply the specified vertical force for the specified number of cycles by means of the local loading pad (5.8) acting 80 mm from front edge of the load bearing structure of the footrest at those points most likely to cause failure. For round cross section ring shaped footrests, the force shall be applied through the centre of the ring cross section.

If the seating tends to overturn, increase the load on seat to a magnitude that just prevents overturning and record the load used.

6.22 Auxiliary writing surfaces durability test

Apply the specified downward force to the seat at the seat loading point.

Apply a downwards vertical force at the same position as specified in 6.14 using the local loading pad (5.8) for the number of cycles specified.

If the seating tends to overturn, increase the load on seat to a magnitude that just prevents overturning and record the load used, see Figure 15.

6.23 Tipping seat operation test

If the seating unit features tip-up seats, one seat shall be operated for the specified number of cycles.

Moving of the seat from the fully closed (stowed) to the fully open (in use) position and then back to the fully closed position shall constitute one cycle. The maximum rate shall not exceed ten cycles per minute.

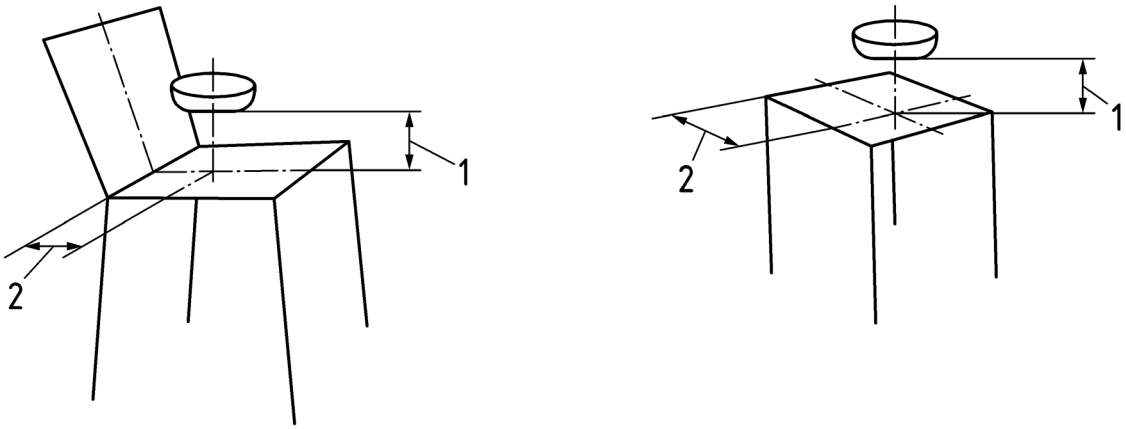
During each cycle, the seat shall be allowed to open or close freely under gravity if that is its correct mode of operation. When cycling from one position to another, seats at the end stop position shall not be loaded and actuated motion shall cease within 5 mm of the end stop position.. For seats that return automatically to the stowed position the test machine shall allow that movement. For seats that do not return automatically to the fully closed (stowed) position the test machine shall move it to its stowed position.

6.24 Seat impact test

Place one layer of 25 mm thick foam (5.9) on the seat. Determine the height of fall from the position of the impactor when it is resting on the surface of that layer of foam (5.9).

Place a second layer of 25 mm thick foam (5.9) between the striking surface and the chair seat for the test. Allow the seat impactor (5.10) to fall freely from the height specified onto the seat loading position, (see Figure 20), as specified by the loading point template (5.2). Repeat the test at one other position considered likely to cause failure, but not less than 100 mm from any edge of the seat.

For multiple seating units, apply the test to one end seat and an intermediate seating position.



a) Example of chairs **b) Example of stools**

Key

1 height of fall

2 seat loading point according to template

Figure 20 — Seat impact test

6.25 Backrest impact test

Place the unloaded seating on the drop test floor (5.3) in normal use position.

Apply a rearward horizontal force to a point 50 mm below the top of the backrest in the centre of the backrest. Measure the force required to lift the front legs off the floor.

a) If the measured force is less than 30 N, test as described in 6.28.

Repeat for the number of cycles specified.

b) If the chair does not tip over at 30 N, place the item with its front legs, feet or castors restrained by stops (5.4) from moving forward. Strike the structure of the centre of the top outside of the backrest at the highest possible point with the centre of the face of the impact hammer (5.11) (see Figure 21 a)). Drop the impact hammer through the height (or angle) specified at the following backrest positions:

   i) on the centre of an item with one seat;

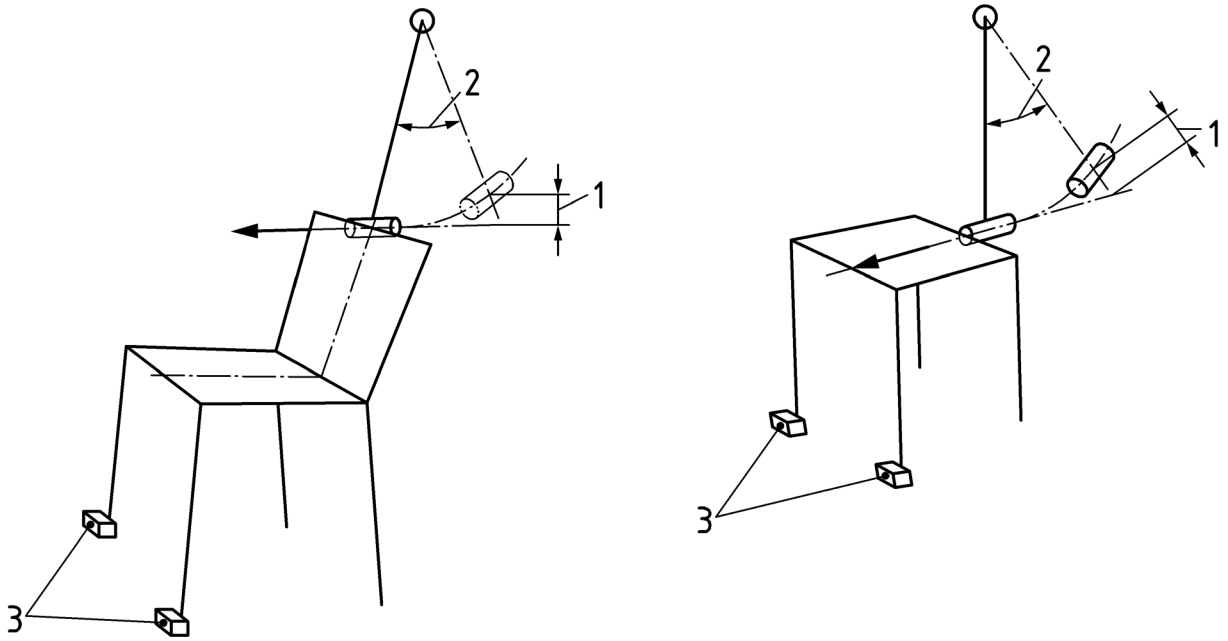
   ii) at both positions for items with two seats;

   iii) at one end position and one centre position for items with three or more seats.

If the item has no backrest, strike the centre of the seat rear edge.

If a stool or bench has no easily determined rear edge, apply the test in the direction most likely to cause failure (see Figure 21 b)).

The item of seating shall not be prevented from overturning during the test, and shall be allowed to strike the rubber faced test floor (5.3).



a) Example of chairs **b) Example of stools**

Key

1 vertical height of fall

2 angle of fall

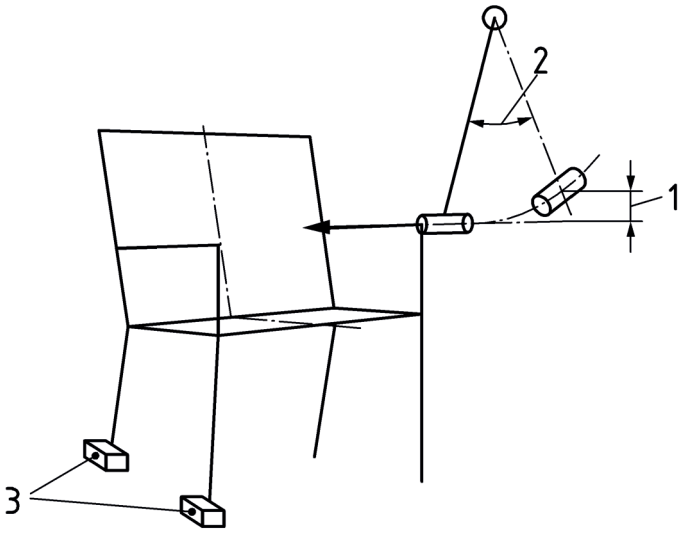
3 stops

Figure 21 — Backrest impact test

6.26 Armrest impact test

Place the item with one pair of front and rear legs, feet or castors restrained by stops from moving sideways. Strike the outside of one armrest with the centre of the face of the impact hammer (5.11) (see Figure 22). The armrest shall be impacted at the point, which is the outermost point of the armrest and on a line parallel to the centreline, but not less than 50 mm from the end of the armrest.

The item of seating shall not be prevented from overturning during the test, and shall be allowed to strike the rubber faced test floor (5.3).



Key

1 vertical height of fall
2 angle of fall
3 stops

Figure 22 — Armrest impact test

6.27 Drop tests

Measure the vertical force required to lift the right and left hand side of the item. This is determined as the lowest upwards vertical force to lift at least one end (10 ± 5) mm off the floor.

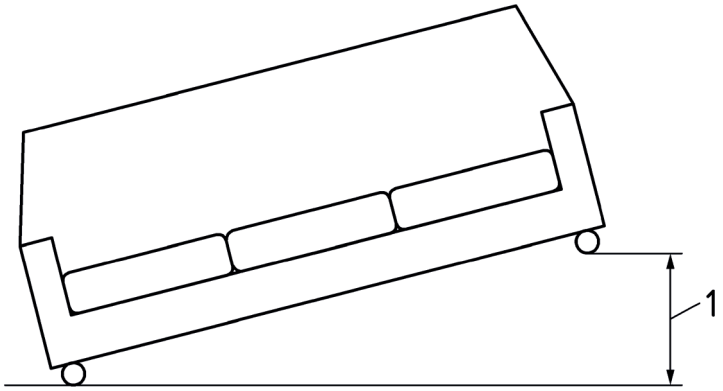
The forces may be replaced by masses. The relationship 10 N = 1 kg shall be used.

Determine the drop height as a percentage of specified drop height according to the following calculation:

Force required to lift one end of unit	Percentage of Specified Nominal Drop Height
0 – 100 N	100
100 – 650 N	100 – [90 x (Force required to lift one end of unit – 100)/550]
> 650 N	10

Lift the item at one end/side and allow it to fall freely from the specified height so that the feet or castors strike the floor (5.3) (see Figure 23).

Repeat the test on the other end of the item.



Key

1 drop height

Figure 23 — Drop test for multiple seat units

6.27.1 Drop test for stacking seating

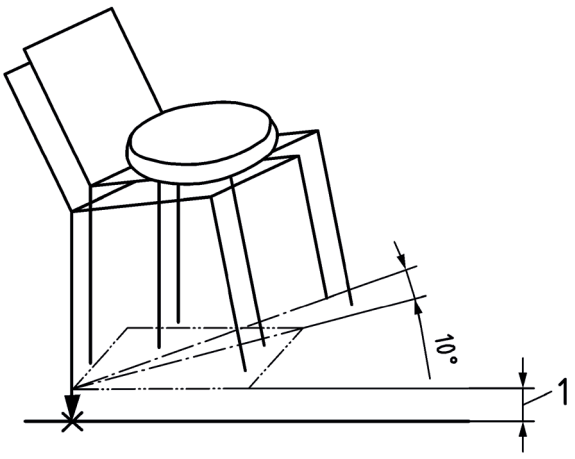
Use two chairs, stack one seating unit upon another. If the stack of two chairs weighs more than 20 kg, carry out the test without additional load. If the stack of two chairs weighs less than 20 kg, place additional load using test bags until the weight of the stack is 20 kg. The additional load shall be secured on the seat loading point as determined by the loading point template (5.2).

NOTE 1 Test bags typically contain glass marbles, shot, and metal punches or similar media.

