BRITISH STANDARD

BS EN
1022:2005

Domestic furniture — Seating — Determination of stability

The European Standard EN 1022:2005 has the status of a British Standard

ICS 97.140

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National foreword

This British Standard is the official English language version of EN 1022:2005. It supersedes BS EN 1022:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FW/0, Furniture, which has the responsibility to:

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Summary of pages

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Domestic furniture - Seating - Determination of stability

Mobilier domestique - Sièges - Détermination de la stabilité

Wohnmöbel - Sitzmöbel - Bestimmung der Standsicherheit

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This European Standard (EN 1022:2005) has been prepared by Technical Committee CEN/TC 207 “Furniture”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2005, and conflicting national standards shall be withdrawn at the latest by December 2005.

This document supersedes EN 1022:1996.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard specifies test methods and requirements for the determination of the stability of all types of domestic seating for adults.

The European Standard does not apply to adjustable geometry seating where the backrest is at an angle of 10º or less to the horizontal.

Stability can be determined by either the experimental or the calculative method. Both methods are based on the same forces and points of application.

The calculative method does not apply to seating, which have variable geometry and to seating, which visibly flex under the applied loads.

If the result of the calculative method is uncertain or marginal the result shall be checked, if possible, by the experimental method.

2 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply:

2.1
stability
ability to withstand forces that tend to cause the loaded seating to overturn

2.2
load bearing structure
any part of a chair, which as its primary function supports a portion of the loads exerted by the sitter, e.g. the seat frame but not the upholstery

2.3
footrest
part of the structure of a chair intended to support the feet of the sitter

3 General test conditions

3.1 General

No prior conditioning is required.

The furniture shall be tested as delivered. The tests shall be carried out in the configuration most likely to cause overturning.

Knock-down furniture shall be assembled according to the instructions supplied with it. If the furniture can be assembled or combined in different ways, the most adverse configuration shall be used for each test. Knock-down fittings shall be tightened before testing.

Stools shall be tested for forwards overturning in all directions. The other stability tests are not applicable.

The test results are only valid for the tested seating. When the test results are intended to be applied to production models, the tested seating shall be representative of the production model.

In the case of designs not catered for in the test procedures, the tests shall be carried out as far as possible as described and deviations from the test procedure recorded in the test report.

3.2 Tolerances

Unless otherwise stated:

— all forces shall have an accuracy of ± 5 % of the nominal force.

— all masses an accuracy of ± 0,5 % of the nominal mass.

— all dimensions an accuracy of ± 1 mm of the nominal dimension.

— all angles an accuracy of ± 2° the nominal angle.

The tolerance for positioning of loading pads shall be ± 5 mm.

The tests are described in terms of the application of forces. Masses can however be used. The relationship 10 N = 1 kg may be used for this purpose.

4 Test equipment

4.1 General

Except otherwise specified, the tests may be applied by any suitable device, because results are dependent on correctly applied loads and not upon the apparatus.

The test equipment shall not hinder any deformation of the seating being tested.

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

4.2 Loading pad

Rigid circular object 200 mm in diameter with a face having a convex spherical curvature of 300 mm radius with a 12 mm edge radius. The loading pad shall be mounted on a device, which can apply a vertical force as specified.

4.3 Horizontal force application device

A device, which can apply a force either at a given value or at a gradually increasing value, e.g. a spring balance.

4.4 Loading discs

Discs with a mass of 10 kg each, diameter 350 mm and a thickness of 48 mm.

4.5 Support apparatus

An apparatus to support the main stack of the loading discs in reclining chair tests. It shall be as light as possible and not heavier than 2,5 kg. Figure 1 shows a basic design.

Dimensions in millimetres

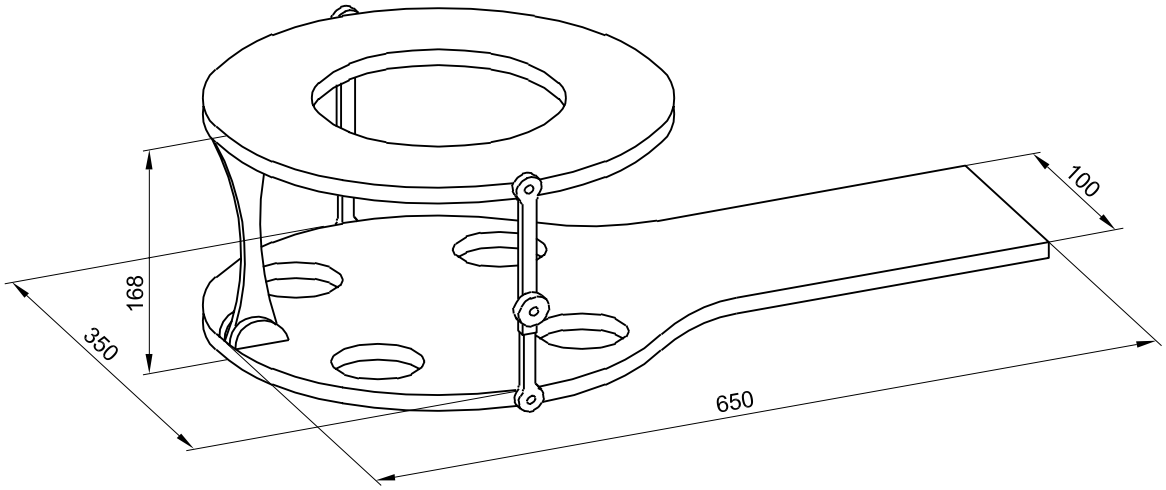


Figure 1 — Support apparatus

4.6 Loading point template

A template, which consists of two shaped members fastened together by a pivot at one end (Figures 2 and 3). The contours of the shaped surfaces are so devised as to sink into the upholstery. For this purpose the seat loading arm shall have a mass of 20 kg applied at the seat loading point.

