BS 5459-2:2000
Incorporating Amendment No. 1

Specification for performance requirements and tests for office furniture —

Part 2: Office pedestal seating for use by persons weighing up to 150 kg and for use up to 24 hours a day, including type-approval tests for individual components

ICS 97.140

British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee FW/3, Office furniture, upon which the following bodies were represented:

British Coatings Federation Ltd.
British Contract Furnishing Association
British Educational Suppliers' Association
British Measurement and Testing Association
British Office Systems and Stationery Federation
British Telecommunications plc
Castor Manufacturers' (UK) Association
Department of Social Security (Benefits Agency)
Federation of the Electronics Industry
Furniture Industry Research Association
SATRA Technology Centre
Co-opted member

This British Standard, having been prepared under the direction of the Consumer Products and Services Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 November 2000

First published April 1977
Second edition July 1990
Third edition November 2000

The following BSI references relate to the work on this standard:
Committee reference FW/3
Draft for comment 00/705081 DC

ISBN 0 580 33232 2

Amendments issued since publication

Amd. No.	Date	Comments
16218	February 2006	See foreword

Contents

Foreword

This part of BS 5459 has been prepared by Technical Committee FW/3. Together with BS EN 1335-2 and BS EN 1335-3, it supersedes BS 5459-2:1990, which is withdrawn. Its purpose is to cater for office pedestal seating which is designed for a more severe range of use than that covered by BS EN 1335-2. Office seating for use for up to 8 hours a day by persons weighing up to 110 kg, which was previously included in BS 5459-2:1990, is now covered by BS EN 1335-2 and BS EN 1335-3.

[A1) The start and finish of text introduced or altered by Amendment No. 1 is indicated in the text by tag. (A1]

This part of BS 5459 is mainly concerned with the specification of performance requirements for the structural safety of office seating when used by persons weighing more than 110 kg, or when used for more than 8 hours a day.

This part of BS 5459 seeks to ensure that the seating will not become a danger or cause injury to users when it is used as office seating in a manner which is forseeable.

[A1) Depending on the user, the task, the working regime and the office environment office chairs are subject to widely varying severity of use. For this reason it is neither possible nor useful to equate the testing described in this standard to the service life of a chair. (A1]

The tests specified in this standard do not ensure that structural failure will not eventually occur as a result of habitual misuse or after an excessively long period of service. An attempt has been made to ensure that as far as can be forseen, such service failures as may occur will not be a serious hazard to health.

This part of BS 5459 does not include requirements for office visitors' chairs. A European Standard is in preparation for office visitors' chairs. In the interim period, office visitors' chairs may be tested in accordance with BS 4875-1:1985 and BS 7945:1999.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct applicaiton.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 39 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

blank

1 Scope

This part of BS 5459 specifies performance requirements and test methods for the structural safety and stability of office pedestal seating when used by persons weighing up to 150 kg, or when used for up to 24 hours a day, including chairs for use with tables and desks higher than those specified in BS EN 527-1.

This Part of BS 5459 also specifies requirements and test methods for type approval of bases, columns, seat actions, back stems and locking devices.

NOTE 1 BS EN 1335-2 and BS EN 1335-3 contain requirements and test methods for office pedestal seating which is intended for use for up to 8 hours a day by persons weighing up to 110 kg.

This standard does not apply to office visitors' chairs.

NOTE 2 Office visitors' chairs are chairs used in the office environment which are not classed as office work chairs and which are used for long or short meetings or consultations, as well as for reading, writing, listening and waiting.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 903-A26:1995, *Physical testing of rubber — Method for determination of hardness (hardness between 10 IRHD and 100 IRHD)*.

ISO 2439:1997, *Flexible cellular polymeric materials — Determination of hardness (indentation technique)*.

3 Terms and definitions

For the purposes of this part of BS 5459, the following terms and definitions apply.

3.1

column

component that fits between the base and the seat action

NOTE A column normally incorporates a seat height adjustment and swivel mechanism.

3.2

gas spring seat height adjustment component

height-adjustment component in which the pressurized outer tube directly carries the applied bending moments

3.3

footrest

structure integral with a chair, intended as a foot support, whether used when sitting or when mounting the chair

3.4

component

part of the seating which is separately manufactured

3.5

safe failure

damage to the chair of which the sitter would immediately be aware but which would not place the sitter at risk of injury at that time

3.6

seat action

mechanism or structure attaching a seat and/or back assembly to the top of the pedestal column

3.7

back stem

component which supports the back rest

3.8

locking device

device which inhibits the movement of the seat action and/or the back rest

4 Requirements

4.1 Durability

After completing 120 000 cycles of the fore-and-aft safety test specified in **A.5.1**, followed by the tests specified in **A.5.2**, **A.5.3** and **A.5.4**, the chair shall not fail as specified in **4.6.1**.

[A1) After completing 120 000 cycles of the locking device fatigue test specified in **A.7.9**, safe failure is permitted. The number of cycles at which this occurs shall be recorded. (A1]

4.2 Component durability

When tested in accordance with **A.7**, the components shall not fail as specified in **4.6.1**.

4.3 Stability

When tested in accordance with **A.6**, the chair shall not overturn.

4.4 Safety

When tested for the remaining 380 000 cycles of the fore-and-aft safety test specified in **A.5.1** (see **A.1.7**), and when tested in accordance with **A.5.5**, the chair shall not fail as specified in **4.6.1** or shall fail safely as specified in **4.6.2**.

4.5 Type approval of bases, columns, seat actions, back stems and locking devices

4.5.1 *General*

Chairs fitted with all the following components which have satisfied the type approval requirements of **4.5** are not required to undergo the tests in **A.5.1** and **A.5.5**:

- — base;
- — column;
- — seat action;
- — back stem;
- — locking device.

4.5.2 *Seat actions*

When tested in accordance with **A.8**, seat actions shall show no damage as specified in **4.6.1**, or, alternatively, all 12 samples shall fail consistently and safely (see **4.6.2**).

4.5.3 *Columns, bases, back stems and locking devices*

When tested in accordance with **A.8**, columns, bases, back stems and locking devices shall show no damage as specified in **4.6.1**.

4.5.4 *Additional requirements for bases with structural components incorporating plastics*

When tested in accordance with **A.8.3.2**, the column shall not pass through the underside of the base by more than 0.5 mm during the first and second applications of the test.

4.6 Criteria for failure and safe failure

4.6.1 *Criteria for failure*

The chair is considered to have failed if any of the following occurs:

a) fracture of any member, joint or component (including back support, column, base, seat suspension and castors);

b) loosening of joints or components intended to be rigid, which is shown to be permanent by applying hand pressure;

c) deformation affecting the appearance or function;

d) impairment of the operation of any mechanical part.

4.6.2 *Criteria for safe failure*

The chair is considered to have failed safely if any damage to the chair is such that the sitter would immediately be aware that the chair was impaired but would not be at risk of injury at that time.

Permanent tilting of the chair or structural insecurity are acceptable provided that:

a) the chair and its occupant would not overturn at the moment of failure (see note 1); and

b) expulsion of internal parts of the chair under pressure is not possible; and

c) the seat cannot be detached except by deliberately lifting it.

NOTE 1 Safe failures in accordance with **4.6.2**a can be assessed by loading the chair with the 13 discs specified in **A.3.11**.

If failure is caused by a specific weakness in the test sample, such as a weld fault or casting porosity, repeat the tests on a new sample.

NOTE 2 The following are examples of safe failure: bending of an arm of the chair; fracture of part of an arm (though not the sudden loss of an arm); damage to the tilt mechanism or seat structure (provided that the seat is not suddenly detached from the pedestal), including bending of the base or pedestal and loss of or damage to castors.

5 Marking

5.1 Complete chairs

Each item of seating that conforms to this standard shall be marked with the following, or shall be accompanied by the following information:

a) the name of the manufacturer, registered trade name, registered trade mark or other means of identifying the manufacturer;

b) the number and date of this British Standard, i.e. BS 5459-2:2000[1)];

c) the date of manufacture of the item.

5.2 Columns, bases, seat actions, back stems and locking devices

Columns, bases, seat actions, back stems and locking devices which have been tested in accordance with **A.8**. and found to conform to **4.5** shall be permanently marked with the following:

a) the name of the manufacturer, registered trade name, registered trade mark or other means of identifying the manufacturer;

b) the model number;

c) the date of manufacture.

The marking shall be located so that it is visible on the outside of the component.

[1)] Marking BS 5459-2:2000 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

Annex A (normative)
Test methods

A.1 General

NOTE A summary of the tests is given in Table A.1.

A.1.1 *Moisture content and conditioning*

Before testing, the chair shall be of a sufficient age to ensure that all component materials have developed their full strength. At least 4 weeks shall elapse between the manufacture and testing of chairs which include plastics moulded parts or glued joints in timber. Before testing, parts made of timber products shall be checked with an electric moisture meter to ensure that the moisture content is between 8 % and 12 %. If the moisture content is greater than 12 %, the chair shall be allowed to dry out in a warm ventilated room until the moisture content is between 8 % and 12 %.