Support the bottom seating unit so that one leg is lifted to the specified drop height and the line joining that leg to the leg diagonally opposite is inclined 10° to the horizontal (see Figure 24). The two remaining legs shall be maintained at the same level.

Drop it on the rubber faced test floor (5.3) for the number of times specified. The test shall be carried out on one front leg and one rear leg.

NOTE 2 The test can be carried out by lifting the seating by means of three cords, which are adjusted in length so that the 10° angle is obtained.



Key

1 drop height

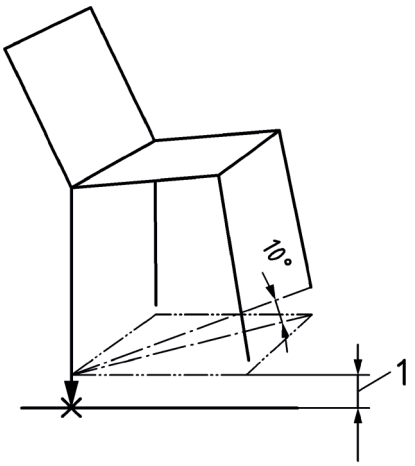
Figure 24 — Drop test for stacking seating

6.27.2 Drop test from the height of a table

This test is only applicable to seating weighing less than 10 kg and intended to be placed at high level (e.g. on a table top during cleaning). Support the seating so that one leg is lifted to the specified drop height and the line joining that leg to the leg diagonally opposite is inclined 10° to the horizontal (see Figure 25). The two remaining legs shall be maintained at the same level.

Drop it on to the rubber faced test floor (5.3). The test shall be carried out on one front leg and on one rear leg.

NOTE The test can be carried out by lifting the seating by means of three cords, which are adjusted in length so that the 10° angle is obtained.



Key

1 drop height

Figure 25 — Drop test from the height of a table

6.28 Backward fall test

Place the unloaded seating on the drop test floor (5.3) in normal use position and block the rear leg(s) to prevent sliding.

Apply a rearward horizontal force to a point 50 mm below the top of the backrest in the centre of the backrest. Measure the force required to lift the front legs off the floor.

If the measured force in 6.25 is less than 30 N, push the top of the backrest rearwards until it reaches the equilibrium point (see Figure 26). Allow it to fall freely on its back, onto the rubber faced test floor (5.3), without initial force or velocity.

Repeat for the number of cycles specified.

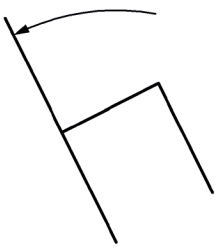


Figure 26 — Backward fall test

6.29 Castor and chair base durability test

6.29.1 Castor and chair base durability test for chairs with castors on all legs

This test does not apply to chairs with castors which are braked when the chair is loaded.

The chair shall be placed on a rotating table with a test surface (5.13) so that the rotating axis of the chair coincides with the rotating axis of the table. Load the seat with the specified load at the seat loading point. The item shall be loosely fixed in such a way that there is no rotation of the item but that the natural movements of the castors during testing are not prevented. The castors shall be left free to swivel and the table shall be rotated with a rate of six cycles per minute. The angle of rotation shall be from 0° to 180° and back. One rotation forward and one rotation backward constitutes one cycle.

Alternatively, attach the chair to a device that provides a linear movement of (1 000 ± 25) mm and a test surface (5.13). Load the seat in the seat loading point with the specified load. The item shall be loosely fixed in such a way that there is no rotation of the item but that the natural movements of the castors during testing are not prevented. The castors shall be left free to swivel and the device shall move with a rate of six cycles per minute.

One movement forward and one movement backward constitutes one cycle.

For both alternatives it is recommended to perform the test with a velocity as slow as possible with a short break when the device changes direction.

6.29.2 Castor and chair base durability test for chairs with castor and glide combinations

For units with castor and glide combinations, the legs without castors shall be raised a maximum of 50 mm above the test platform during this test. The castors shall be free to rotate and swivel where applicable. There shall be no load placed on the seat of the unit or unit base. Perform the test described in 6.29.1.

6.30 Rolling resistance test of the unloaded chair

The chair shall be placed on the test floor (5.13) and shall be pushed or pulled over a distance of at least 550 mm. A velocity of 50 mm/s shall be maintained over the measuring distance. The force shall be applied at a height of (200 ± 50) mm above the test surface.

Record the average value of the force used to push or to pull the chair over the distance from 250 mm to 500 mm as the rolling resistance.

6.31 Seat side-to-side durability test in D-G points for single column seating

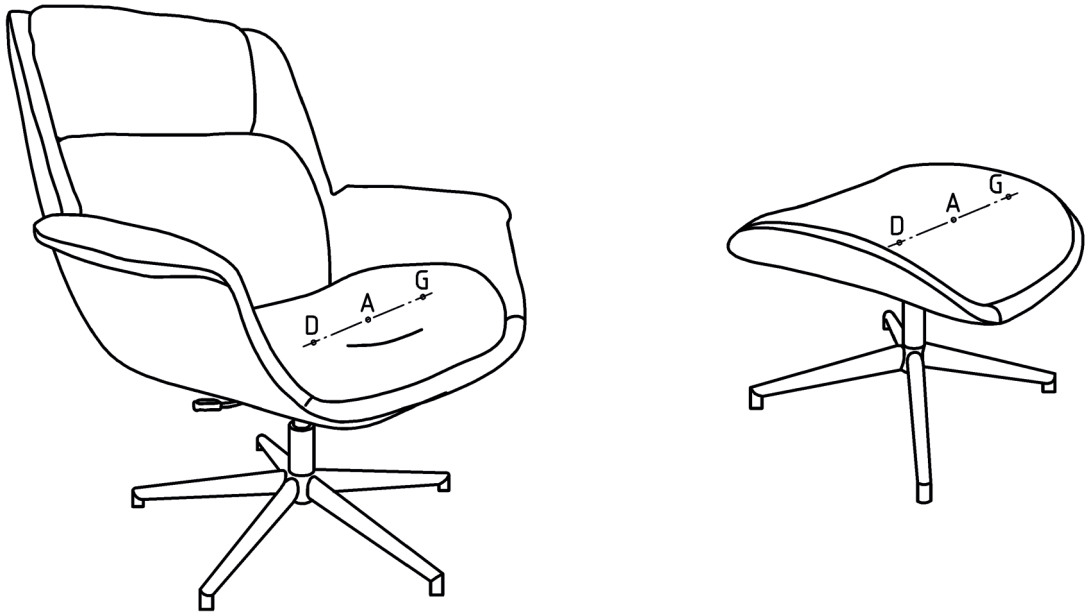
Position the seating on the test surface according to 5.3 with its components as specified in Table 4.

6.31.1 Loading points

The seat loading point A shall be determined according to 6.2.

Loading point D is the point 150 mm to the right of seat loading point A in transverse plane, but not less than 100 mm from the edge of the seat structure. See Figure 27.

Loading point G is the point 150 mm to the left of seat loading point A in transverse plane, but not less than 100 mm from the edge of the seat structure. See Figure 27.



a) Seating with backrest **b) Seating without backrest**

Key

A reference point A

D loading point D

G loading point G

Figure 27 — Loading points for single column seating

Prevent the seating from moving by placing stops (5.4) behind supporting points of the seating.

The seat loads shall be applied vertically by smaller seat loading pads (5.6), alternately in positions D and G. If it is not possible to perform the test in D and G points (i. e. when distance between D-G is less than 210 mm) then local loading pads (5.8) shall be used instead of the smaller loading pads.

One cycle shall consist of the application and removal of the forces at the respective loading points.

Seating with locking device(s) for seat and/or backrest angle movements shall be tested with the mechanism set free to move and tension set to its maximum level.

Table 4 — Positioning of the seating components

Test	Seat height	Seat	Backrest height	Backrest in depth	Tilt tension adjustment	Castors and base
Seat side-to-side durability test in D-G points	Highest position	Horizontal, foremost position	Highest position	Most likely to cause failure	Mid-range	Least likely to cause overturning

7 Test procedures – Work Chairs

7.1 General

The chair and its components shall be configured as specified in Table 5.

If a test cannot be carried out as specified, the test shall be carried out as closely as possible to that specified. Any modification to the test method shall be technically justified and shall be recorded in the test report.

Position the chair and its components as specified in Table 5 on the test surface (5.3).

A layer of foam (5.9) shall be positioned between the loading pads and the test structure.

Table 5 — Positioning of chair components

Clause	Test	Seat height	Seat	Back-rest height	Back-rest in depth	Tilt tension adjustment	Castor and base	Armrest	Footrest
7.3	Combined seat and backrest static load test	highest position	foremost position	---	---	---	least likely to cause overturning	---	---
7.4	Seat front edge static load test	highest position	most adverse position	highest position	rearmost position	mid range	least likely to cause overturning	---	---
7.5	Armrest downward static load test – central	lowest position	horizontal	---	---	---	---	most likely to cause failure	---
7.6	Armrest downward static load test – front	lowest position	horizontal	---	---	---	---	highest, widest, foremost position	---
7.7	Armrest sideways static load test	lowest position	horizontal	---	---	---	---	highest, widest position	---
7.8	Footrest static load test	---	---	---	---	---	least likely to cause overturning	---	highest position
7.9	Seat and backrest durability	highest position	horizontal, foremost position	highest position	most likely to cause failure	mid range	least likely to cause overturning	---	---
7.10	Armrest durability	lowest position	horizontal	---	---	maximum tension	---	highest, widest position	---
7.11	Swivel test	highest position	horizontal, foremost position	highest position	rearmost position	---	---	---	---
7.12	Footrest durability	---	---	---	---	---	least likely to cause overturning	---	lowest position
7.13	Castor and chair base durability	lowest position	horizontal	---	---	---	---	---	---

7.2 Loading points

7.2.1 General

The loading points for work chairs are graphically shown in Figure 29. The determination of "left" and "right" is based on the user's seated position in the chair.

7.2.2 Loading point A

Loading point A is the point in which the chair's axis of rotation intersects with the seat surface with the seat in a position as close as possible to the horizontal.

7.2.3 Loading point B

Loading point B is the point on the centreline of the backrest, 300 mm above loading point A (7.2.2) measured when the seat is loaded with 640 N through the seat loading pad.

7.2.4 Loading point C

Loading point C is the point in front of loading point A (7.2.2) along the centreline of the seat, 100 mm from the edge of the load bearing structure of the seat.

7.2.5 Loading point D

Loading point D is the point 150 mm to the right of loading point A (7.2.2), but not less than 100 mm from the edge of the seat structure.

7.2.6 Loading point E

Loading point E is the point 50 mm to the right of loading point B (7.2.3).

7.2.7 Loading point F

Loading point F is the point in front of loading point D (7.2.5) on a line parallel to the centreline, 100 mm from the edge of the load bearing structure of the seat on that line.

7.2.8 Loading point G

Loading point G is the point 150 mm to the left of loading point A (7.2.2), but not less than 100 mm from the edge of the seat structure.