The apparatus is marked as shown in Figure 3.

4.7 Stops

Stops shall be of the minimum height required to prevent sliding and shall not inhibit overturning.

4.8 Floor surface

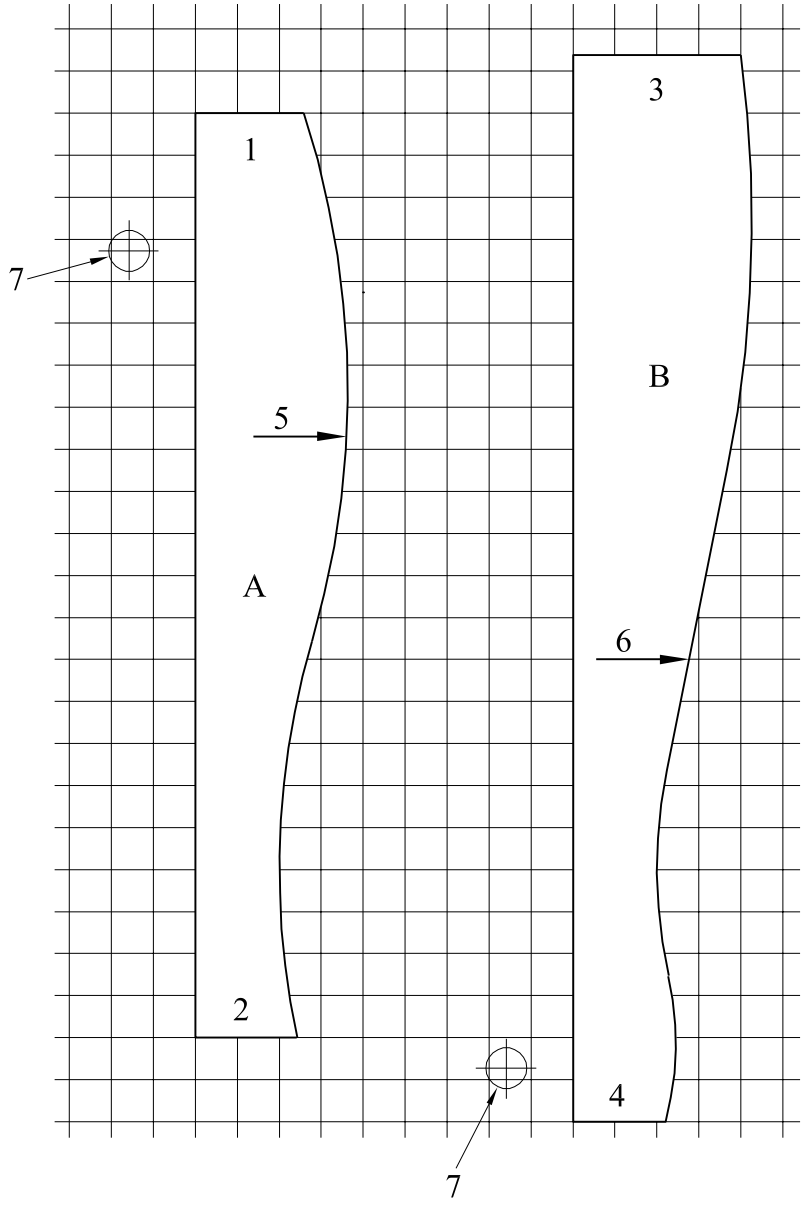
Horizontal, flat, rigid and with a smooth surface.

5 Determination of seat and back loading points

The seat and back loading points shall be determined using the loading point template (4.6) as specified below. In some cases it may not be possible to determine the loading points by means of the loading point template. In such cases, the loading points of 175 mm forward of the seat/back junction and 300 mm upward from the seat/back junction shall be used.

Position the loading point template (4.6) on the fore and aft centreline as far towards the rear as possible with its load applied at the seat loading point.