A.1.2 *Assembly*

If the seating can be assembled in different ways, the most adverse condition shall be used for each test, taking into account any instructions supplied by the manufacturer. Fastenings shall be checked for tightness before the first test and not retightened thereafter.

A.1.3 *Inspection*

Before testing, each chair shall be thoroughly inspected. Any defects in the members, joints or attachments shall be noted so that they are not attributed to the effects of the tests. In order to detect any permanent deformation, the critical dimensions of the chair shall be measured and recorded. After completion of each test, the chair shall be thoroughly inspected. Any apparent defects shall be noted and any changes that have taken place since the initial inspection shall be recorded.

A.1.4 *Positioning and adjustment*

With a 950 N load on the seat, adjust the seat height to 440 mm, if that lies within the range of adjustment. If it does not, adjust the height to the mid-point of the range of adjustment.

Unless otherwise stated, position the chair on the floor surface (**A.3.10**) with the supporting points restrained by stops (**A.3.3**).

Adjustable arms shall be set at their highest position.

Seat-action locking devices shall not be engaged except during the test specified in **A.7.9**.

Other adjustable components, e.g. castors, shall be adjusted to their most adverse position, which shall be recorded in the test report.

A.1.5 *Test loading*

The apparatus used to apply seat loading shall not in itself restrain the chair from tipping, nor hinder horizontal movement of the chair when the back force is applied.

NOTE The tests may be carried out by the use of masses as an alternative to the specified forces. For practical purposes, a force of 10 N may be taken to be equal to the downward force due to a mass of 1 kg.

A.1.6 *Rate of carrying out the tests*

Fatigue cycles (repeated application and removal of loads) shall be carried out at a rate sufficiently slow to ensure that negligible dynamic load is applied and also to ensure that kinetic heating does not occur.

A.1.7 *Sequence of tests*

The tests in **A.5** shall be carried out in the following sequence:

- 120 000 cycles of the fore-and-aft safety test specified in **A.5.1**;
- the tests specified in **A.5.2**, **A.5.3** and **A.5.4;**
- the remaining 380 000 cycles of the fore-and-aft safety test specified in **A.5.1**;
- the tests specified in **A.5.5** to **A.7.9**, in sequence.

Tests **A.5.1** to **A.5.4** shall be performed on the same chair. Tests **A.5.5** to **A.7.9** may be performed on additional samples of the same chair.

The test results are valid only for the chair tested. When the test results are intended to be applied to other similar chairs, the test specimen has to be truly representative of them.

A.1.8 ***Ranges of chairs***

Any chairs from a range of chairs with basically similar construction (see note 1) can be considered likely to conform to this part of BS 5459 if samples of chairs, from the same range, which are most likely to be adversely affected by the tests have been tested and found to conform to this part of BS 5459. This would normally mean subjecting:

a) the chair with the highest back and no arms to all tests; and

b) the armchair with the highest back to the tests specified in **A.5.4**, **A.6.2.2**, **A.7.2**, **A.7.3** and **A.7.4**.

NOTE 1 Chairs of basically similar construction are those which have similar geometries and are constructed from the same materials and components. From the structural point of view, differences in the fabric or sewing detail of the outer upholstery cover are considered immaterial.

Table A.1 — Summary of tests

Clause no.	Test description	Test parameters	
A.5.1	Fore-and-aft safety	Seat load V_1:	
		for chairs with full back inclination, θ, of 75° or less	1 500 N × sin θ
		for other chairs	1 400 N
		Back load H_1:	
		for chairs with full back inclination, θ, of 75° or less	1 500 N × cos θ
		for other chairs	400 N
		Load applied to front edge V_2	1 400 N
		Maximum number of cycles	500 000
A.5.2	Seat impact	Drop height	350 mm
A.5.3	Back impact	Drop height	330 mm
		Angle	48°
A.5.4	Drop	Drop height:	
		for leg length < 200 mm	250 mm
		for leg length ≥ 200 mm	450 mm
A.5.5	Side-to-side safety	Downward vertical load	1 200 N
		Maximum number of cycles	250 000
A.6.2.1	Forward overturning for all chairs, and sideways overturning for chairs without arms	Downward vertical force	600 N
		Horizontal force	20 N
A.6.2.2	Sideways overturning for armchairs	Downward vertical force on seat	250 N
		Downward vertical force on arm	350 N
		Horizontal force	20 N
A.6.3.1	Rearward overturning	Downward vertical force on seat	600 N
		Overturning force F:	
		for chairs with $h \geq 720$ mm	80 N
		for chairs with $h < 720$ mm	285.7 [1−(h/1 000)] N
A.6.3.2	Accidental rearward overturning	See **A.6.3.2**	
A.6.4	Rearward overturning of tilting and reclining chairs	13 discs	
A.7.2	Arm sideways static load	Outward horizontal force	600 N
A.7.3	Arm downward static load	Downward vertical force	1 200 N
A.7.4	Arm impact	Angle	48°
A.7.5	Chair swivelling	Downward vertical force	1 200 N
		Number of cycles	100 000
A.7.6	Seat height adjustment	Downward vertical force	1 200 N
		Number of cycles	10 000

Table A.1 — Summary of tests *(continued)*

Clause no.	Test description	Test parameters	
A.7.7	Footrest fatigue	Downward vertical force	1 200 N
		Number of cycles	200 000
A.7.8	Durability of controls	Force	100 N
A.7.9	Locking device fatigue	Back load H_1	(see **A.5.1**)
		Number of cycles	500 000
A.8	Type approval of columns, bases, actions, back stems and locking devices	See Tables A.3 to A.7.	

A.2 Principle

The stability and strength of the structure of an office chair is determined by the application of loads or forces simulating normal use and acceptable misuse, to various parts of the article. The test programme consists of the following.

a) *Static tests*

Static tests are used to assess the office seating under high levels of loading which will only occur occasionally.

b) *Fatigue tests*

Fatigue tests are used to assess the strength of the component parts of the chair under the repeated operations, movement or application of load which will occur during normal use of the chair.

c) *Impact tests*

Impact tests are used to assess the impact strength of the chair under the rapid rates of loading which will only occur occasionally.

d) *Safety tests*

Safety tests are used to assess the ability of a chair to withstand impact and fatigue loads which may lead to dangerous failure, or to assess the ability of the chair to fail safely when impact and fatigue loads are applied.

e) *Stability tests*

Stability tests are used to assess the ability of the chair to withstand overturning.

A.3 Apparatus

A.3.1 *General*

A.3.1.1 Unless otherwise stated, the following tolerances apply.

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

— All masses shall have an accuracy of ±0.5 % of the nominal mass.

— All dimensions shall have an accuracy of ±1 mm.

— All angles shall have an accuracy of ±2°.

— The positioning of loading pads shall have an accuracy of ±5 mm.

A.3.1.2 All loading pads shall be mounted on a ball joint or equivalent and the pivot point shall be as close as practically possible to the load surface.

A.3.1.3 All loading pads shall be used in conjunction with a layer of polyether foam (**A.3.12**).

A.3.2 *Loading point template* (see Figures A.1, A.2 and A.3), consisting of two shaped members fastened together by a pivot at one end. The seat loading member has a total mass of 20 kg applied through the seat loading point. The apparatus is marked as shown in Figure A.1.

NOTE The contours of the shaped surfaces are so devised as to sink into the upholstery for a representative distance under moderate loads.

A.3.3 *Stops*, to prevent the chair from sliding but not from overturning, no higher than 12 mm, unless the design of the chair necessitates the use of higher stops, in which case the lowest stop which will prevent the chair from moving is used.

A.3.4 *Seat loading pad* (see Figure A.4 and annex B), a naturalistically shaped rigid indentor with a hard, smooth surface.

A.3.5 *Small seat loading pad* (see Figure A.5), a rigid circular object 200 mm in diameter having a face with a convex spherical curvature of 300 mm radius and a 12 mm edge radius.

A.3.6 *Back loading pad* (see Figure A.6), a rigid rectangular object 200 mm high and 250 mm wide having a face curved across the width of the pad with a convex cylindrical curvature of 450 mm radius and with a 12 mm radius on all front edges.

A.3.7 *Local loading pad*, a rigid cylindrical object 100 mm in diameter having a flat face with a 12 mm radius on the front edge.

A.3.8 *Impactor* (see Figure A.7), a circular body of approximately 200 mm diameter separated from a 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, without the springs has a mass of (17 ± 1) kg. The whole apparatus has a mass of (25 ± 0.1) kg. The springs shall be such that the combined spring system has a nominal spring rate of (6.9 ± 1) N/mm and the total frictional resistance of the moving parts is between 0.25 N and 0.45 N.

The spring system shall be compressed to an initial load 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.

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.

A.3.9 *Impact hammer* (see Figure A.8), cylindrical pendulum head assembly composed of steel, wood and rubber, having a mass of 6.5 kg, supported from a high-tensile steel tube 38 mm in diameter with a wall thickness of 2 mm. The distance between the pivot and centre of gravity of the pendulum head is 1 m. The pendulum arm shall be pivoted on a low-friction bearing.