7.2.9 Loading point H

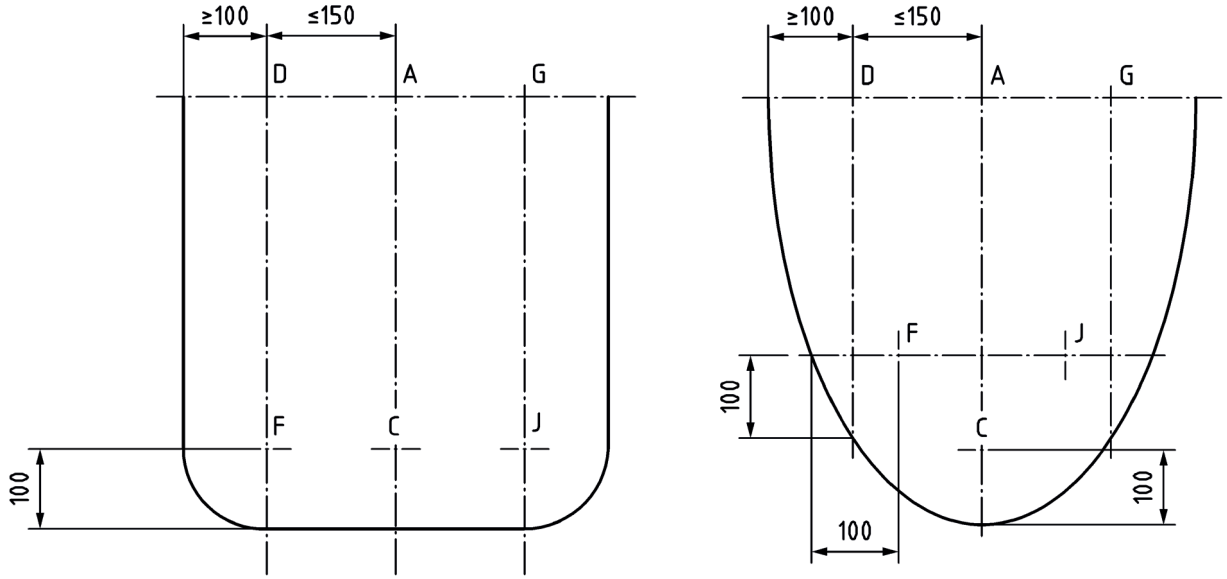
Loading point H is the point 50 mm to the left of loading point B (7.2.3).

7.2.10 Loading point J

Loading point J is the point in front of loading point G (7.2.8) on a line parallel to the centre line, 100 mm from the structure of the seat edge on that line.

If the distance from any edge of the structure is less than 100 mm, move the point inwards on a line parallel to the line intersecting points A, D and G such that the distance from the edge is 100 mm (see Figure 28).

Dimensions in millimetres



a) Example of loading points F & J on seat with flat front part

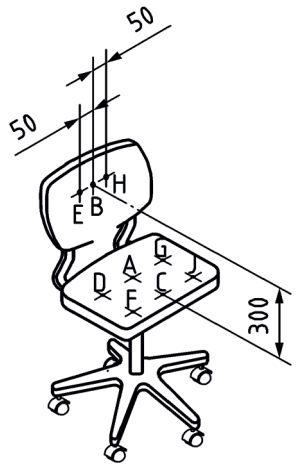
b) Example of loading points F & J on seat with curved front part

Key

A	loading point A	F	loading point F
C	loading point C	G	loading point G
D	loading point D	J	loading point J

Figure 28 — Determination of loading points F & J

Dimensions in millimetres



Key

A	loading point A	D	loading point D	G	loading point G
B	loading point B	E	loading point E	H	loading point H
C	loading point C	F	loading point F	J	loading point J

Figure 29 — Loading points

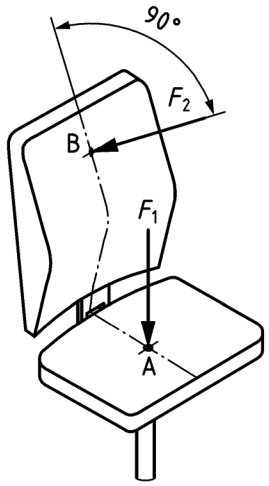
7.3 Combined seat and backrest static load test

Prevent the chair from moving rearwards by placing stops (5.4) behind two adjacent supporting points at the rear of the chair.

Chairs with (a) locking device(s) for seat and/or backrest angle movements shall be tested first with the device(s) locked for half of the cycles and then with the device(s) unlocked for the other half of the cycles. For the first half of the cycles the backrest shall be in the upright position.

Apply a vertical force F_1 through the seat loading pad (5.5) at point A (7.2.2). Keep the seat loaded and apply a force F_2 through the centre of the back loading pad (5.7) at point B (7.2.3). When fully loaded the force shall act at (90 ± 10)° to the backrest plane (see Figure 30). If the chair tends to overturn, reduce the backrest force and report the actual force. Remove the backrest force and then the seat force.

For backrests that pivot apply force F_2 at the pivot point to apply the same bending moment as if point B was 300 mm above point A.



Key

A seat loading point (7.2.2)
B seat loading point (7.2.3)
F_1 vertical force
F_2 perdendicular force

Figure 30 — Combined seat and backrest static load test

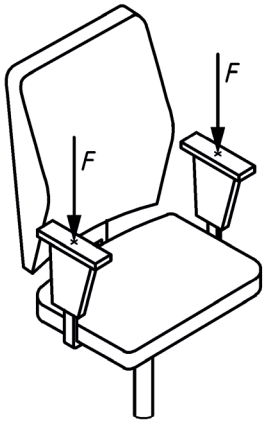
7.4 Seat front edge static load test

Position the smaller seat loading pad (5.6) at loading point F (7.2.7) or J (7.2.10). Apply a vertical downward force through the centre of the loading pad.

7.5 Armrest downward static load test – central

The armrests shall be loaded vertically by means of the local loading pads (5.8). The loading points shall be at the midpoint of the armrest length and centred side to side. In the case of an armrest which is not horizontal, or which is curved, the length is measured in a horizontal plane 20 mm below the highest point of the armrest.

Apply the force to both armrests simultaneously (see Figure 31).



Key

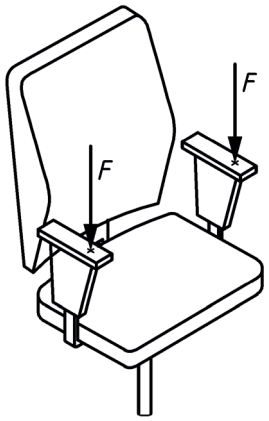
F vertical force

Figure 31 — Armrest downward static load test – central

7.6 Armrest downward static load test – front

The armrests shall be loaded vertically by means of the local loading pads (5.8). The loading points shall be 75 mm from the front edge and centred side to side.

Apply the force to both armrests simultaneously (see Figure 32).



Key

F vertical force

Figure 32 — Armrest downward static load test – front

7.7 Armrest sideways static load test

This test shall be carried out as described in 6.10.

7.8 Footrest static load test

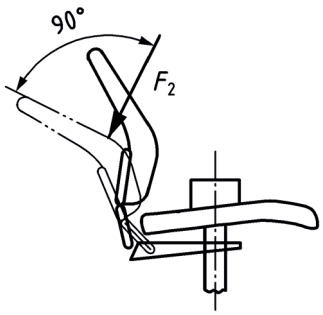
This test shall be carried out as described in 6.8.

7.9 Seat and backrest durability test

The upper part of the chair shall be positioned so that the centre of the backrest is midway between two adjacent supporting points of the base with stops (5.4) against these supporting points.

The seat load shall be applied vertically using the seat loading pad (5.5) in positions A and C, and using the smaller seat loading pad (5.6) in positions D, F, G and J. The backrest force shall be applied at an angle of (90 ± 10)° to the backrest when fully loaded (see Figure 33) using the back loading pad (5.7).

Front edge shall be determined by using the front load locator device (5.14).



Key

F_2 perpendicular force

Figure 33 — Backrest force application – principle

All chairs shall be tested to steps 1 to 5 (see Table 6).

Chairs with a locking device(s) for seat and/or backrest angle movements shall be tested in step 2, first with the device(s) locked for half of the cycles and then with the device(s) unlocked for the other half of the cycles. For the first half of the cycles, the backrest shall be in the upright position. In steps 3, 4 and 5 the mechanism shall be set free to move.

One cycle shall consist of the application and removal of the force(s) at the respective loading point(s).

Each step shall be completed before going to the next.

First the seat force shall be applied and maintained while the backrest force is applied.

If the backrest pad is pivoting around a horizontal axis above the height of the seat and is free to move, the horizontal force shall be applied on the axis. If height adjustable, the axis shall be set as close as possible to 300 mm above point A (7.2.2). If the axis cannot be adjusted to 300 mm, adjust the force to produce the same bending moment.

If the flexibility and movement of the seating components do not allow load application within the time requirement given in 4.2 the application of the force shall take precedence over the load application time.

Table 6 — Seat and backrest durability test

Step	Loading point
1	A
2	C-B
3	J-E
4	F-H
5	D-G

7.10 Armrest durability test

The test shall be carried out as described in 6.20.

7.11 Swivel test

The base of the chair shall be secured on a rotating table with a test surface (5.3) so that the rotating axis of the chair coincides with the rotating axis of the table. The upper part of the chair shall be loosely fixed in such a way as not to hinder the rotation of the base. Load the seat in loading point A (7.2.2) with the specified load and in loading point C (7.2.4) with the specified additional load, or any equivalent loading which will result in the same downwards force and bending moment on the chair. The angle of rotation shall be 360° at a rate of (10 ± 5) cycles/minute. Change direction after each rotation.

7.12 Footrest durability test

This test shall be carried out as described in 6.21.

7.13 Castor and chair base durability test

This test does not apply to chairs with castors which are braked when the chair is loaded.

The chair shall be placed on a rotating table with a test surface (5.13) so that the rotating axis of the chair coincides with the rotating axis of the table. Load the seat at point A with the specified load. The base shall be loosely fixed in such a way that there is no rotation of the base but that the natural movements of the castors during testing are not prevented. The castors shall be left free to swivel and the table shall be rotated with a rate of six cycles per minute. The angle of rotation shall be from 0° to 180° and back.

One rotation forward and one rotation backward constitutes one cycle.

Alternatively attach the chair to a device that provides a linear movement of (1 000 ± 250) mm and a test surface (5.13). Load the seat at point A with the specified load. The base shall be loosely fixed in such a way that there is no rotation of the base but that the natural movements of the castors during testing are not prevented. The castors shall be left free to swivel and the device shall move with a rate of six cycles per minute.

One movement forward and one movement backward constitutes one cycle.

For both alternatives, it is recommended to perform the test with a velocity as slow as possible with a short break when the device changes direction.

7.14 Rolling resistance test of the unloaded chair

This test shall be carried out as described in 6.30.

8 Test procedures – Loungers

8.1 General

The tests shall be carried out in the configuration most likely to cause failure.

If a test cannot be carried out as specified, the test shall be carried out as closely as possible to that specified. Any modification to the test method shall be technically justified and shall be recorded in the test report.

A layer of foam (5.9) shall be positioned between the loading pads and the test structure.

8.2 Seat and backrest static load test

This test shall be carried out as described in 6.4.

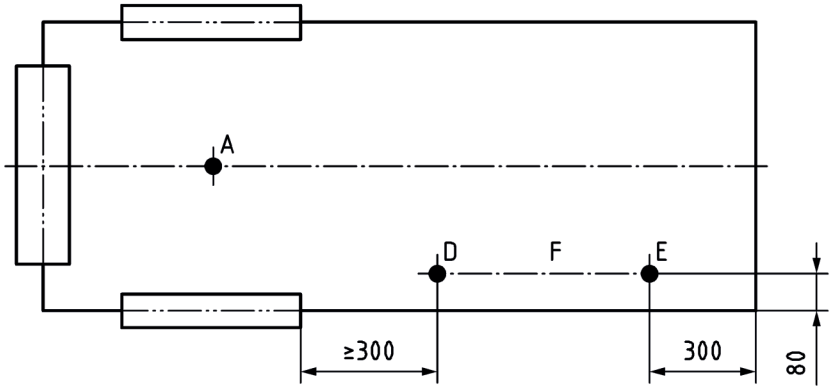
8.3 Additional seat and legrest static load test

Load the seat with the specified seat load at the seat loading point (6.2) and maintain the load for the duration of the test.

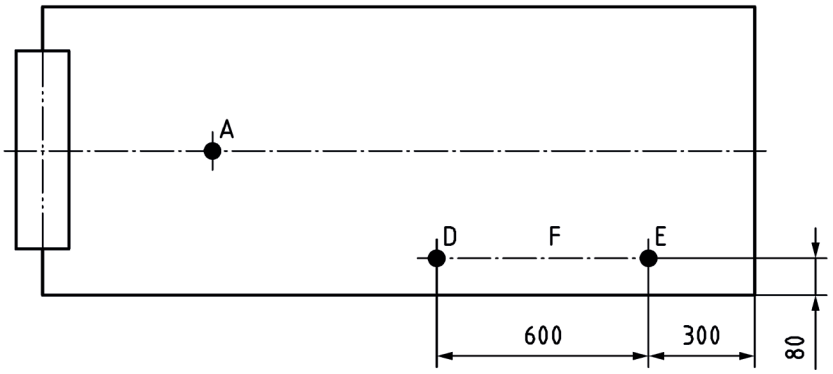
Using the seat loading pad (5.5), apply the specified force at the most adverse position between point D and E specified in Figure 34.