Scale: 1 square = 20 mm

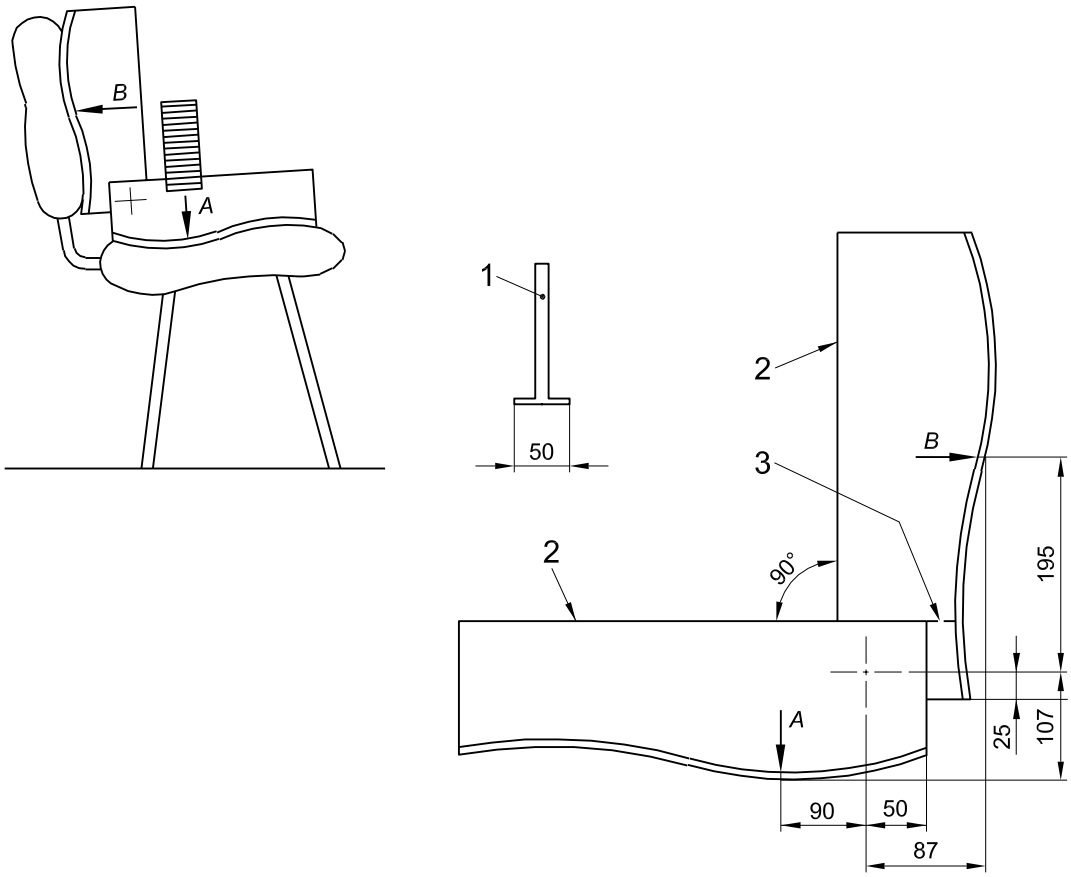


Key

1 Rear
2 Front
3 Top
4 Bottom
5 Seat loading point
6 Back loading point
7 Pivot point
A Seat portion
B Back portion

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

Dimensions in millimetres



Key

1 Typical section
2 Straight edge for determination of seat or back inclination
3 Mark to fix 90°
A Seat loading point (chairs)
B Back loading point (chairs)

Figure 3 — Loading point template

Adjust its position by pushing the back portion into the back, so levering the seat portion forwards until the shape of the loading point template correlates with that of the seat. In cases where the loading point template can be settled in more than one position, the position having the smallest angle between the seat and back portions of the loading point template shall be used.

The angle shall in no cases be less than 90°.

Mark the loading points from the loading point template.

When a seating has more than one sitting place, repeat the procedures on the other sitting places. If the number of sitting places in the seating is not obvious, divide the total seat length (in millimetres) by 600 and round to the nearest whole number to determine the number of places. Divide the total seat length into that number of places of equal length.

6 Test procedure and requirements, all seating: experimental method

6.1 Requirements

When tested according to Clause 6, the seating shall not overturn.

6.2 Forwards overbalancing, all seating

Position the seating on the floor surface (4.8) with the front legs or base restrained by stops (4.7).

Apply a force of 600 N vertically (for multiple sitting places to a maximum of 2 places) by means of the loading pad (4.2) acting at those points 60 mm behind the front edge of the load bearing structure most likely to result in overturning.

At each loaded position apply a force *F* of 20 N for at least 5 s horizontally outwards along a horizontal line extended forward from the point where the base of the loading pad meets the upper surface of the seat (Figure 4).

For calculative method see Clause 8.

6.3 Forwards overturning for seating with footrest

For seating with footrests repeat the procedure in 6.2 applying the vertical and horizontal loads to the footrests. For footrests of tubular construction the loads shall be applied along the centre line of the tube.

6.4 Sideways overbalancing, all seating without arms

Position the seating on the floor surface (4.8) with the side legs or base restrained by stops (4.7).

Apply a force of 600 N vertically by means of the loading pad at those points 60 mm behind the edge of the load bearing structure of the side nearest the stopped feet most likely to result in overturning.

Apply a sideways force *F* of 20 N horizontally outwards for at least 5 s along a line from the point where the base of the loading pad meets the upper surface of the seat (Figure 5).

For calculative method see Clause 8.

6.5 Sideways overbalancing, all seating with arms

Position the seating on the floor surface (4.8) with the side legs or base restrained by stops (4.7).