A.3.10 *Floor*, flat, smooth, rigid and horizontal; except for the test specified in **A.5.4**, where it shall comprise a surface material 2^{+1}_{0} mm thick, having a hardness of (85 ± 5) IRHD, determined in accordance with BS 903-A26:1995, resting on a concrete floor.

A.3.11 *Thirteen stability discs*, of diameter 350 mm, thickness 48 mm and mass 10 kg.

A.3.12 *Foam*, layer of polyether foam 25 mm thick, having a hardness index of (1 100 ± 100) N, determined in accordance with ISO 2439:1997, method A, for use with the loading pads specified in **A.3.4**, **A.3.5**, **A.3.6** and **A.3.7**, and with the impactor specified in **A.3.8**.

A.3.13 *Test cones*, type A full cones and type B plate cones in accordance with Figure A.9. The corners of the holes in the mild steel plates are smoothed and rounded.

NOTE If the gas spring seat height adjustment components to be tested are such that the test cones specified in **A.3.13** do not fit, then type A cones may be made to the manufacturer's specification and type B cones are sized to engage the gas cylinder between 0 mm and 2 mm above the lower limit of the taper, with a plate thickness of at least 4 mm or equal to the thickness of the outer cylinder wall if this is greater. Cylinders without a tapered top attachment are held in a split clamp over the top 35 mm.

A.3.14 *Base test spigot*, a tapered spigot as specified in Figure A.10.

A.3.15 *Action test spigot*, tapered spigot as specified in Figure A.11.

A.4 Determination of seat and back loading points

Position the template (**A.3.2**) on the centreline of the seating as far towards the rear of the seating as possible. Adjust the template position by pushing the back loading member into the back of the seating, so levering the seat loading member forward until the shape of the template corresponds to that of the seating (see Figure A.2). Mark the seat loading point and back loading point from the template on to the seating.

A.5 Durability and safety tests

A.5.1 ***Fore-and-aft safety*** (see Figure A.12)

A.5.1.1 If the chair is equipped with a locking device, this shall not be engaged during this test.

A.5.1.2 One test cycle comprises:

a) applying a load, V_1, (as specified in **A.5.1.4** or **A.5.1.5**) to the seat loading point, using the seat loading pad (**A.3.4**);

b) applying a load, H_1, (as specified in **A.5.1.4** or **A.5.1.5**) to the back loading point, using the back loading pad (**A.3.6**);

c) removing the loads applied in a) and b);

d) applying a load V_2 (as specified in **A.5.1.4** or **A.5.1.5**) to the furthest forward position on the seat to which a load can be applied without the chair overturning, or to a position 100 mm back from the front edge of the seat, whichever is the furthest away from the front edge of the seat.

A.5.1.3 Repeat the test cycle 500 000 times (see **A.1.7**), or until failure occurs.

A.5.1.4 For all chairs except those described in **A.5.1.5**, the seat load V_1 is 1 400 N, the back load H_1 is 400 N, and V_2 is 1 400 N.

A.5.1.5 For chairs with a full back inclination to the horizontal, θ, of 75° or less, V_2 is 1 400 N, and the seat load V_1, in newtons, and the back load H_1, in newtons, are calculated as follows:

$$V_1 = 1\,500 \times \sin\theta$$
$$H_1 = 1\,500 \times \cos\theta$$

where

θ is the full back inclination of the chair to the horizontal.

A.5.2 ***Seat impact*** (see Figure A.13)

A.5.2.1 Set the seat height to the maximum.

Place a piece of foam (**A.3.12**) on the seat.

If it is difficult to measure the drop height (see **A.5.2.2**) accurately owing to the softness of the upholstery, place a 2 kg mass of diameter 200 mm on the chair and determine the drop height as the distance to the underside of the mass. Remove the mass before proceeding with the test.

A.5.2.2 Allow the impactor (**A.3.8**) to fall freely on to the seat loading point (see **A.4**) from a height of 350 mm. Repeat four more times.

A.5.2.3 Using the same drop height, allow the impactor to fall on to a point as near the front edge of the seat as possible. Repeat four more times.

A.5.2.4 Set the seat height to the minimum and repeat the procedure of **A.5.2.2** and **A.5.2.3**.

A.5.3 ***Back impact*** (see Figure A.14)

A.5.3.1 Using stops (**A.3.3**), restrain the front castors or glides of the chair from moving forward.

A.5.3.2 Allow the impact hammer (**A.3.9**) to fall through a vertical height of 330 mm or an angle of 48° so that it strikes the top of the outside of the back of the chair in the centre with the pendulum arm vertical (see Figure A.14). Perform this operation a total of 10 times.

A.5.4 ***Drop*** (see Figure A.15)

A.5.4.1 Support the chair so that the base lies on a plane inclined at 10° to the horizontal. Position the base so that one leg is at the lowest point on the plane and is just in contact with the floor.

A.5.4.2 Lift the chair up to the height specified in Table A.2 as appropriate to the type of chair. Drop the chair on to the floor (**A.3.10**) 10 times on a front leg and 10 times on a back leg.

NOTE The test may be carried out by lifting the chair with three cords that are adjusted in length, with the chair standing in the correct orientation on a plane inclined at 10° from the horizontal.

Table A.2 — Drop height

Length of pedestal legs mm	Drop height mm
< 200	250
≥ 200	450

A.5.5 ***Side-to-side safety*** (see Figure A.16)

A.5.5.1 Using the small seat loading pad (**A.3.5**), apply a load of 1 200 N vertically downwards at a point 50 mm from the side edge of the seat on the transverse line which passes through the top of the pedestal. Remove the load and reapply it at the corresponding point on the opposite side of the seat. This constitutes one cycle of the test.

A.5.5.2 Apply the loads alternately, as described in **A.5.5.1**, for a total of 250 000 cycles, or until failure occurs. [A1] After completing 120 000 cycles, safe failure is permitted. The number of cycles at which this occurs shall be recorded. [A1]

NOTE The height at which the seat is set does not affect the result of this test.

A.6 Stability tests

A.6.1 ***General***

For tests on chairs with swivelling bases, rotate the base to the position relative to the seat that is most likely to cause overturning, and tighten any assembly fitting. Set adjustable-height chairs to their maximum height. Position five-star bases so that two castors or glides are located against stops.

NOTE A suitable linkage arrangement for stability testing is shown in Figure A.17.

A.6.2 ***Forward and sideways overturning***

A.6.2.1 *Forward overturning for all chairs, and sideways overturning for chairs without arms* (see Figure A.18)

A.6.2.1.1 Position the chair as specified in **A.6.1**. If the chair is of the reclining or tilting type, or has an adjustable backrest, set or lock the back assembly so that it is inclined as far forward as possible.

Using the small seat loading pad (**A.3.5**), apply a force of 600 N vertically downward so as to act at a point 50 mm from the front edge of the seat at any position considered likely to result in instability. (Tests on the centreline are usually sufficient.) While maintaining the downward force, apply a force of 20 N horizontally forward along a line through the point where the base of the loading pad meets the upper surface of the seat (see Figure A.18a).

A.6.2.1.2 For chairs without arms, repeat the procedure described in **A.6.2.1.1**, but applying the downward force so as to act at a point 50 mm from one side edge of the seat, and applying the horizontal force sideways outwards (see Figure A.18b).

A.6.2.2 *Sideways overturning for armchairs* (see Figure A.19)

A.6.2.2.1 Position the chair as specified in **A.6.1**.

A.6.2.2.2 Apply a downward vertical force of 250 N to the seat at a point 100 mm from the fore-and-aft centreline of the seat on the same side as the stopped castors or glides, and between 175 mm and 250 mm forward of the rear edge of the seat. Maintain this force while proceeding with **A.6.2.2.3** and **A.6.2.2.4**.

A.6.2.2.3 Using the small seat loading pad (**A.3.5**), apply a downward vertical force of 350 N to the arm of the chair on the same side as the stopped castors or glides, at a position 37.5 mm from its outer edge, at the most adverse position along its length. Maintain this force while proceeding with **A.6.2.2.4**.

A.6.2.2.4 Apply a horizontal force of 20 N outward at the upper surface of the armrest to which the 350 N vertical force is applied (see **A.6.2.2.3**) and acting through the point of application of the vertical force.

A.6.3 ***Rearward overturning (all chairs)***

A.6.3.1 *Rearward overturning* (see Figure A.20)

A.6.3.1.1 Position the chair as specified in **A.6.1**. If the angle of the backrest is adjustable, set the backrest at its maximum rearward angle from the vertical, or if this angle is greater than 20°, set the backrest so that it is inclined rearwards from the vertical by an angle of 15° ± 5°. If the chair has a free-swivelling backrest pad, adjust the backrest height so that the axis of rotation coincides with the back loading point (see **A.4**).