If the item tends to overturn, apply a counter balancing load to the opposite side of to the most adverse load position, with a load just sufficient to prevent overturning.

Dimensions in millimetres



a) Lounger with armrest



b) Lounger without armrest

Key

A loading point A
D loading point D
E loading point E
F location of static load application

Figure 34 — Additional seat and legrest static load test

8.4 Seat and backrest durability test

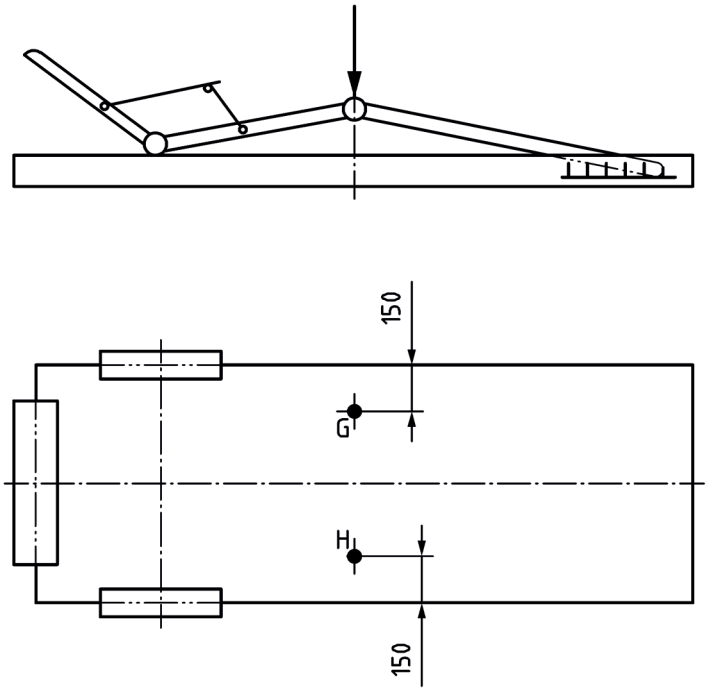
8.4.1 Seat and backrest durability test procedure

The test shall be carried out as described in 6.17.

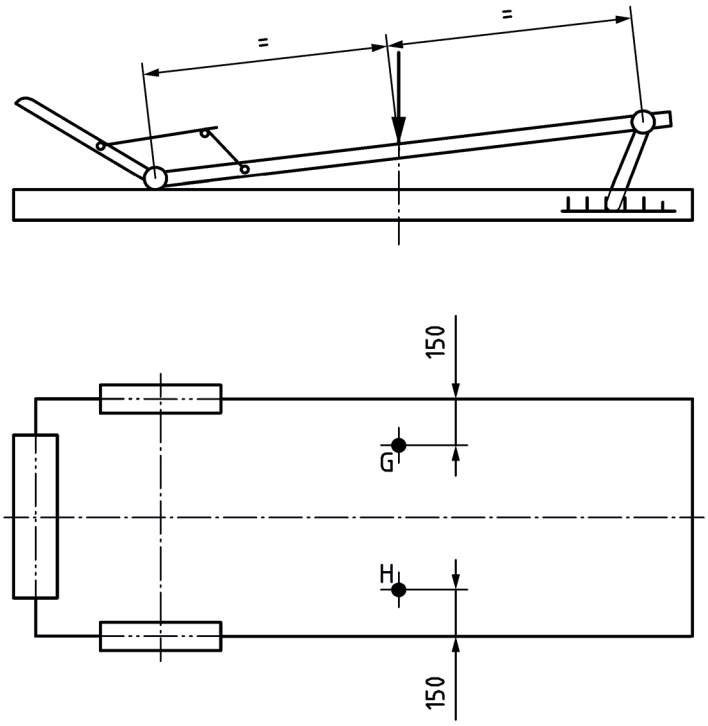
8.4.2 Additional seat durability test procedure

Apply the vertical seat durability load specified using the smaller seat loading pad (5.6) alternately at points G and H (see Figure 35).

Dimensions in millimetres



a) Lounger with adjustment



b) Lounger without adjustment

Key

G loading point G

H loading point H

Figure 35 — Seat fatigue test

8.5 Durability test on backrest mechanism

The test shall be carried out as described in 6.19.

8.6 Armrest downwards static load test

This test shall be carried out as described in 6.11.

8.7 Armrest durability test

This test shall be carried out as described in 6.20.

8.8 Impact test

With the exception of the application points specified below, the impact test procedure is performed in accordance with 6.24.

The application points shall be:

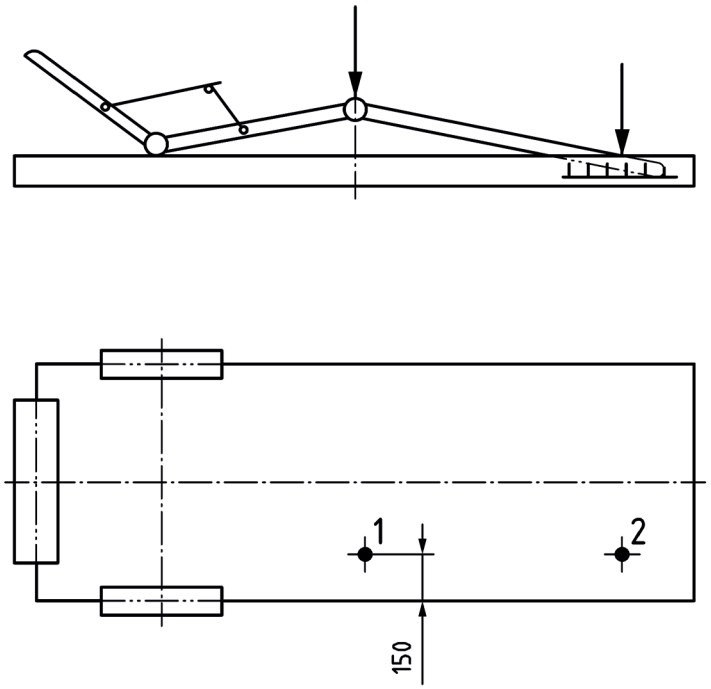
— the most adverse point on the seat-legrest section,

— 150 mm in from the edge of the lounger, and,

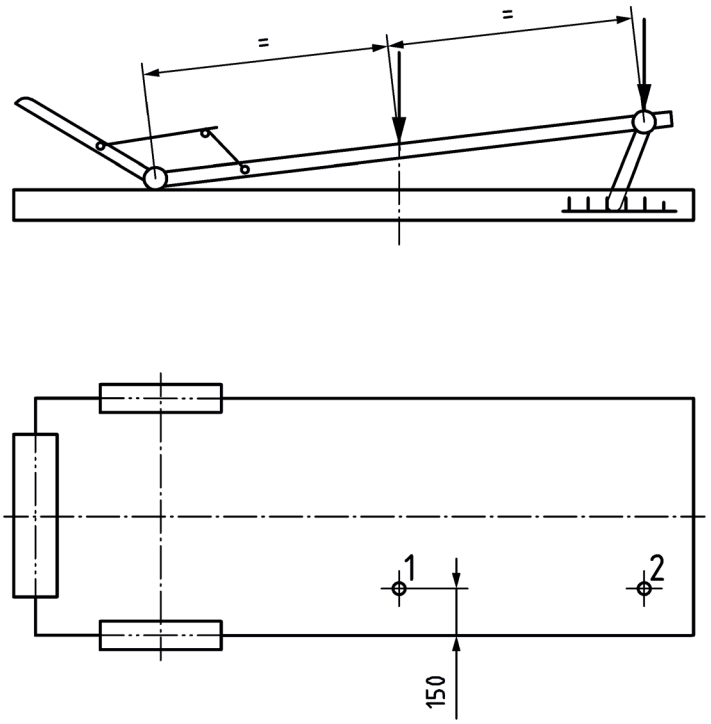
— directly on the end support,150 mm from any edge of the lounger (see Figure 36) on the same side of the lounger as the first impact position.

NOTE The most adverse point is normally over any adjustment mechanism, or the mid-point of the span between seat-legrest section supports.

Dimensions in millimetres



a) Lounger with adjustment



b) Lounger without adjustment

Key

1 impact point – most adverse position

2 impact point – end support

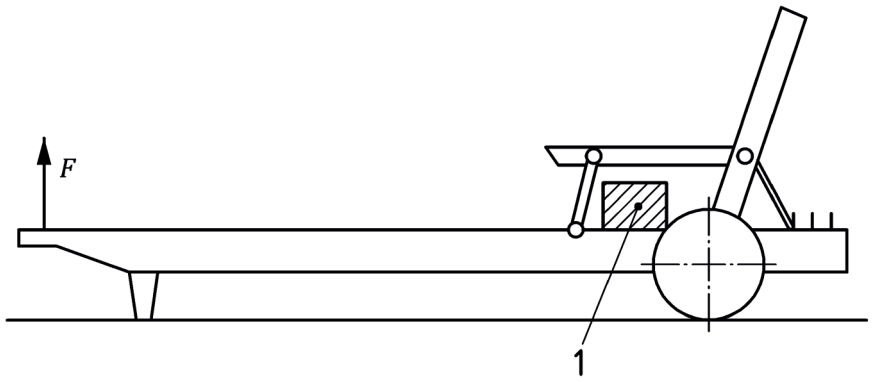
Figure 36 — Impact test

8.9 Lifting test for mobile loungers

This test is only applicable to mobile loungers that are designed to be moved whilst an occupant is seated.

Load the seat with the specified seat load at the seat loading point (6.2) and maintain the load for the duration of the test.

Lift the foot end of the lounger up to a height so that only the wheels are in contact with the floor surface for the specified number of cycles (see Figure 37).



Key

1 seat loading point (6.2)

F lifting force

Figure 37 — Lifting test for mobile loungers

Annex A
(normative)

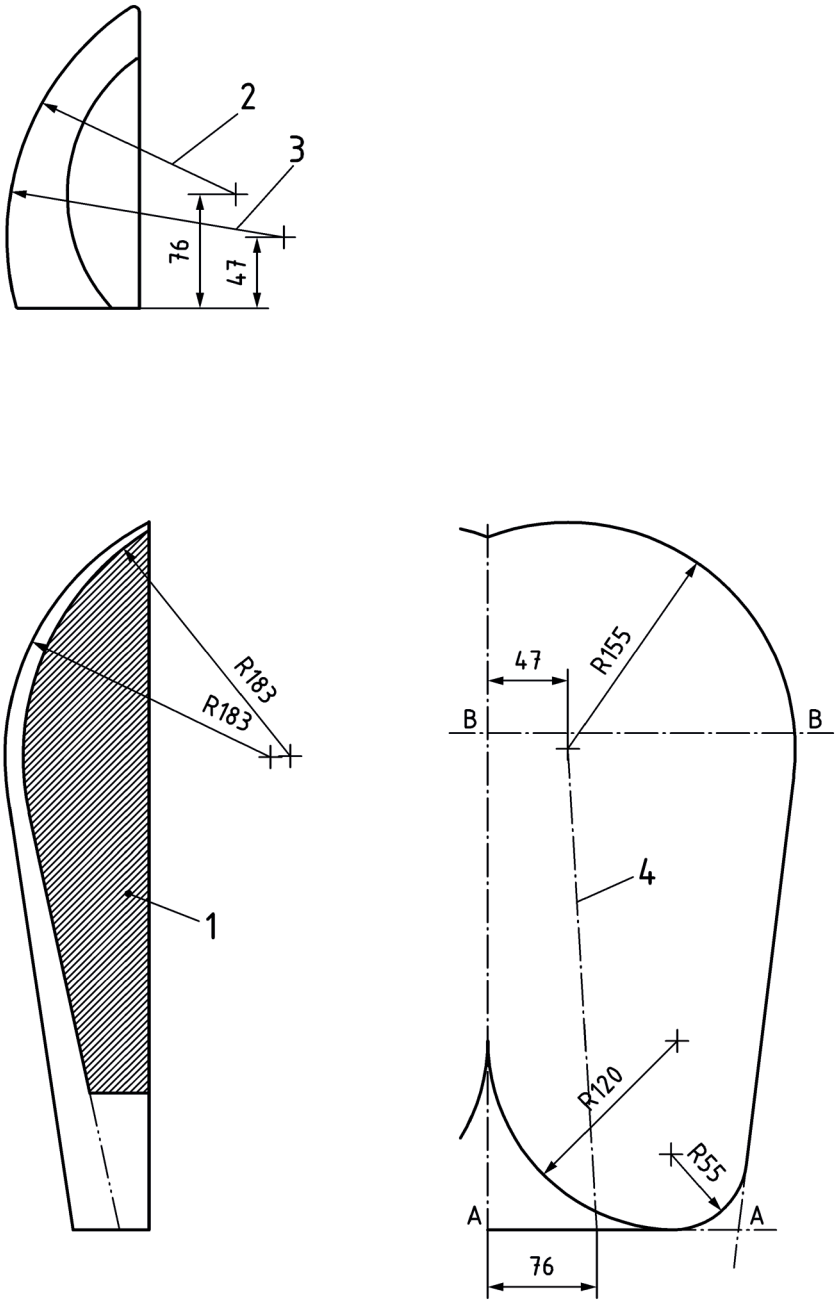
Seat loading pad data

The seat loading pad specified in 5.5 currently exists in two versions:

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

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

Dimensions in millimetres
All dimensions: ±5 mm



Key

1 centre section cross hatched
2 R105 (section A-A, see the top view)
3 R183 (section B-B, see the top view)
4 axis of the cone

Figure A.1 — Seat loading pad geometry – Machined construction

Dimensions in millimetres
All dimensions: ±5 mm

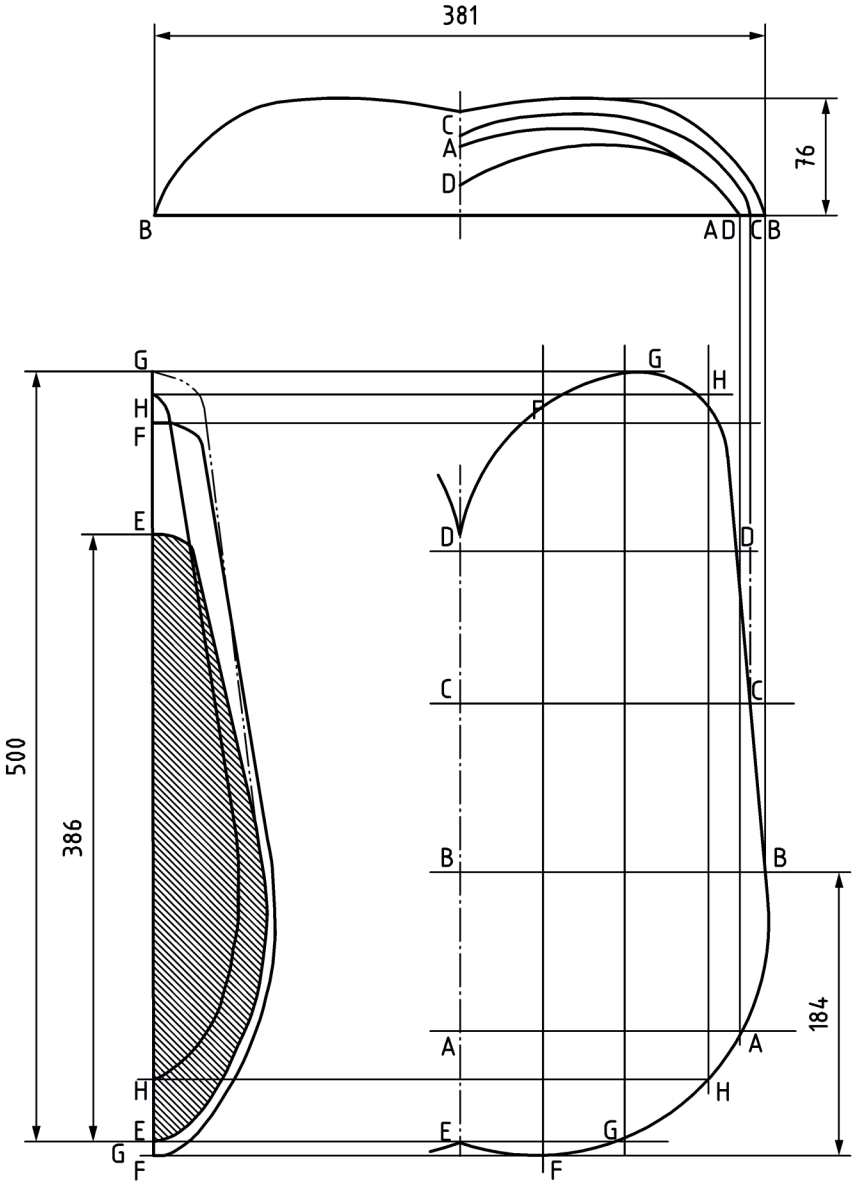


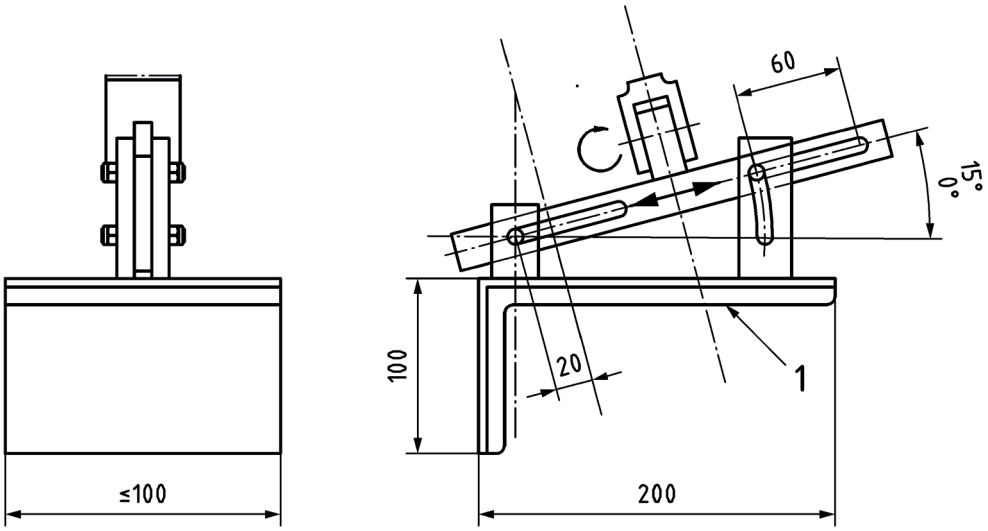
Figure A.2 — Seat loading pad geometry – Moulded construction

Annex B
(informative)

Armrest loading pad details

The armrest loading device shown in Figure B.1 is an example of a loading pad that can be used to test the majority of armrest designs used in furniture.

Dimensions in millimetres



Key

1 nylon facing material

Figure B.1 — Example of armrest loading device

Annex C
(normative)

Front load locator device (5.14)

C.1 Construction details

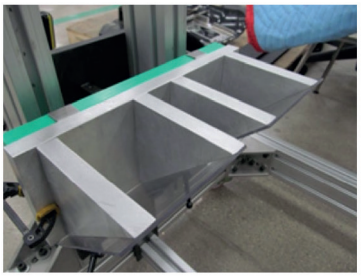
Construction details are given in Figures C.1 to C.6.

Tolerances unless otherwise specified:

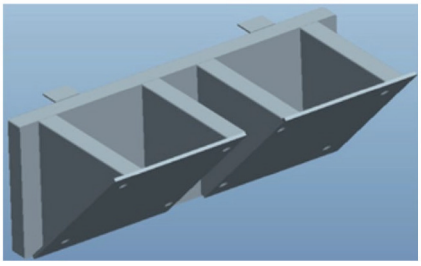
,xx ±0,15

,x ±0,3

Angles ±0° 30’