Apply a vertical force *F* of 350 N by means of the loading pad (4.2) at a position on the centre line of the arm up to a maximum 40 mm inwards from the outer edge of the arm structure at the most adverse position along its length.

Apply a vertical force of 250 N at a point 100 mm to the side of the fore and aft centre line of the seat (Figure 6) which is nearest the stopped feet and at the same distance from the backrest as the arm loads.

Apply a horizontal force *F* of 20 N outwards, and perpendicular to the line joining the stopped feet, for at least 5 s, at the upper surface of the armrest in line with the vertical arm force and on the side with stopped feet (Figure 6).

For calculative method see Clause 8.

6.6 Rearwards overbalancing, all seating with backs

This sub-clause only applies to seating with backs extending 50 mm or more above the unloaded seat.

Position the seating on the floor surface (4.8) with the rear legs or base restrained by stops (4.7).

All adjustable backs shall be set in their most upright position.

Apply a vertical force of 600 N to the seat by means of the loading pad (4.2) at the seat loading point *(A)* determined by the loading point template.

Determine the distance *(H)* in millimetres between the loaded seat and the floor. For seating having a value of H ≥ 720mm use a force F of 80 N.

For seating having a value of *H* < 720 mm calculate the force *F*, in newtons, required from the following formula:

$F = 0{,}2857\ (1000\text{-}H)$

where:

H is in millimetres

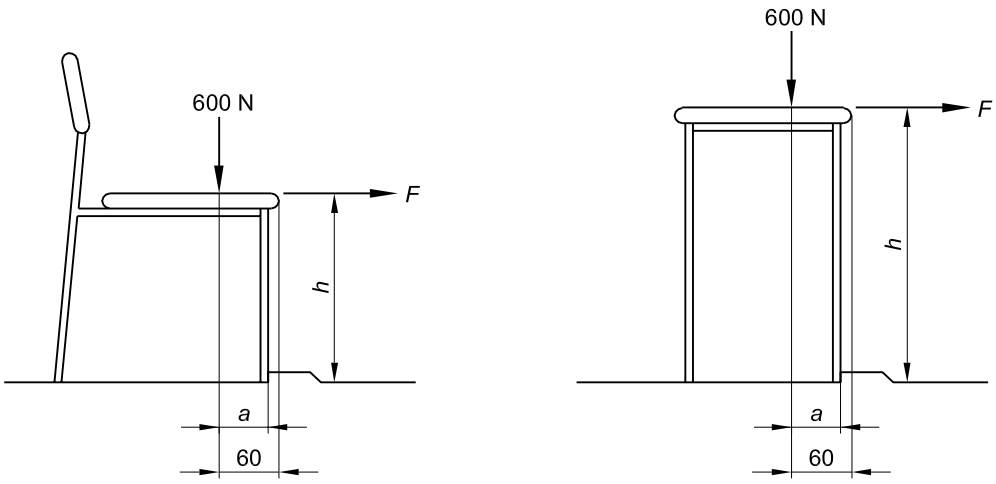
F is in newtons.

Apply the force *F* horizontally for at least 5 s in a rearward direction to the back of the seating at the point (B) determined by the loading point template, or at the top edge of the back rest, whichever is the lower (Figure 7).

When the seating has more than one sitting place, carry out the procedure on two most adverse sitting places simultaneously.

For calculative method see Clause 8.

Dimensions in millimetres



Key

a The minimum horizontal distance from the overturning axis to the vertical projection of the seat loading point (see also Figures 6, 7 and 8)

Figure 4 — Forwards overturning for chairs and stools

Dimensions in millimetres

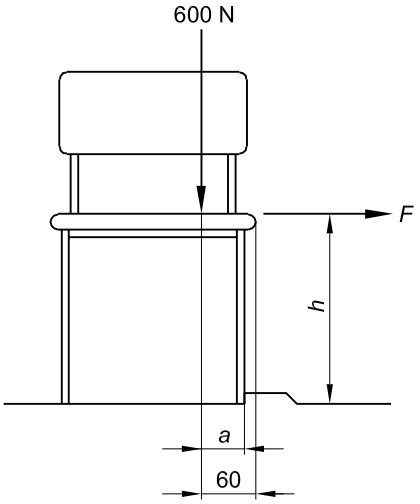
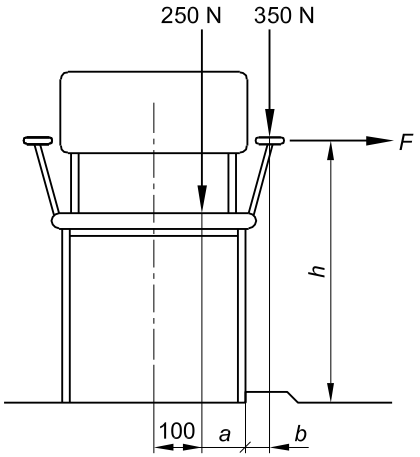


Figure 5 — Sideways overturning for chairs without arms

Dimensions in millimetres



Key

b The minimum horizontal distance form the overturning axis to the vertical projection of the loading point