A.6.3.1.2 Using the small seat loading pad (**A.3.5**), apply and maintain a downward vertical force of 600 N to the seat at the seat loading point (see **A.4**).

A.6.3.1.3 Determine the distance h, in millimetres, between the upper surface of the loaded seat and the floor. For chairs having a value of h equal to or greater than 720 mm, use an overturning force F of 80 N (see **A.6.3.1.4**). For chairs having a value of h of less than 720 mm, calculate the required overturning force F (in newtons) from the following equation:

$$F = 285.7\left(1 - \frac{h}{1\,000}\right)$$

A.6.3.1.4 Apply the overturning force F horizontally rearwards to the back of the chair at the back loading point, or at the top edge of the backrest, whichever is the lower.

A.6.3.2 *Accidental rearward overturning* (see Figure A.21)

Position the chair as specified in **A.6.1**. Tilt the chair rearwards on its rear feet so that the front edge of the seat moves through a horizontal distance of 100 mm (see Figure A.21). Allow the chair to fall freely.

A.6.4 ***Rearward overturning of tilting and reclining chairs*** (see Figure A.22)

NOTE This is an additional test for chairs that can be reclined or tilted.

A.6.4.1 The test is valid for all angles of inclination of the chair back (see Figure A.22). This test is not required when the minimum angle of inclination is greater than 70°.

A.6.4.2 Place 13 discs (**A.3.11**) on the chair seat and firmly settle them against the contours of the back of the chair. If the discs, stacked on top of each other, exceed the height of the chair back, use a light stick, or other means of support, to prevent the upper discs from sliding off.

A.7 Durability of components

A.7.1 ***General***

A.7.1.1 Locking devices which have been type-approved in accordance with **4.5** may be considered capable of conforming to the relevant requirements of **4.4** and do not require testing in accordance with **A.7**.

A.7.1.2 Components of a chair that has been tested in accordance with **A.7.5** to **A.7.9** and found to conform to **4.2**, may be considered capable of conforming to **4.2** when fitted on another chair. Evidence of such conformity shall be given in a test report.

A.7.1.3 It is unlikely that the operational durability of components referred to in this clause can be affected by the design or structure of any chair to which they are fitted, and therefore the tests in **A.7** may be carried out on an additional sample of the chair.

A.7.2 ***Arm sideways static load*** (see Figure A.23)

Using local loading pads (**A.3.7**), apply an outward horizontal force of 600 N simultaneously to each arm of the chair at the point along the arm most likely to cause failure. Apply the forces 10 times in total.

A.7.3 ***Arm downward static load*** (see Figure A.24)

A.7.3.1 Using the small seat loading pad (**A.3.5**), apply a downward vertical force of 1 200 N to the point along one arm most likely to cause failure.

A.7.3.2 If the chair tends to overturn, apply a balancing load of sufficient magnitude to prevent the chair from overturning. Apply the balancing load on the surface of the seat on the side opposite to the arm to which the vertical force is applied.

A.7.3.3 Apply the vertical force 10 times in total.

A.7.4 ***Arm impact*** (see Figure A.25)

A.7.4.1 Place stops against the castors or glides of the chair on the opposite side of the chair to the arm being tested.

A.7.4.2 Allow the impact hammer (**A.3.9**) to fall through a vertical height 330 mm, or fall through an angle of 48°, so that when the pendulum arm is vertical, the hammer strikes the outside face of the arm at the position most likely to cause failure. If the chair has a swivel base, ensure that the direction of impact passes through the vertical axis of the swivel.

A.7.4.3 Strike the arm in this way a total of 10 times.

Dimensions in millimetres

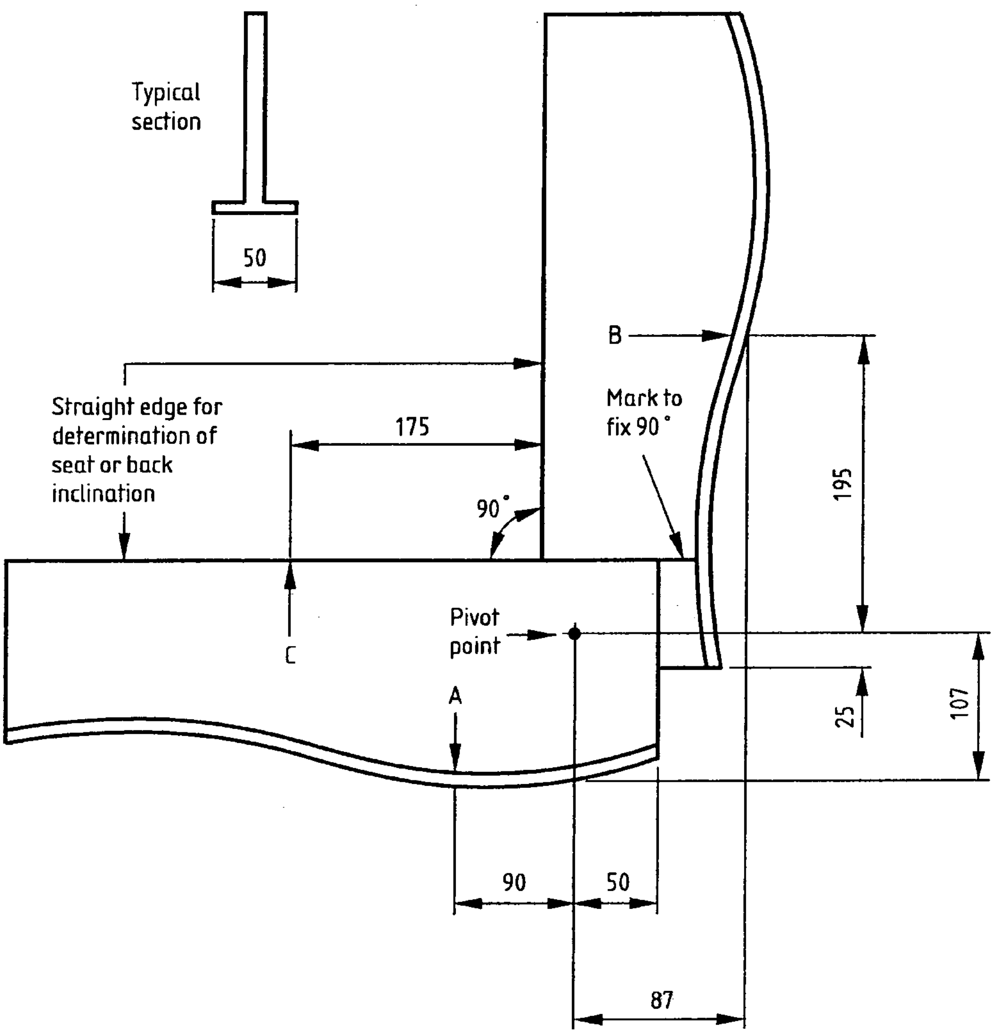


Figure A.1 — Loading point template

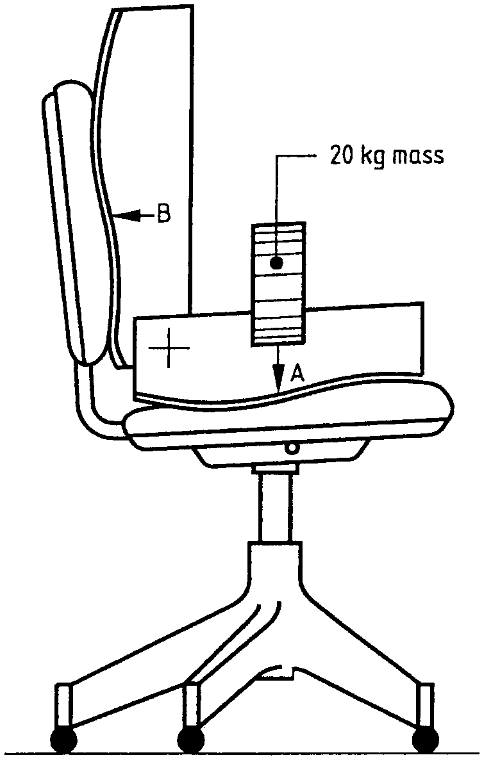
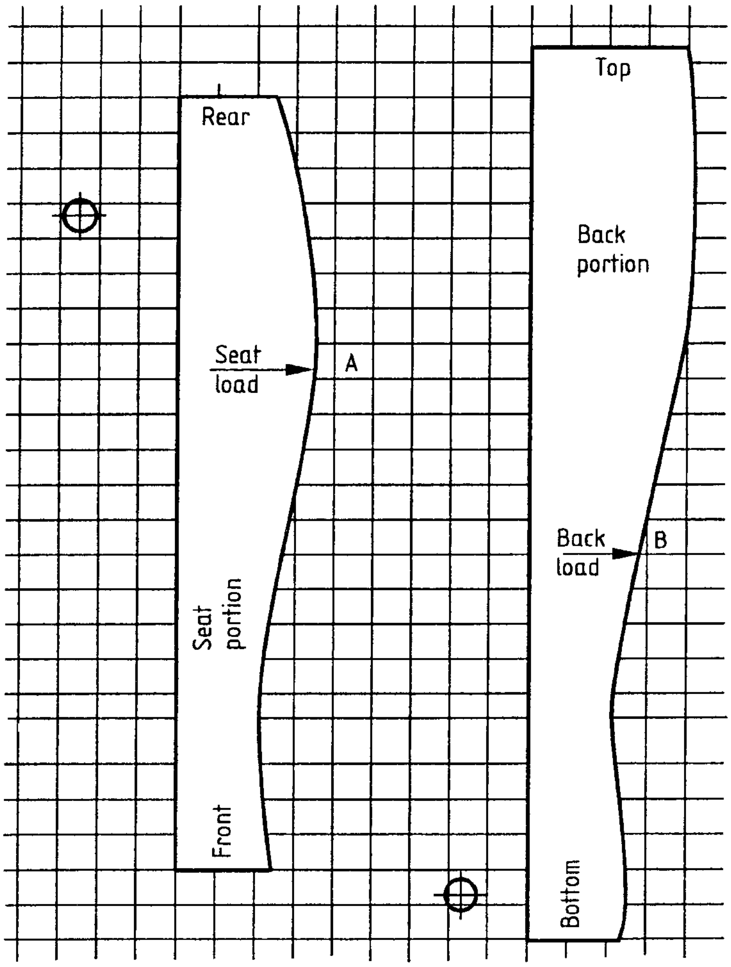