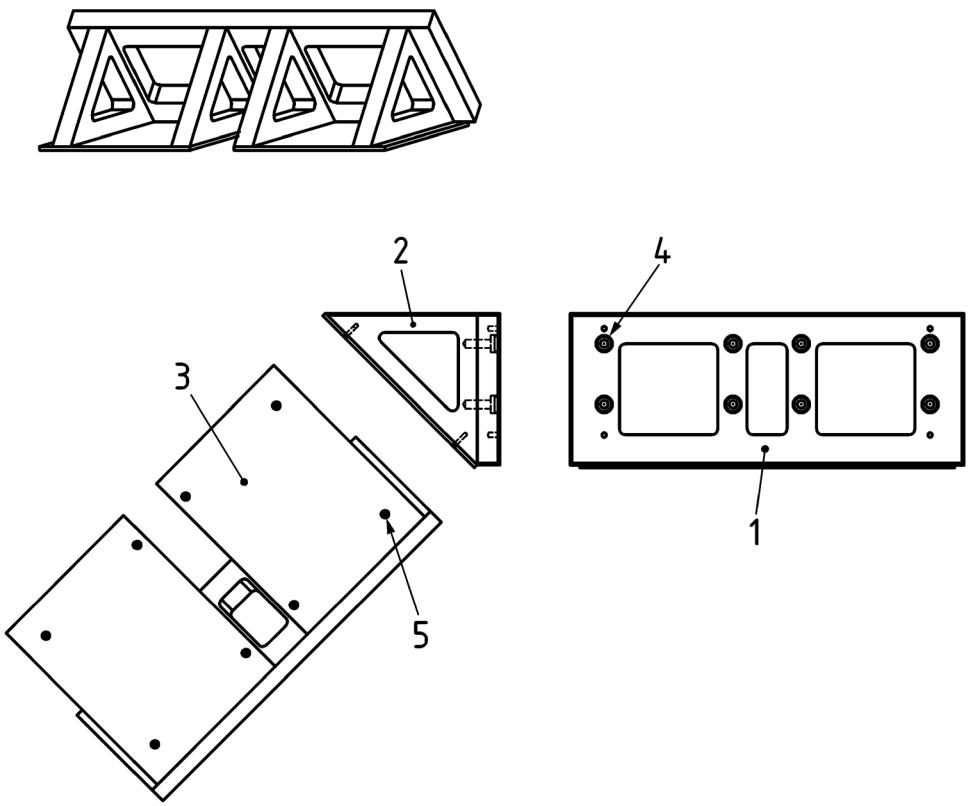


a) Application in practice



b) 3D view

Figure C.1 — Front load locator device in practice

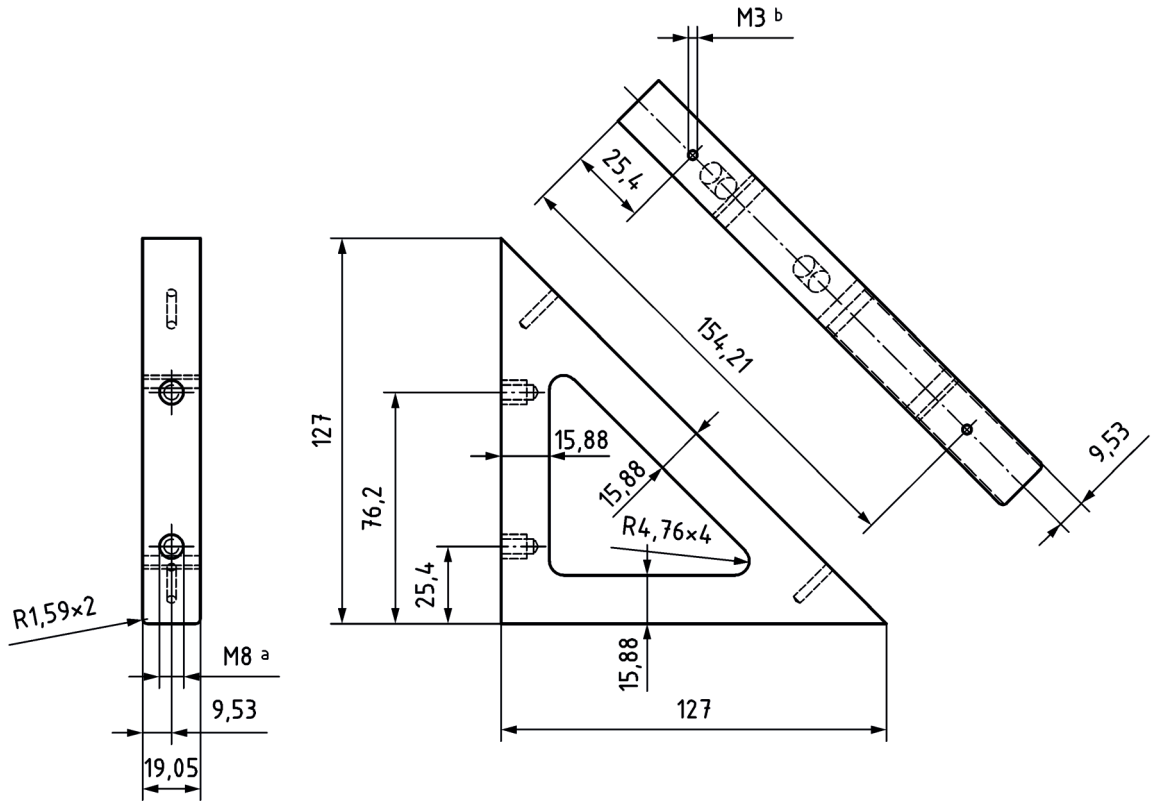


Key

1 main frame
2 angle frame
3 contact plate
4 M8 x 1,25 SHCS
5 M3 x 0,5 FHCS

Figure C.2 — Front load locator device

Dimensions in millimetres

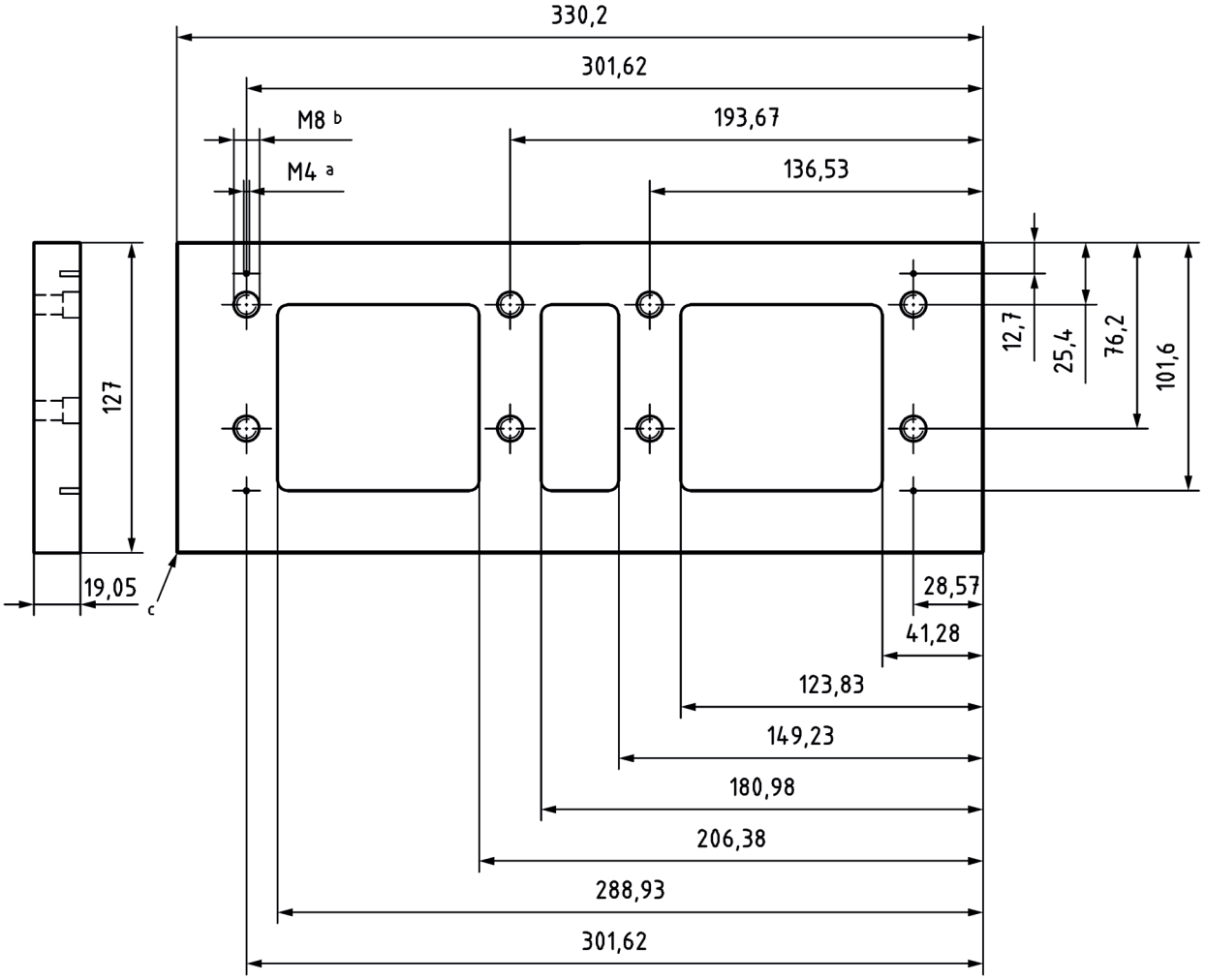


a M8x1,25 ISO – H TAP ↧ 8,000
6,8 drill (6,800) ↧ 10,000 –(2) hole.

b M3x0,5 ISO – H Drill 2,5
Drill (2,500) ↧ 12,000 – (2) hole.

Figure C.3 — Front load locator device, angled bracket

Dimensions in millimetres



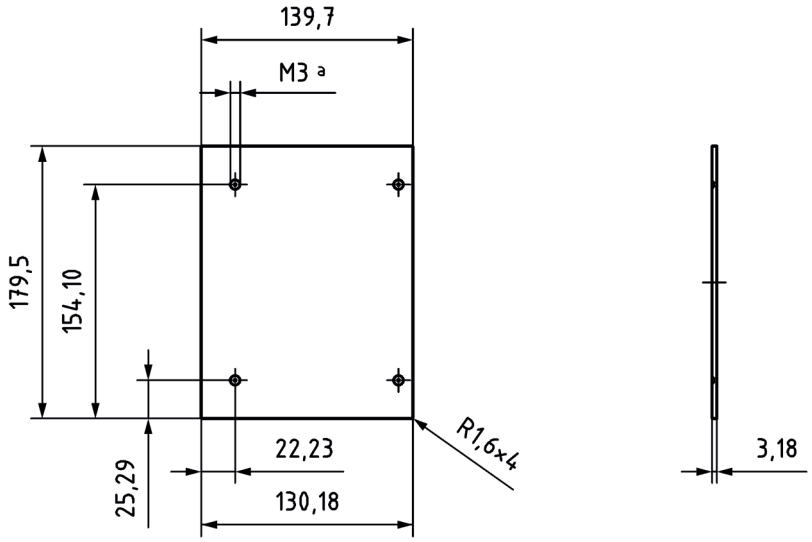
a M4x0,7 ISO – H TAP ↧ 7,920
3,3 drill (3,300) ↧ 9,500 –(4) hole.

b 3x1,5 ISO – H clear 9,0 drill (9,000) thru – (8) hole.

c Break all sharp edges with 0,5 mm radius.

Figure C.4 — Front load locator device, mainframe bracket

Dimensions in millimetres



a M3x0,5 ISO – H clear
3,4 drill (3,400)
Thru –(4) hole
⌵Ø 6,4x90°.

Figure C.5 — Front load locator device, contact plate

Dimensions in millimetres

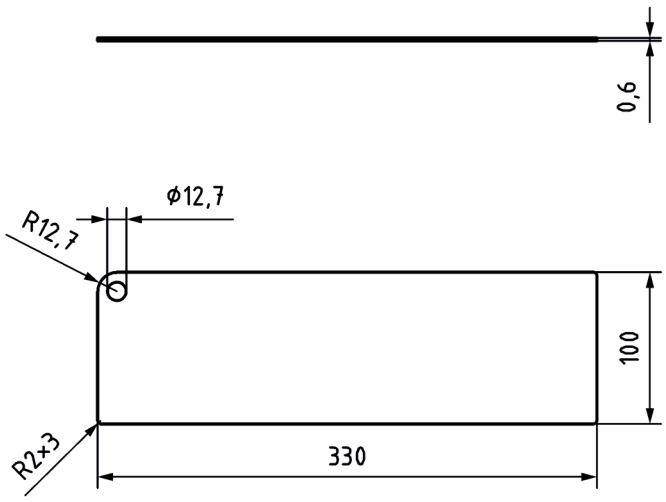
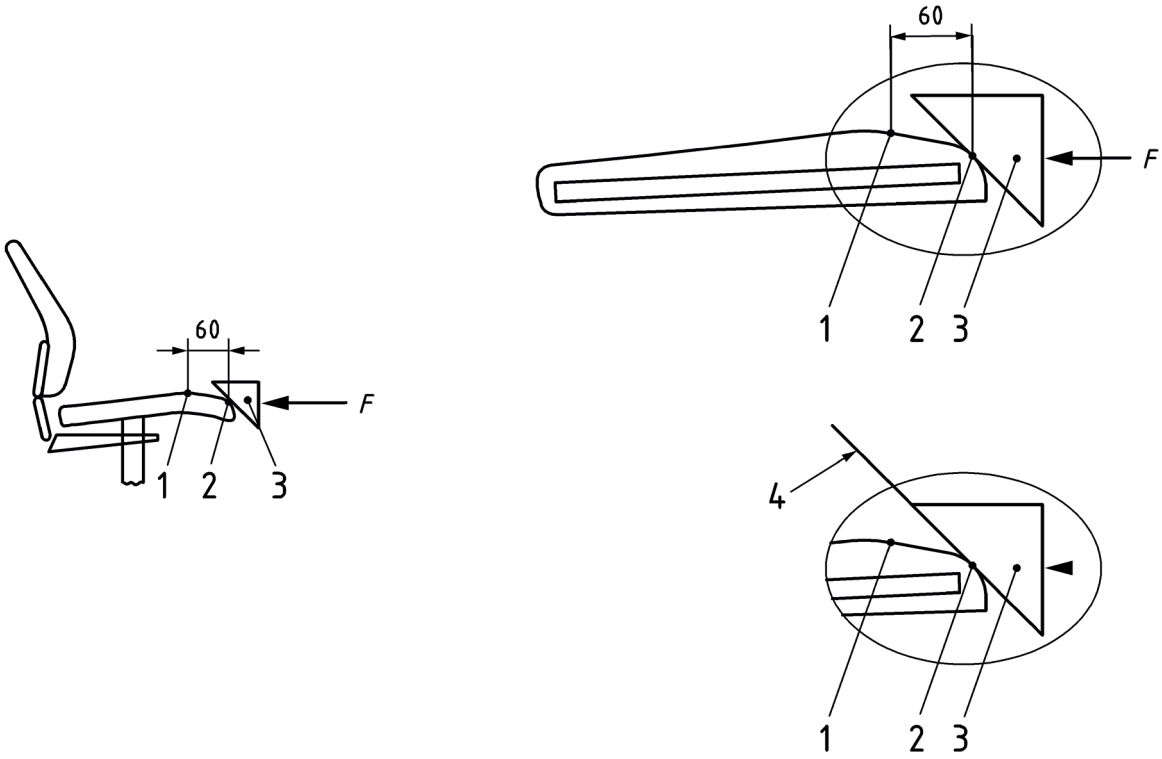


Figure C.6 — Front load locator device, feeler gage

C.2 Methodology

Apply the load locator device to the front centre edge of the seat pan with a horizontal force of 40 N, see Figure C.7 a). Mark the force application point 60 mm horizontally from the point of contact. To identify the contact point, move a metal shim (or similar applicable device) without additional force between the load locator device and the seat pan until there is a resistance, see Figure C.7 b).