Figure 6 — Sideways overturning for chairs with arms

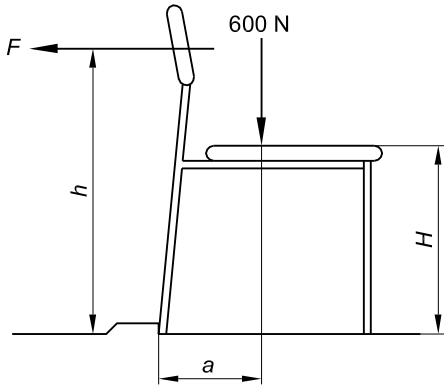


Figure 7 — Rearwards overbalancing

7 Test procedures and requirements for seating with variable geometry: experimental method

7.1 Requirements

When tested according to Clause 7, the seating shall not overturn.

7.2 General

There is no calculative method for seating with variable geometry.

In addition to the tests in Clause 6 or calculations in Clause 8, seating with variable geometry shall be subjected to the tests for tilting, rocking or reclining, as specified below provided their geometry falls within the limiting configurations for the appropriate tests.

Seating with backrests permanently reclined which fall within the limiting configurations shall be tested as reclining chairs.

The test shall be carried out with the seating in the fully tilted or reclined condition.

γ is the angle between the seat and back;

θ is the angle of inclination of the back from the horizontal (Figures 8 a), 10a and 12a.

For seating with shaped or padded seats or backs the seat-loading template shall be used to establish the relevant angles of inclination.

If the height of the stack of loading discs used in tests 7.2, 7.3, 7.4 and 7.7 exceeds the height of the backrest, prevent the upper discs from sliding off by the use of a light support, e.g. a piece of cardboard (Figure 8b).

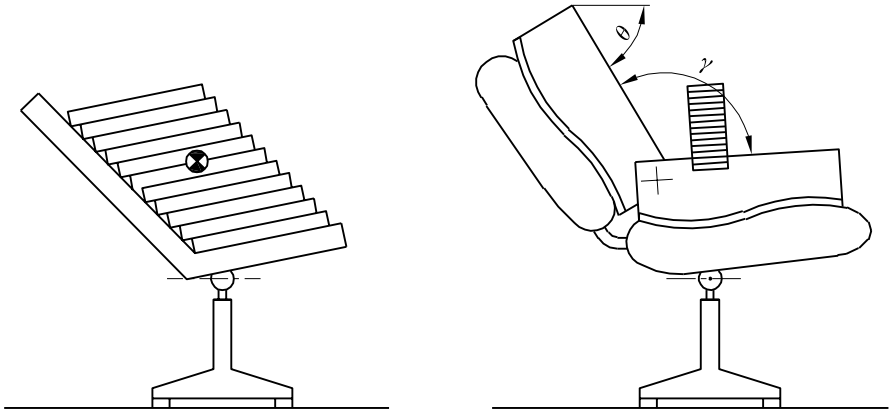
When testing rocking chairs, it may be necessary to restrain the loading discs with lightweight strapping, e.g. tape, string or webbing.

7.3 Tilting chairs

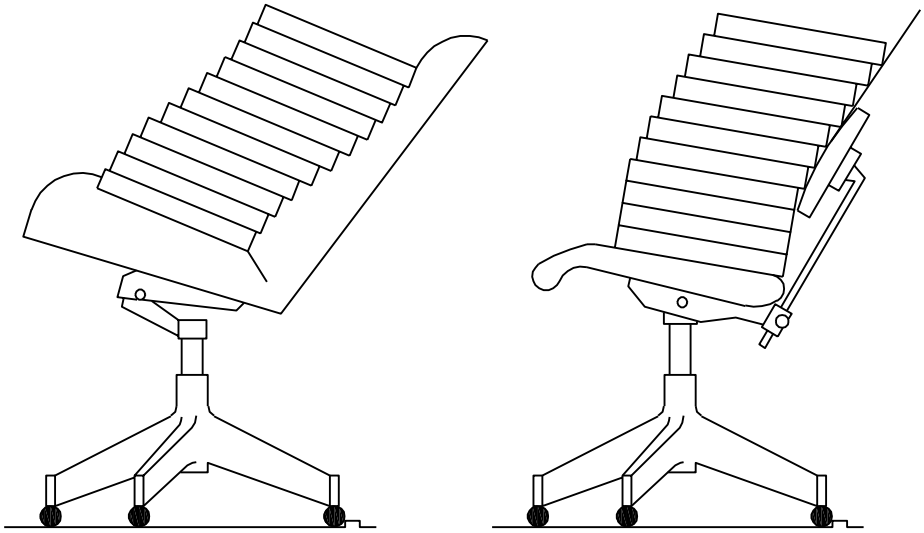
The test method applies to all values of $\theta \geq 10$ and values of γ between 90° and 170°.

If the seating has a locking system it shall be set in the fully tilted position.