Figure A.2 — Position of loading point template



Scale: one square = 20 mm

Figure A.3 — Loading surface curves for seat and back loading point template

Dimensions in millimetres

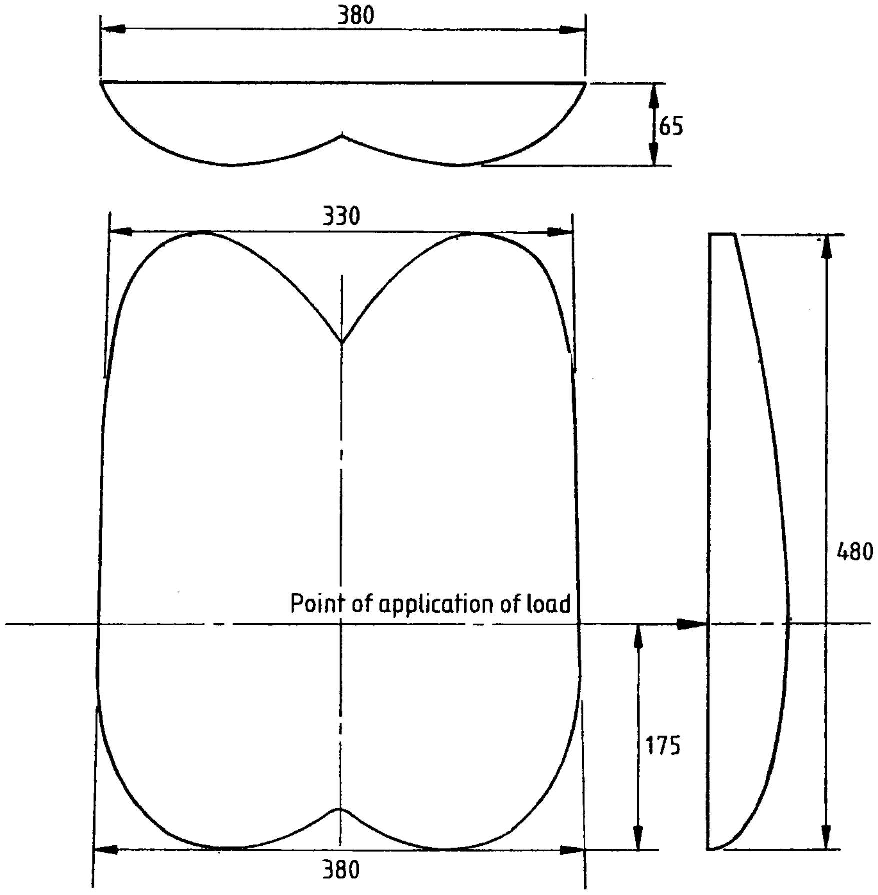


Figure A.4 — Seat loading pad (plan and side elevations)