Dimensions in millimetres



a) Determining the load location for front stability test

b) Example of a soft surface with inner structure seat

Key

1 force application point
2 contact point
3 front load locator device
4 metal shim
F force (40 N)

Figure C.7 — Determination of the load location for front stability test

Annex D
(informative)

Purpose and applicability of test methods

In Tables D.1 to D.3, the purpose and applicability of test methods are described.

Table D.1 — Seating other than work chairs

Test no.	Test title	Purpose	Applicability
6.4	Seat and backrest static load test	Test to assess the strength of the seating structure when subjected to high loads to account for reasonably foreseeable misuse. This may occur when more than the intended number of users simultaneously use a single seat position in the chair/seating unit. It also assesses the connection between the seat and backrest (rearward) and the strength of the rear legs.	All seating
6.5	Seat front edge static load test	Test to assess the strength of a seating structure when subjected to high loads applied to the front edge of the seat to account for reasonable foreseeable misuse such as when two persons simultaneously use the same chair.	All seating
6.6	Vertical static load test on backrests	Test to assess the strength of a seating structure when subjected to high vertical load applied to the top edge of the backrest such as when a person sits on top of the backrest.	The test is only applicable for chairs with a height of the backrest that is or can be adjusted to < 950 mm above ground.
6.7	Horizontal forward static load test on backrests	Test to assess the strength of a seating structure when subjected to horizontal forces, applied from back to front such as when a person presses against the backrest with their hands or feet.	This test is only applicable to seating fixed to the floor, e.g. theatre seating, stadium seating, park benches.
6.8	Footrest static load test	Test to assess the strength of a footrest assembly and its supporting structure when subjected to very high loads such as when a person applies their full body weight to the footrest.	All seating with footrest.
6.9	Legrest static load test	Test to assess the strength of a legrest and its supporting structure when subjected to very high loads such as when a person applies their full body weight to the legrest, using it as a seat.	This test is only applicable to legrests designed to support the full weight of the user, such as those with additional support to the floor under the legrest.
6.10	Armrest sideways static load test	Test to assess the strength of armrests and the supporting structure when subjected to a high horizontal load such as when a person sits sideways on the seat, leaning back on one armrest, legs positioned on top of or against the opposite armrest (forces applying on both armrests).	All seating with armrests.

Table D.1 *(continued)*

Test no.	Test title	Purpose	Applicability
6.11	Armrest downward static load test	Test to assess the strength of armrests and the supporting structure to account for reasonable foreseeable misuse when subjected to a high vertical load such as when a person leans or sits on the armrest.	All seating with armrests.
6.12	Headrest static load test	Test to assess the strength of the headrest when subjected to a rearward horizontal force such as when a person leans their head on it.	All seating with headrest.
6.13.1	Vertical upward static load test on armrest – Seating which can be moved when occupied	Test to assess the strength of armrests when subjected to a high vertical upward load such as when a person lifts the seating unit by the armrests with a user sitting on it.	This test is only applicable to seating where the manufacturer specifically states that the seating unit is suitable for lifting an occupied seating unit by the armrests.
6.13.2	Vertical upward static load test on armrest – Stacking seating	Test to assess the strength of armrests when subjected to a high vertical upward load such as when a person lifts a stack of chairs by the armrests.	This test applies only to stacking seating units where the stack is moved by lifting by the armrests. Normally this test does not apply when the manufacturer supplies devices for moving the seating or when the information for use includes instructions for moving the stack of chairs without lifting by the armrests.
6.14	Vertical static load test on auxiliary writing surfaces	Test to assess the strength of auxiliary writing surfaces under a high vertical downward load such as when a person leans on an auxiliary writing surface or places a heavy object on it.	All seating with auxiliary writing surfaces.
6.15	Leg forward static load test	Test to assess the strength of front legs when subjected to horizontal back-to-front forces such as when seated person(s) leans and attempts to slide the chair forward.	All seating with legs.
6.16	Leg sideways static load test	Test to assess the strength of side legs when subjected to horizontal side to side forces such as when seated person(s) leans and attempts to slide the chair sideways.	All seating with legs.
6.17	Combined seat and backrest durability test	Test to assess the durability of a seating structure to repeated loading and unloading such as when a person sits down on the seat and then leans on the backrest.	All seating.
6.18	Seat front edge durability test	Test to assess the durability of a seating structure to repeated loading and unloading such as when a person sits down on the seat and then gets up or shifts their weight while sitting.	All seating
6.19	Durability test on outdoor seating with a multi-position backrest	Test to assess the durability of the seating structure when the backrest is subjected to repeated loading and unloading in an alternating sequence such as when a person shifts position against the backrest.	This test is applicable to seating with backrests that manually adjust to three or more discrete reclined positions (stops).

Table D.1 *(continued)*

Test no.	Test title	Purpose	Applicability
6.20	Armrest durability test	Test to assess the durability of the armrests to repeated loading and unloading when the user lowers into the seated position and rises from the seated position while using the armrests.	All seating with armrests.
6.21	Footrest durability test	Test to assess the durability of the footrest when subjected to repeated loading and unloading such as when the user steps on the footrest to enter and exit the seat.	All seating with a footrest.
6.22	Auxiliary writing surfaces durability test	Test to assess the durability of auxiliary writing surfaces when subjected to repeated vertical downward loading and unloading such as when a person uses the auxiliary writing surface as intended.	All seating with an auxiliary writing surface.
6.23	Tipping operation	Test to assess the durability of seat tip-up mechanisms when subjected to repeated opening and closing such as when a person moves the seat as intended through its range of motion.	All seating with a tip-up seat.
6.24	Seat impact test	Test to assess the strength of the seating structure such as when a user drops themselves into the seat.	All seating.
6.25	Backrest impact test	Test to assess the strength of the seating and backrest structure when the backrest is subjected to impacts such as when a chair tips and then drops onto its backrest or a person hits the backrest.	All seating with armrests.
6.26	Armrest impact test	Test to assess the strength of the seating and armrest structure when the armrest is subjected to impacts such as when a chair tips and drops onto its armrest or a person hits the armrest.	All seating with armrests.
6.27.1	Drop test – Multiple seat units	Test to assess the strength of the seat structure when subjected to impacts such as when a seating unit is dropped onto the floor.	This test is only applicable to multiple seating.
6.27.2	Drop test – Stacking seating	Test to assess the strength of the seat structure when subjected to impacts such as when a stack of chairs is dropped onto the floor.	This test is only applicable to stacking seating.
6.27.3	Drop test – from the height of a table	Test to assess the strength of the seat structure when subjected to impacts such as when a single chair is dropped onto the floor.	This test is only applicable to seating weighing less than 10 kg and intended to be placed at high level (e. g. on a table top during cleaning).
6.28	Backward fall test	Test to assess the strength of the seating and backrest structure when the backrest is subjected to impacts such as when a chair tips and then drops onto its backrest.	All chairs.
6.29	Castor and chair base durability test	Test to assess the durability of castors and chair bases when subjected to movement under load such as when a chair is moved while occupied by a user.	This test does not apply to chairs with castors which are braked when the chair is loaded.

Table D.1 *(continued)*

Test no.	Test title	Purpose	Applicability
6.30	Rolling resistance	Test to measure the resistance of the chair moving when the user impacts the chair while standing up causing the chair unintentionally to roll away. It is intended to prevent the user from falling down when trying to sit down again on the chair.	All chairs with castors except for seating with seat height higher than 600 mm.
6.31	Seat side-to-side durability test in D-G points for single column seating	Test to assess the durability of a seating structure due to repeated loading and unloading such as when a person sits down on the seat and then leans sideways.	All seating with seat supported on single column.

Table D.2 — Work chairs

Test no.	Test title	Purpose	Applicability
7.3	Combined seat and backrest static load test	Test to assess the strength of the seating structure when subjected to high loads to the seat and backrest to account for intense use and overloading of the chair.	Work chairs.
7.4	Seat front edge static load test	Test to assess the strength of the seating structure when subjected to high loads to a front corner of the seat to account for intense use and overloading of the chair.	Work chairs.
7.5	Armrest downward static load test – central	Test to assess the strength of armrests and the supporting structure to account for reasonable foreseeable misuse when subjected to a high vertical load such as when a person leans or sits on the armrest.	All work chairs with armrests.
7.6	Armrest downward static load test – front	Test to assess the strength of armrests and the supporting structure when subjected to a high vertical load such as when a person enters or exits the chair.	All work chairs with armrests.
7.7	Armrest sideways static load test	Test to assess the strength of armrests and the supporting structure when subjected to a high horizontal load such as when a person sits sideways on the seat, leaning back on one armrest or moving the loaded chair sideways by pulling on one armrest.	All work chairs with armrests.
7.8	Footrest static load test	Test to assess the strength of a footrest assembly and its supporting structure when subjected to high loads such as when a person applies their full body weight to the footrest.	All work chairs with footrest.
7.9	Seat and backrest durability test	Test to assess the durability of a seating structure due to repeated loading and unloading such as when a person sits down on the seat and then leans on the backrest.	All work chairs.
7.10	Armrest durability test	Test to assess the durability of the armrests due to repeated loading and unloading when the user lowers into the seated position and rises from the seated position while using the armrests.	All work chairs with armrests.
7.11	Swivel test	Test to assess the durability of the swivel mechanism due to a person rotating in the seating unit.	All work chairs that rotate.

Table D.2 *(continued)*

Test no.	Test title	Purpose	Applicability
7.12	Footrest durability test	Test to assess the durability of the footrest when subjected to repeated loading and unloading such as when the user steps on the footrest to enter and exit the seat.	All work chairs with a footrest.
7.13	Castor and chair base durability test	Test to assess the durability of castors and chair bases when subjected to movement under load such as when a chair is moved while occupied by a user.	All work chairs with castors, except work chairs with castors which are braked when the chair is loaded.
7.14	Rolling resistance test of the unloaded chair	Test to measure the resistance of the chair moving when the user impacts the chair while standing up causing the chair unintentionally to roll away. It is intended to prevent the user from falling down when trying to sit down again on the chair.	All work chairs with castors.

Table D.3 — Loungers

Test no.	Test title	Purpose	Applicability
8.2	Seat and backrest static load test	Test to assess the strength of the lounger structure when subjected to high loads to account for reasonably foreseeable misuse. This may occur when more than the intended number of users simultaneously use a single seat position in the lounger. It also assesses the connection between the seat and backrest (rearward) and the strength of the legs.	All loungers
8.3	Additional seat and legrest static load test	Test to assess the strength of the lounger structure when subjected to loads caused by two persons, one sitting in the normal seating position and one sitting in the legrest area.	All loungers.
8.4.1	Seat and backrest durability test	Test to assess the durability of a lounger structure due to repeated loading and unloading such as when a person sits down on the seat and then leans on the backrest.	All loungers.
8.4.2	Additional seat durability test	Test to assess the durability of a lounger structure to repeated alternating loading and unloading such as when a person enters and exits the lounger or shifts their weight from side to side.	All loungers.
8.5	Durability test on backrest mechanism	Test to assess the durability of the lounger structure when the backrest is subjected to repeated loading and unloading in an alternating sequence such as when a person shifts position against the backrest.	This test is applicable to loungers with backrests that manually adjust to three or more discrete reclined positions (stops).
8.6	Armrest downwards static load test	Test to assess the strength of armrests and the supporting structure to account for reasonable foreseeable misuse when subjected to a high vertical load such as when a person leans or sits on the armrest.	All loungers with armrests.
8.7	Armrest durability test	Test to assess the durability of the armrests to repeated loading and unloading when the user lowers into the resting position and rises from the resting position while using the armrests.	All loungers with armrests.

Table D.3 *(continued)*

Test no.	Test title	Purpose	Applicability
8.8	Impact test	Test to assess the strength of the lounger structure such as when a user drops themselves into the lounger, typically in the legrest area.	All loungers.
8.9	Lifting test for mobile loungers	Test to assess the durability of the lounger structure such as when lifting the foot end of an occupied lounger.	Mobile loungers that are designed to be moved whilst an occupant is seated.