Load the seat with 11 loading discs (4.4) so that the discs are firmly settled against the back rest, as shown in Figures 8a and 8b.



a)



b)

Key

a) Test for tilting chairs
b) Practical example of test method

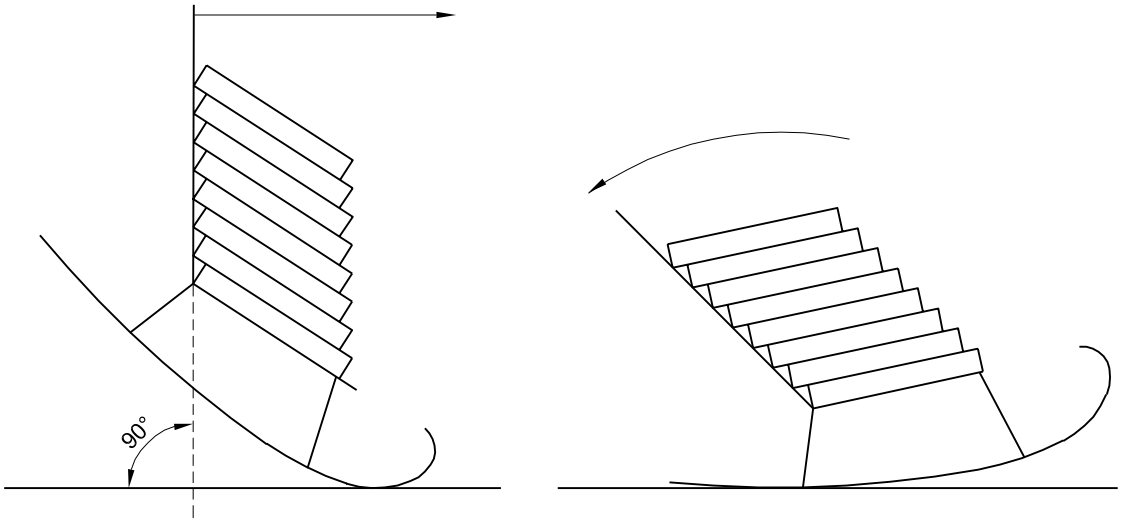
Figure 8 — Test for tilting chairs with practical example

7.4 Rocking chairs

The most adverse floor surfacing shall be used, e.g. smooth and shiny or carpet or rubber.

Load the chair with eight loading discs (4.4) so that the discs rest against the chair back.

Rock the chair forwards as far as is practicable or until the back is vertical (Figure 9a). Allow the chair to rock rearwards freely under gravity (Figure 9b).



Key

a) Method for rocking chairs: rock forwards
b) Method for rocking chairs: rock freely forwards

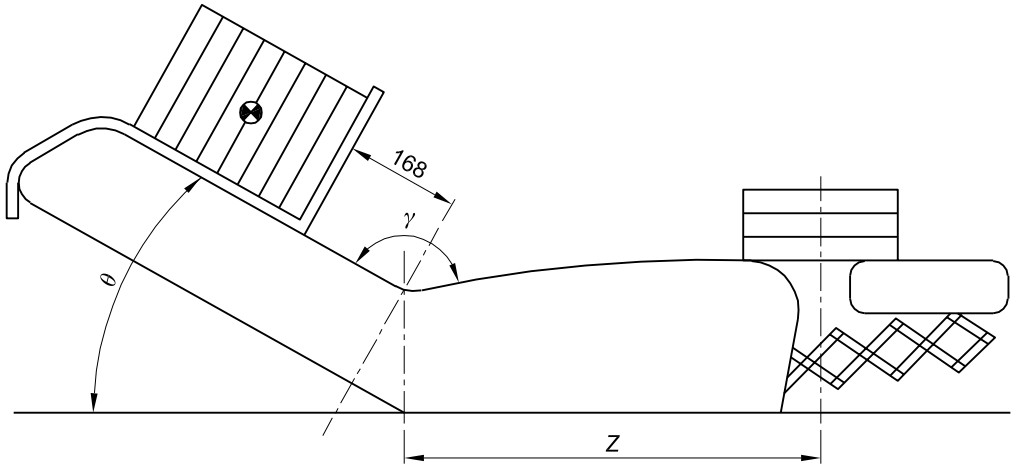
Figure 9 — Method for rocking chairs

7.5 Reclining chairs with footrest

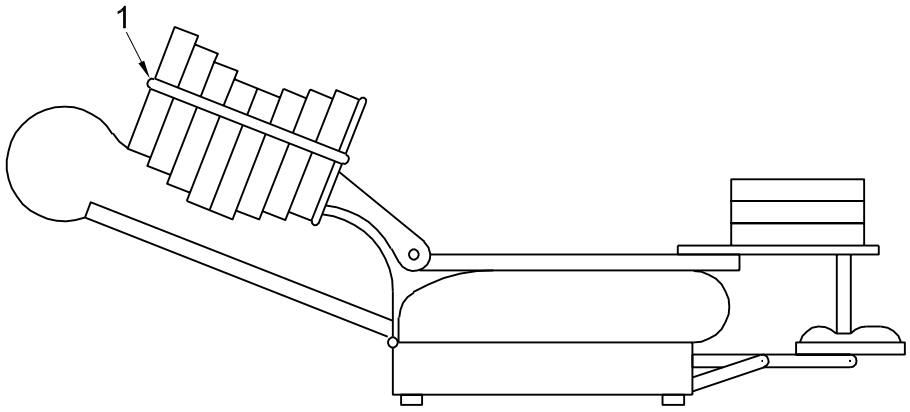
The test method applies to all values of $\theta \geq 10$ and less than 55° and values of γ between 90° and 170°.