Dimensions in millimetres

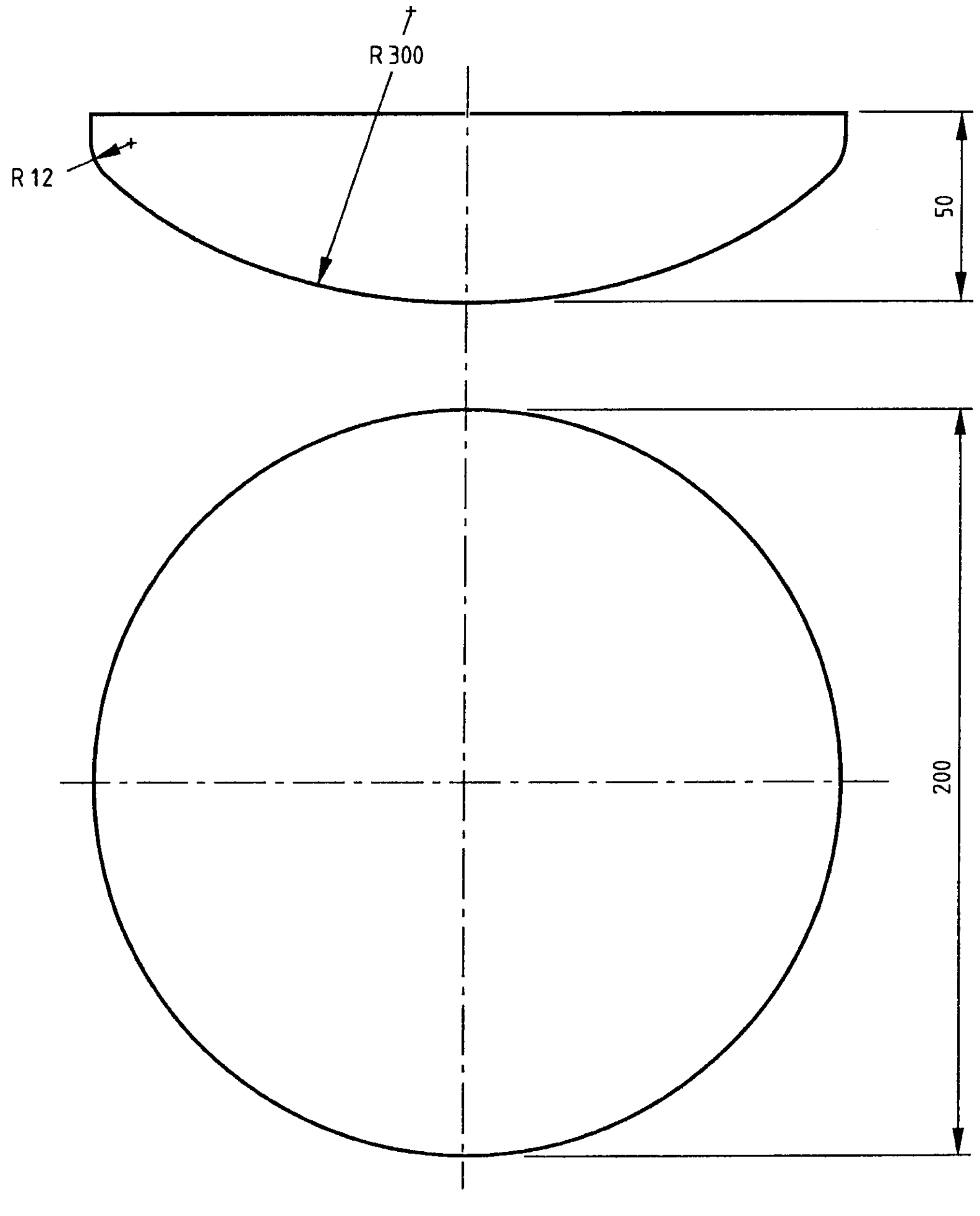


Figure A.5 — Small seat loading pad

Dimensions in millimetres

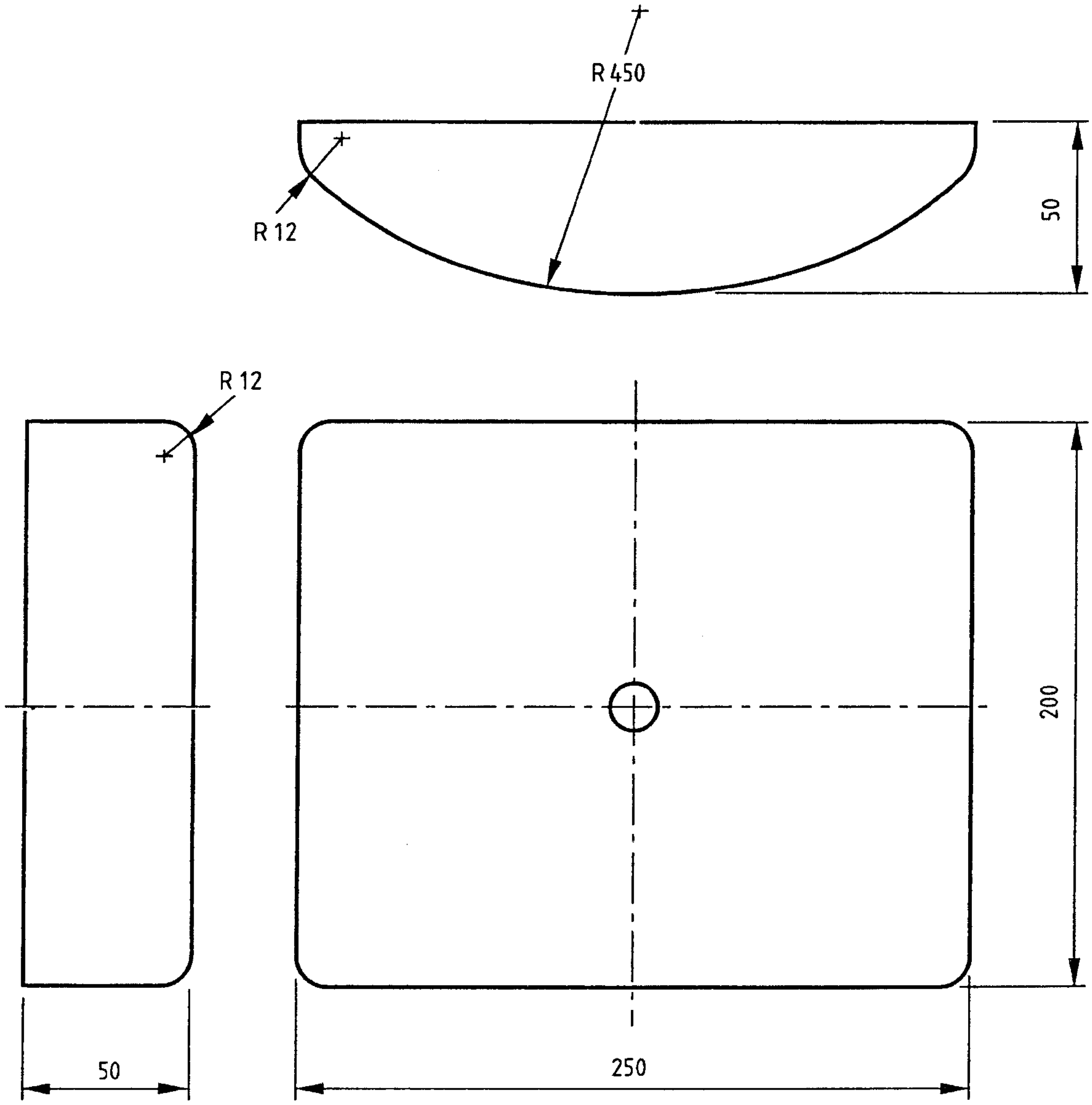


Figure A.6 — Back loading pad

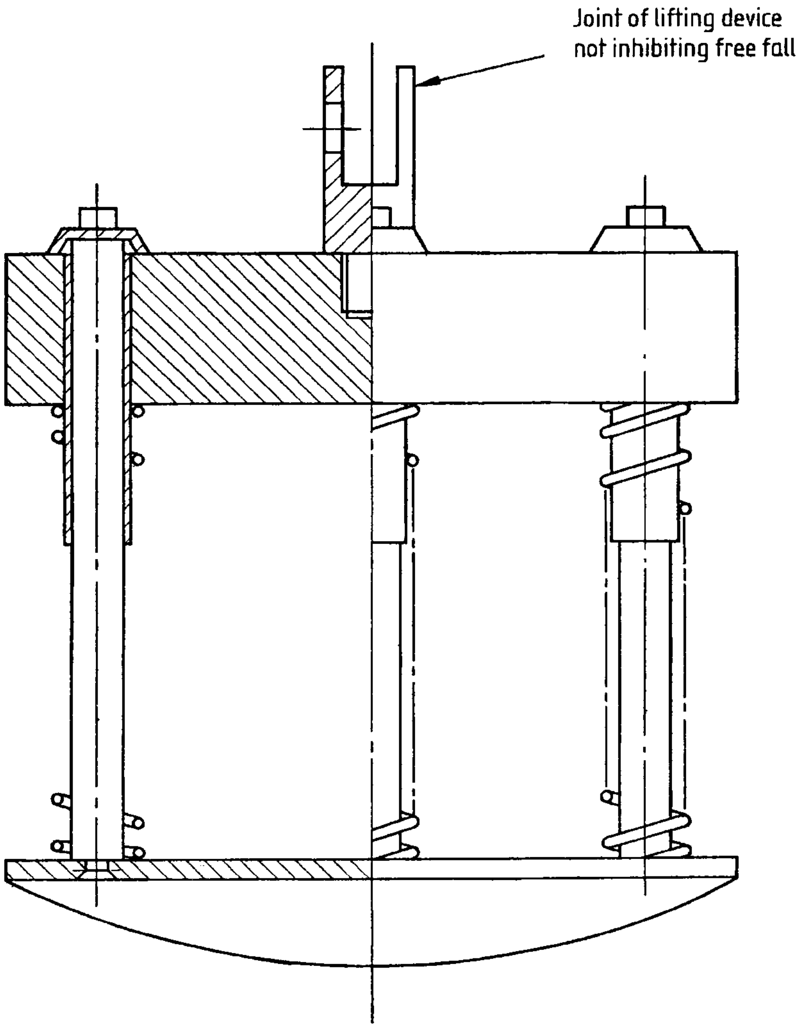


Figure A.7 — Impactor

Dimensions in millimetres