Annex E
(informative)

Suggested loads and cycles

E.1 Principle

Loads and forces are suggested in this annex to ensure that the standards will be of use where no requirements document is available or to assist in the development of one.

The suggested loads and forces are intended to ensure that specifiers may gain experience in the use of this standard in a manner which will make it possible to compare the test results with those of other specifiers. For example, without any guidance, one specifier might choose to use a 250 N load. This would have no meaning to another specifier which had chosen to use a 100 N load.

The suggested loads and forces should be sufficient to cover the full range of domestic and contract applications.

The suggested loads and forces are provided to allow specifiers the freedom to carry out the tests in the manner they consider preferable.

E.2 Requirements

It is emphasized that the application of this International Standard is only useful if the requirements truly represent the service environment for which the furniture is intended. Requirements which are too severe or insufficiently severe render the results of the testing valueless.

The requirements should be determined by the specifier. However, the following is proposed:

The chair should be constructed to ensure that it does not create a risk of injury to the user of the chair under the following conditions:

— sitting on the seat, both centrally and off-centre;

— moving forward, backwards, and sideways while sitting in the chair;

— leaning over the arm rests;

— pressing down on the arm rests while getting up from the chair.

These safety, strength and durability requirements are fulfilled when during and after testing in accordance with Table E.1, Table E.2 and Table E.3:

a) there are no fractures of any member, joint or component;

b) there are no loosening of joints intended to be rigid;

c) no major structural element is significantly deformed;

d) the chair fulfils its functions after removal of the test loads.

Suggested loads and cycles are given in Table E.1, Table E.2 and Table E.3.

Table E.1 — Suggested loads and cycles for seating other than work chairs

Test		Reference	Loading [a]	Level		
				L0	L1	L2
1	Seat static load and backrest static load test	ISO 7173, 6.4	Seat: load, N	1 300	1 600	2 000
			Back: load, N	450	560 (min force, 410)	700 (min. force, 410)
			Cycles	10	10	10
2	Seat front edge static load test	ISO 7173, 6.5	Force, N	1 300	1 300	1 600
			Cycles	10	10	10
3	Vertical load on backrests [b]	ISO 7173 6.6	Force, N	-	600	900
			Seat load, N	-	1 300	1 800
			Cycles	-	10	10
4	Horizontal forward static load test on backrests	ISO 7173, 6.7	Force, N	-	-	760
			Cycles	-	-	10
5	Footrest static load test	ISO 7173, 6.8	Force, N	1 000	1 300	1 600
			Cycles	10	10	10
6	Legrest static load test	ISO 7173, 6.9	Force, N	1 000	1 300	1 600
			Cycles	10	10	10
7	Armrest sideways static load test	ISO 7173, 6.10	Force, N	300	400	900
			Cycles	10	10	10
8	Armrest downwards static load test	ISO 7173, 6.11	Force, N	700	750	900
			Cycles	5	5	5
9	Headrest static load test	ISO 7173, 6.12	Force, N	-	-	100
			Cycles	-	-	10
10	Vertical upwards static load test on armrests – seating which can be moved when occupied	ISO 7173, 6.13.1	Seat load, N	-	1 100	1 300
			Cycles	-	10	10
10	Vertical upwards static load test on armrests – stacking seating	ISO 7173, 6.13.2	Seat load, N	-	1 100	1 300
			Cycles	-	10	10
11	Combined seat and backrest durability test	ISO 7173, 6.17	Seat force, N	1 000	1 000	1 000
			Back force N[c]	300	300	300
			Cycles	25 000	100 000	200 000
12	Seat front edge durability test	ISO 7173, 6.18	Force, N	800	800	800
			Cycles	20 000	50 000	100 000
13	Durability test on outdoor seating with a multi-position backrest	ISO 7173, 6.19	Seat load, N	750	750	750
			Force, N	190	250	250
			Cycles	5 000	10 000	20 000

[a] Seat load on parts not undergoing test: 750 N.

[b] The test is only applicable for chairs without head/neck rest and for chairs with a height of the backrest < 1 000 mm above ground.

[c] No minimum force defined.

[d] This test is only for single seating units where the backrest will be the first part of the structure to strike the floor and the force used to overturn the chair rearwards is less than 30 N.

Table E.1 *(continued)*

Test		Reference	Loading [a]	Level		
				L0	L1	L2
14	Armrest durability test	ISO 7173, 6.20	Force,	400	400	400
			Cycles	10 000	30 000	60 000
15	Footrest durability test	ISO 7173, 6.21	Force, N	-	1 000	1 000
			Cycles	-	50 000	100 000
16	Leg forward static load test	ISO 7173, 6.15	Force, N	400	500	620
			Seat load, N	1 000	1 000	1 800
			Cycles	10	10	10
17	Leg sideways static load test	ISO 7173, 6.16	Force, N	300	400	760
			Seat load, N	1 000	1 000	1 800
			Cycles	10	10	10
18	Seat impact test	ISO 7173, 6.24	Drop height, mm	180	240	300
			Cycles	10 times	10 times	10 times
19	Backrest impact test	ISO 7173, 6.25	Height of fall, mm / angle,°	120/28	210/38	330/48
			Cycles	10	10	10
20	Backward fall test[d]	ISO 7173, 6.28	No. of impacts	5	5	5
21	Armrest impact test	ISO 7173, 6.26	Height of fall, mm / angle,°		210/38	330/48
			Cycles	-	10	10
22	Drop tests - multiple seating	ISO 7173, 6.27	Drop height, mm	-	-	450
			Cycles	-	-	2 x 5 times
23	Drop test for stacking seating	ISO 7173, 6.27.1	Drop height, mm	-	150	200
			Cycles	-	10	10
24	Drop test from the height of a table	ISO 7173, 6.27.2	Drop height, mm	-	600	600
			Cycles	-	5 times 1 front leg, 5 times 1 rear leg	5 times 1 front leg, 5 times 1 rear leg
25	Castor and chair base durability test for chairs with castors on all legs	ISO 7173, 6.29.1	Seat load, N	-	-	1 100
			Cycles	-	-	100 000
26	Castor and chair base durability test for chairs with castor and glide combinations	ISO 7173, 6.29.2	Seat load, N	-	-	1 100
			Cycles	-	-	100 000
27	Rolling resistance test of the unloaded chair	ISO 7173, 6.30	Maximum force, N	12	12	12
28	Auxiliary writing surface static load test	ISO 7173, 6.14	Force, N	-	300	300
			Cycles	-	10	10

[a] Seat load on parts not undergoing test: 750 N.

[b] The test is only applicable for chairs without head/neck rest and for chairs with a height of the backrest < 1 000 mm above ground.

[c] No minimum force defined.

[d] This test is only for single seating units where the backrest will be the first part of the structure to strike the floor and the force used to overturn the chair rearwards is less than 30 N.

Table E.1 *(continued)*

Test		Reference	Loading [a]	Level		
				L0	L1	L2
29	Auxiliary writing surface durability test	ISO 7173, 6.22	Force, N	-	150	150
			Cycles	-	10 000	20 000
30	Tipping seat operation test	ISO 7173, 6.23	Cycles	25 000	50 000	100 000
31	Seat side-to-side durability test in D-G points for single column seating	ISO 7173, 6.31	Force, N	1 100	1 100	1 100
			Cycles	20 000	20 000	20 000

[a] Seat load on parts not undergoing test: 750 N.

[b] The test is only applicable for chairs without head/neck rest and for chairs with a height of the backrest < 1 000 mm above ground.

[c] No minimum force defined.

[d] This test is only for single seating units where the backrest will be the first part of the structure to strike the floor and the force used to overturn the chair rearwards is less than 30 N.

Table E.2 — Suggested loads and cycles for work chairs

Test		Reference	Loading	Level	
				L0	L1
1	Combined seat and backrest static load test	ISO 7173, 7.3	Seat: force, N	1 300	1 600
			Back: force, N	450	560 (min force, 410)
			Cycles	10	10
2	Seat front edge static load test	ISO 7173, 7.4	Force, N	1 300	1 600
			Cycles	10	10
3	Armrest downward static load test – central	ISO 7173, 7.5	Force, N	600	900
			Cycles	5	5
4	Armrest downward static load test – front	ISO 7173, 7.6	Force, N	450	450
			Cycles	5	5
5	Armrest sideways static load test	ISO 7173, 7.7	Force, N	400	400
			Cycles	0	10
6	Footrest static load test	ISO 7173, 7.8	Force, N	1 100	1 300
			Cycles	10	10

Table E.2 *(continued)*

Test		Reference	Loading	Level	
				L0	L1
7	Seat and backrest durability test	ISO 7173, 7.9			
	Step 1, A		Force Point A, N	1 500	1 500
			Cycles	120 000	120 000
	Step 2, B - C		Force Point B, N	320	320
			Force Point C, N	1 200	1 200
			Cycles	80 000	80 000
	Step 3, J - E		Force Point E, N	320	320
			Force Point J, N	1 200	1 200
			Cycles	20 000	20 000
	Step 4, F - H		Force Point H, N	320	320
			Force Point F, N	1 200	1 200
			Cycles	20 000	20 000
	Step 5, D – G (alternating)		Force Point D, N	1 100	1 100
			Force Point G, N	1 100	1 100
			Cycles	20 000	20 000
8	Armrest durability test	ISO 7173, 7.10	Force, N:	400	400
			Cycles	60 000	60 000
9	Swivel test	ISO 7173, 7.11	Weight M_1, kg	60	60
			Weight M_2, kg	35	35
			Cycles	120 000	120 000
10	Footrest durability test	ISO 7173, 7.12	Force, N	900	900
			Cycles	50 000	50 000
11	Castor and chair base durability test	ISO 7173, 7.13	Seat load, N	1 100	1 100
			Cycles	100 000	100 000
12	Rolling resistance test of the unloaded chair	ISO 7173, 6.16	Maximum force, N	12	12

Table E.3 — Suggested loads and cycles for loungers

Test		Reference	Loading [a]	Level		
				L0	L1	L2
1	Seat and backrest static load test [a]	ISO 7173, 8.2	Seat: load, N	1 100	1 600	2 000
			Back: load, N	-	410 (min force, 360)	560 (min. force, 500)
			Cycles	10	10	10
			Additional cycles (30 min ± 10 s)	1	1	1
2	Additional seat and leg rest static load	ISO 7173, 8.3	Seat load, N	750	750	750
			Load at D&E points, N	600	900	900
			Cycles	10	10	10

[a] If the seat and backrest are of one piece of flexible material (e.g. textile), only the tests on the seat shall be carried out.

[b] If the arrest is less than 15 mm wide, reduce the load to 700 N.

Table E.3 *(continued)*

Test		Reference	Loading [a]	Level		
				L0	L1	L2
3	Seat and backrest durability test	ISO 7173, 8.4.1	Seat load, N	750	1 000	1 000
			Back load, N	250	333 (min. force, 300)	333 (min. force, 300)
			Cycles	12 500	25 000	50 000
4	Additional seat durability test	ISO 7173, 8.4.2	Seat load, N	750	1 000	1 000
			Cycles	5 000	10 0000	20 000
5	Durability test on backrest mechanism	ISO 7173, 8.5	Backrest load, N	190	250	250
			Seat load, N	1 000	1 000	1 000
			Cycles	5 000	10 000	20 000
6	Armrest downwards static load test	ISO 7173, 8.6	Arm load, N	-	700	900[b]
			Cycles	-	10	10
7	Armrest durability test	ISO 7173, 8.7	Seat load, N	400	400	400
			Cycles	5 000	10 000	30 000
8	Impact test	ISO 7173, 8.8	Drop height, mm	140	180	240
			Cycles	10	10	10
9	Lifting test for mobile loungers	ISO 7173, 8.9	Seat load, N	1 000	1 000	1 000
			Cycles	500	1 000	2 000

[a] If the seat and backrest are of one piece of flexible material (e.g. textile), only the tests on the seat shall be carried out.

[b] If the arrest is less than 15 mm wide, reduce the load to 700 N.

Bibliography

[1] ISO 24496:2021, *Office furniture — Office chairs — Methods for the determination of dimensions*