With the chair in the fully reclined configuration, load the back of the chair with eight loading discs (4.4) by means of the support device (4.5) and place three loading discs onto the footrest (Figures 10a and 10b) at a distance Z from the intersection of the seat and back (Figure 11).

Dimensions in millimetres



a)



b)

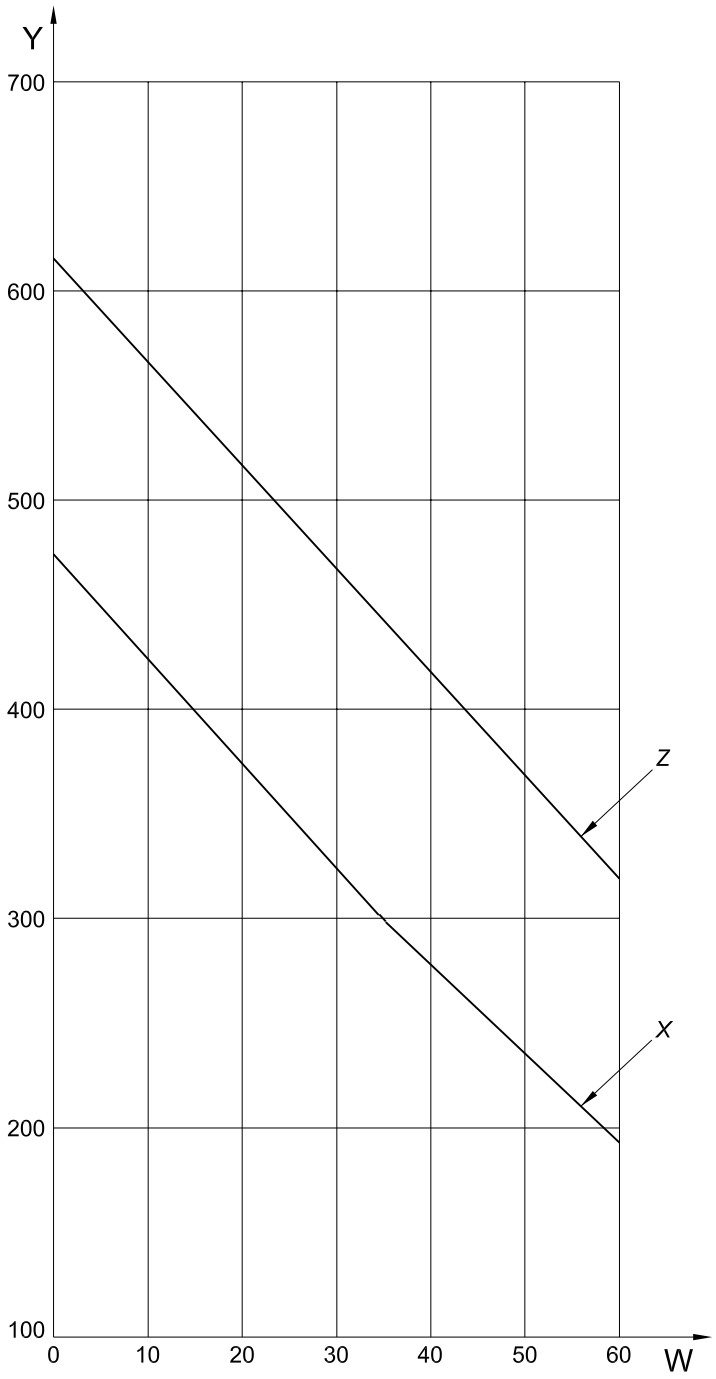
Key

1 Elastic cord
a) Test for reclining chairs with footrest
b) Practical example of test method: reclining chairs with footrest

Figure 10 — Test for reclining chairs with footrest with practical example

Table 1 — Values of X and Z

θ (degrees)	***X* (mm)**	***Z* (mm)**
0	474	614
10	424	564
20	375	515
30	325	464
45	252	392
60	194	314



Key

Y Values of Z and X in millimetres
W θ in degrees

Figure 11 — Values of Z and X (mm)

7.6 Footrest test

In some cases the forward stability test (6.2) cannot be carried out on a reclining chair because the footrest folds up. In this case, the forward stability test (6.2) shall be applied with the footrest in the folded condition only.