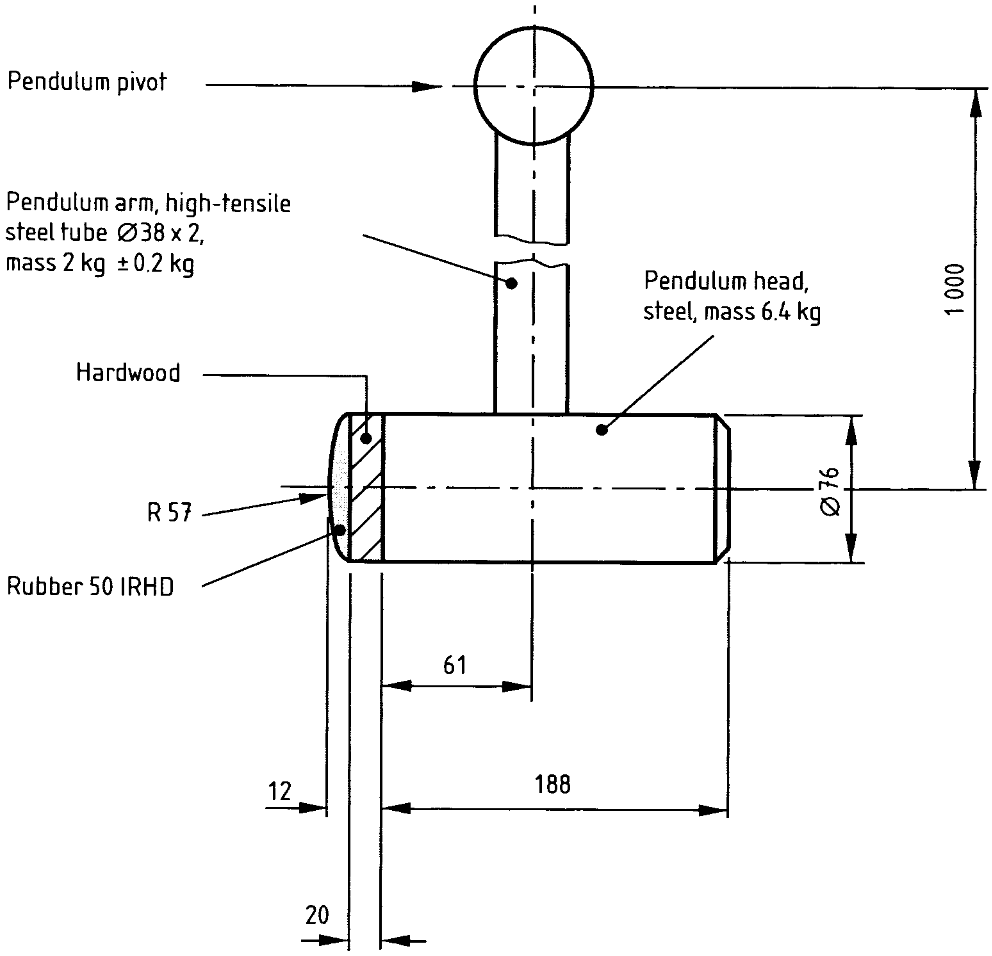


Figure A.8 — Impact hammer

Dimensions in millimetres

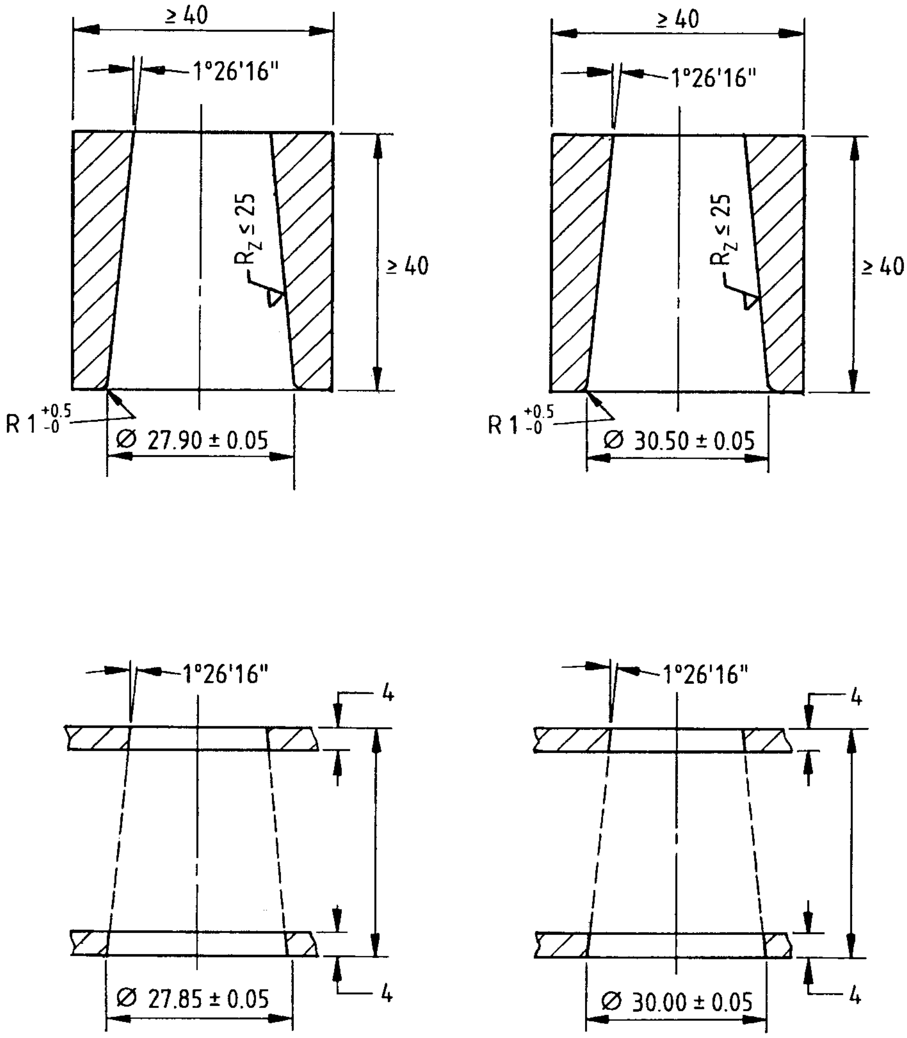


Figure A.9 — Test cones

Dimensions in millimetres

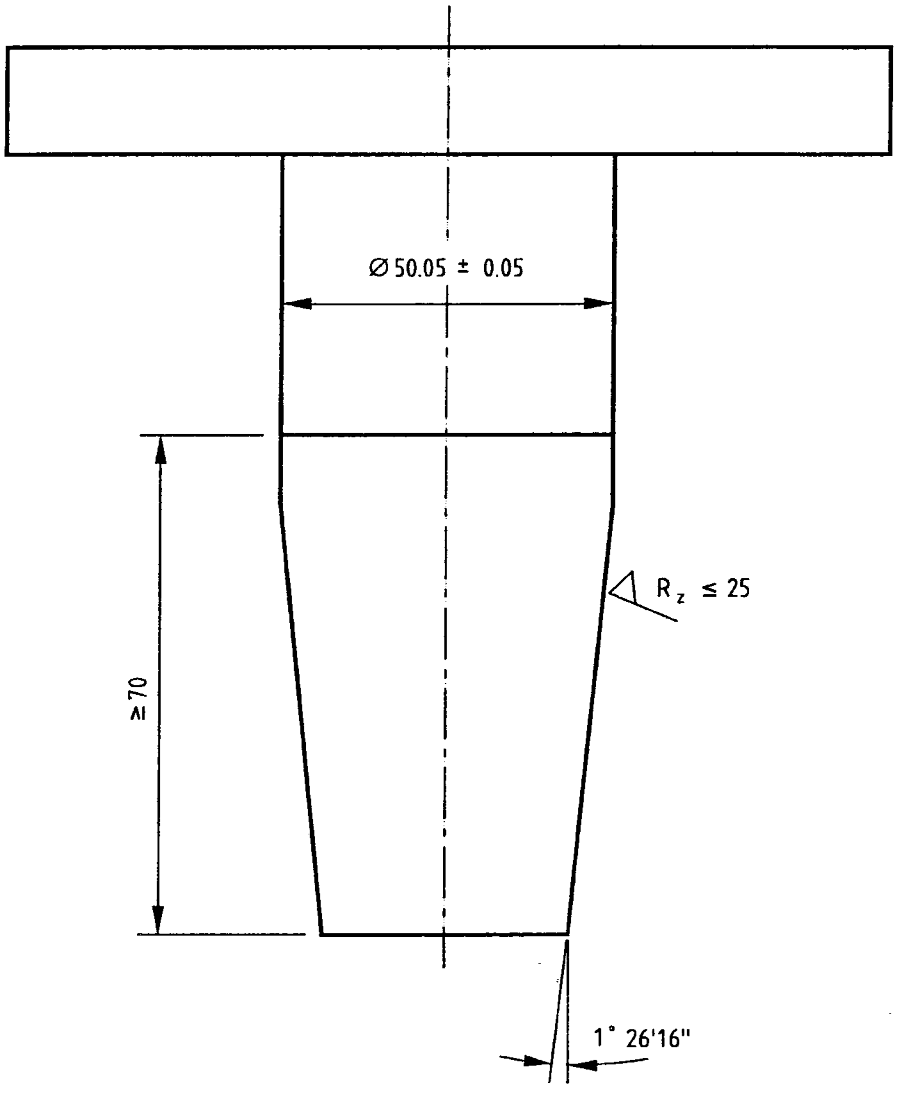


Figure A.10 — Base test spigot

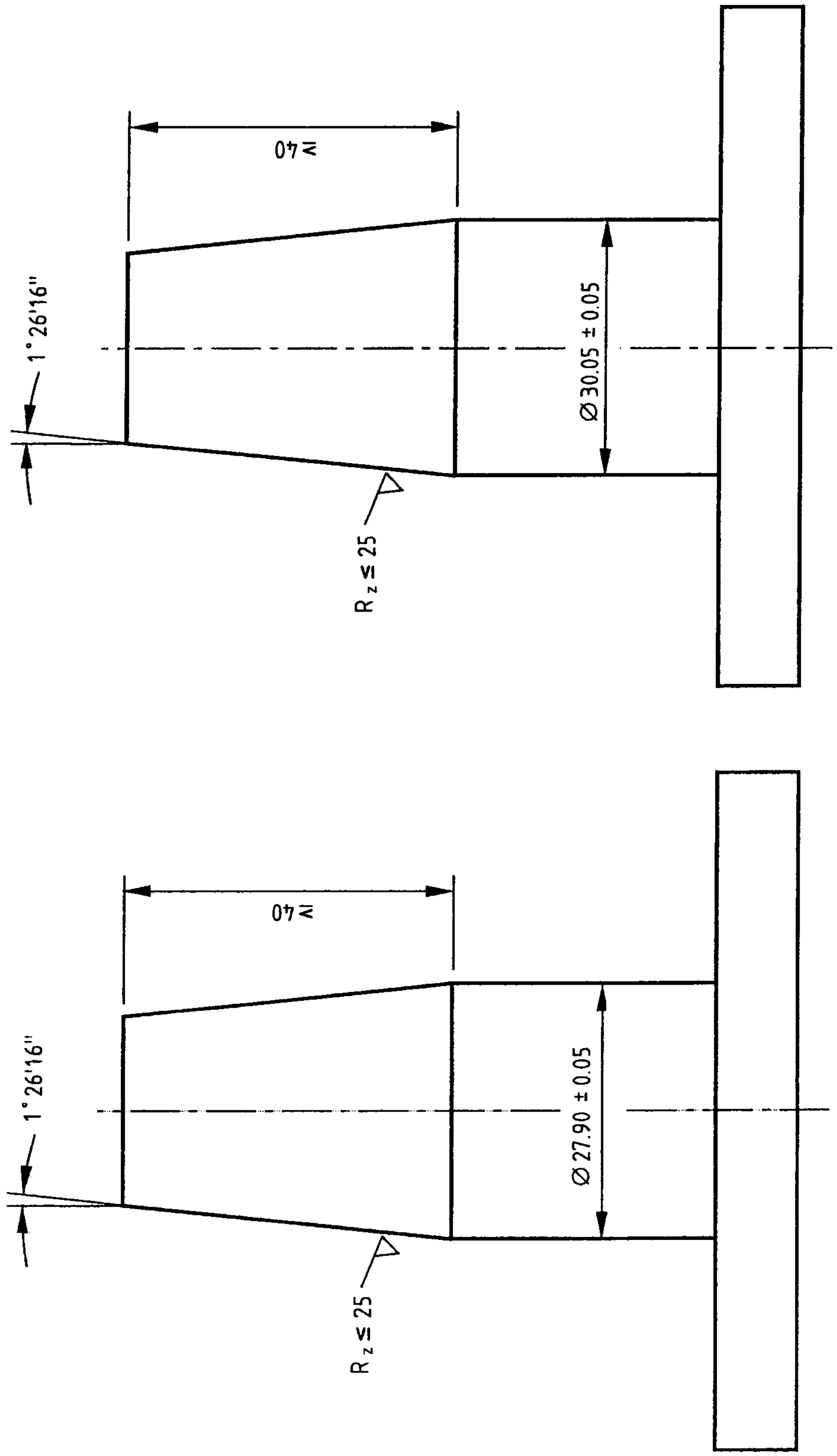