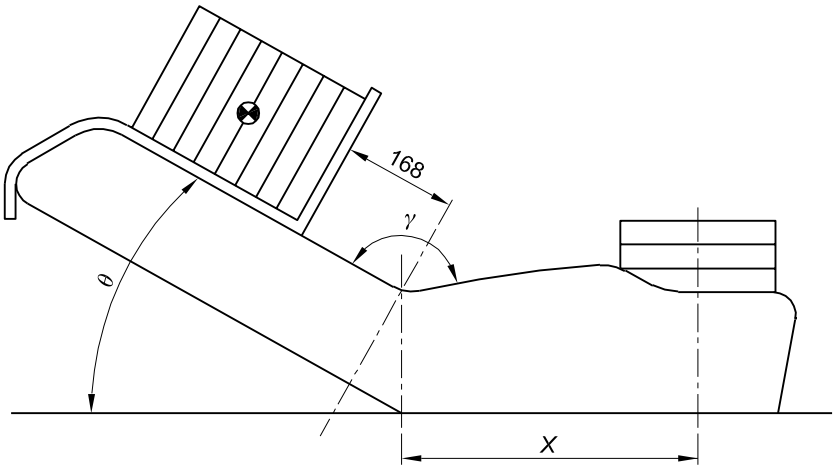
However, in those cases where the footrest does not fold as the sitter's weight is moved towards the footrest (e.g. lever operated chairs) the forward stability test (6.2) shall be applied to the footrest in its fully extended position.

7.7 Reclining chairs without footrest

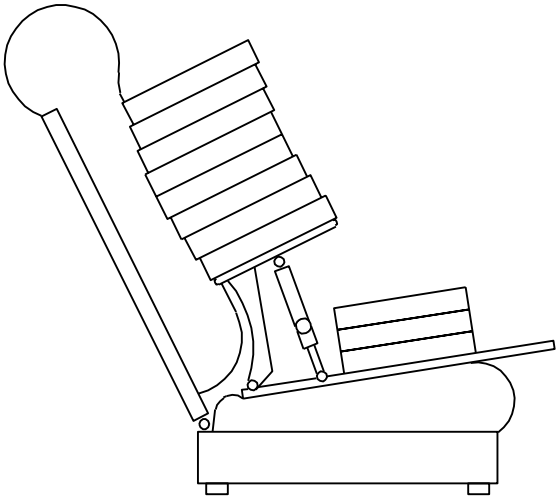
The test method applies to all values of θ ≥ 10 and less than 45° and values of y between 90° and 170°

Load the back of the chair with eight loading discs (4.4) by means of the support device (4.5) and place three loading discs onto the front of the seat of the chair (Figures 12a and 12b) at a distance X from the intersection of the seat and back (Figure11).

Dimensions in millimetres



a)



b)

Key

a) Test for reclining chairs without footrest
b) Practical example of test method: reclining chairs without footrest

Figure 12 — Reclining chairs without footrest with practical example

8 Calculative method

8.1 General

Forwards, rearwards and sideways stability for seating with fixed geometry can be determined by the calculative method specified in this clause.

In the calculative method, the resistance against overbalancing, caused by vertical and horizontal forces, is taken into consideration based on the moments about the restrained supporting points.

For this calculation the dimensions *a, b, H* and *h* shall be measured under the loads specified in Clause 6, where:

— *a* is the minimum horizontal dimension from the overturning axis to the vertical projection of the seat loading point (Figures 4, 5, 6 and 7);

— *b* is the minimum horizontal dimension from the overturning axis to the vertical projection of the arm loading point (Figure 6);

— *h* is the vertical dimension from the point of application of the horizontal force to the test floor (Figures 4, 5, 6 and 7);

— *H* is the loaded seat height (Figure 7).

First determine the loading points as described in 6.2, 6.4, 6.5 and 6.6 and measure the dimensions *a, b, H* and *h.*

NOTE The overturning axis does not always pass through the outer edge of the feet. The overturning axis can be some distance inside the edge of the feet e.g. when the legs are chamfered or rounded at the bottom.

A simple method of finding the point of contact between the leg and the floor is to push a piece of paper under the leg.

Position the unloaded chair with the stops against the two relevant supporting points. Apply a gradually increasing horizontal force F_0 acting to tilt the chair over the two restrained supporting points in accordance with *F* as shown in Figures 4,5, 6, and 7.

Record the value F_0 when the seating overturns.

Calculate the force F_c required to overturn the seating had it been loaded with the test loads.

8.2 Forwards and sideways overbalancing for chairs without arm rest

Calculate the force F_c required to overturn the chair from the formula:

$F_c = F_o + 600\ a/h$

F_c shall be ≥ 20 N.

8.3 Sideways overbalancing for chairs with arm rest

Calculate the force F_c required to overturn the chair from the formula:

$$F_c = F_o + 1/h\,(250\mathrm{a} - 350\mathrm{b})$$

F_c shall be ≥ 20 N.

8.4 Stools, all directions

Determine the stability of stools in all directions in the manner described in 8.2.

F_c shall be ≥ 20 N.

8.5 Rearwards overbalancing

Calculate the force F_c required to overturn the chair from the formula:

$F_c = F_o + 600\ a/h$

F_c shall be 80 N when $H \geq 720$ mm

F_c shall be ≥ 0,2857 (1000 -*H)* when $H < 720$ mm.

9 Test report

The test report shall include at least the following information:

a) reference to this document;

b) piece of furniture tested (relevant data);

c) test results, stable or unstable;

d) details of any deviations from this standard;

e) name and address of the test laboratory;

f) date of test.

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