Figure A.11 — Action test spigot

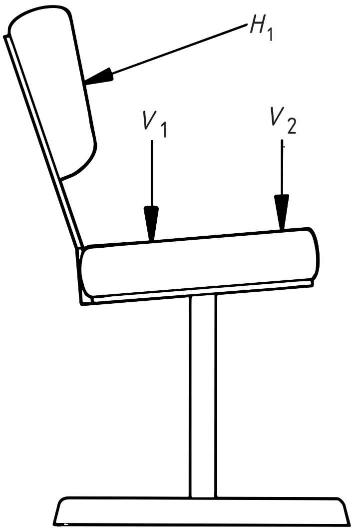


Figure A.12 — Fore-and-aft safety test

Dimensions in millimetres

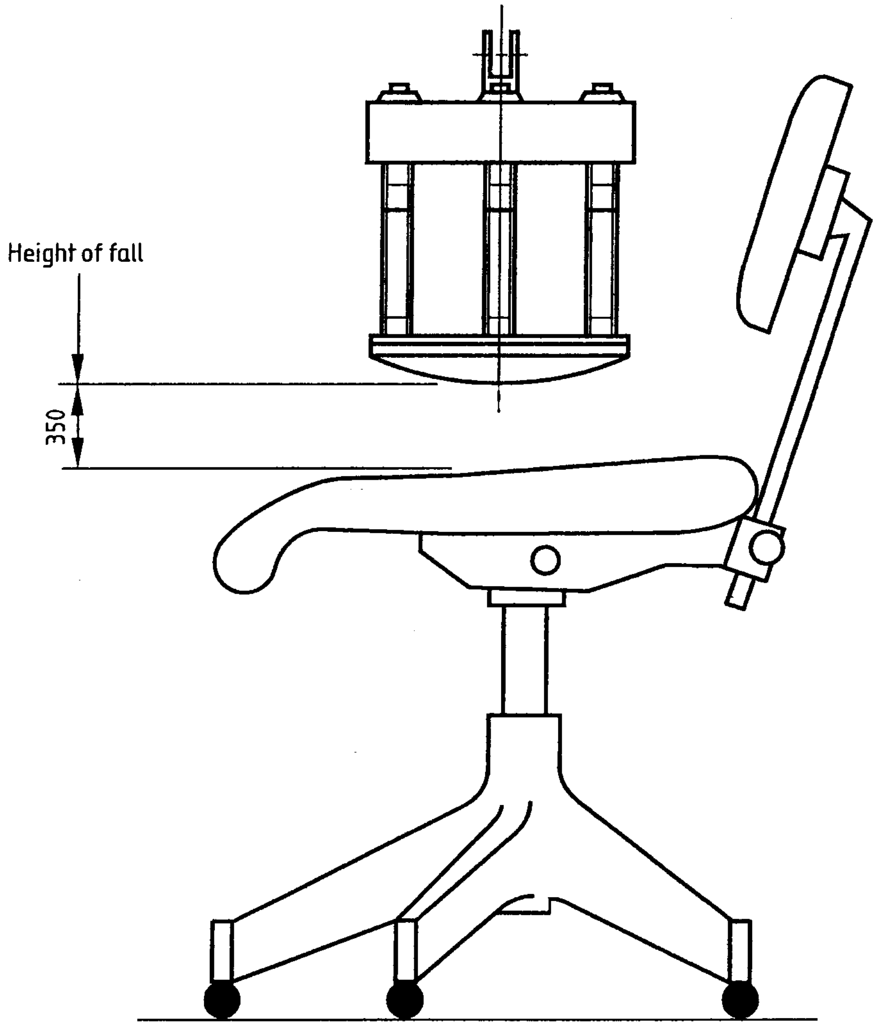


Figure A.13 — Seat impact test

Dimensions in millimetres

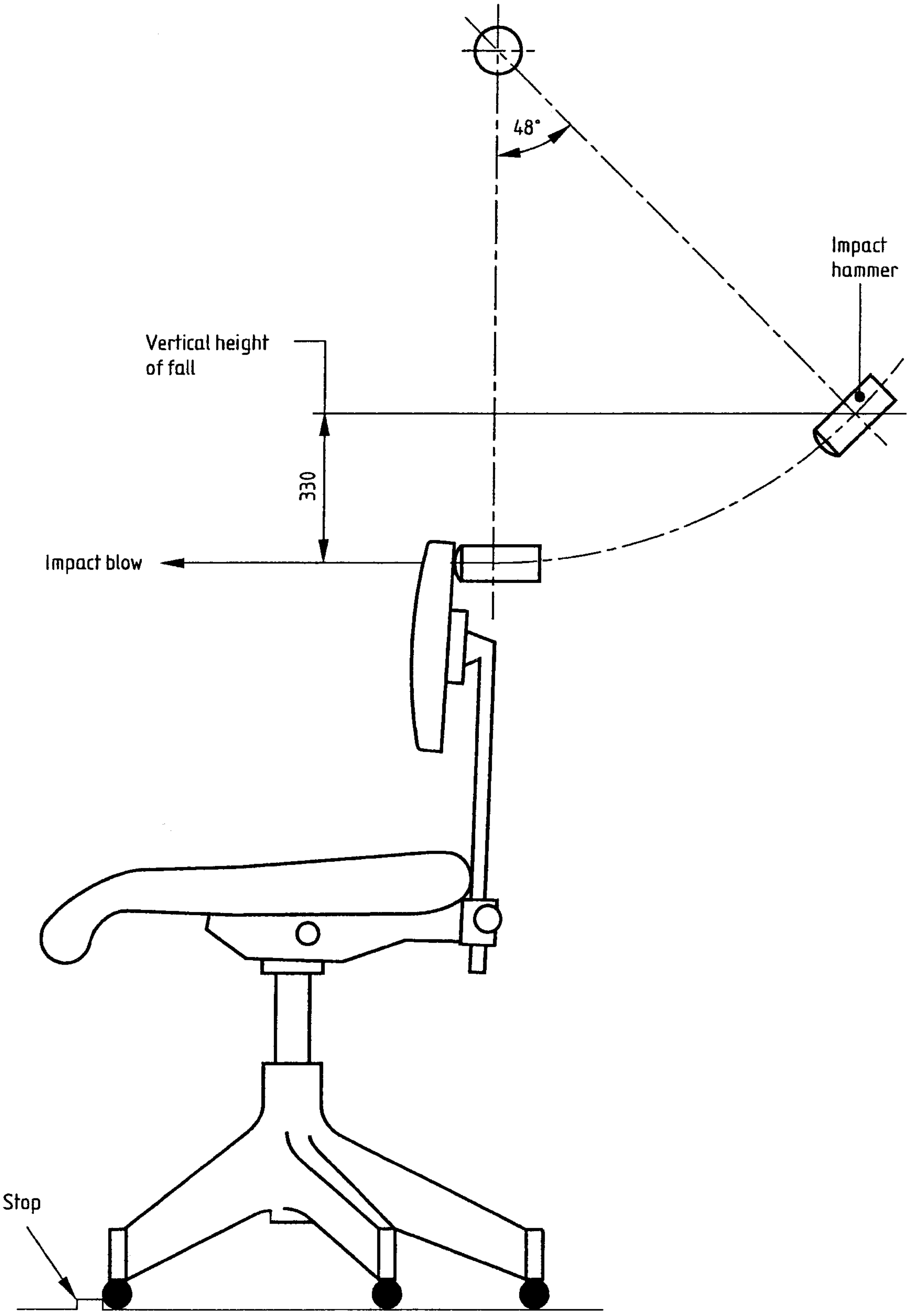
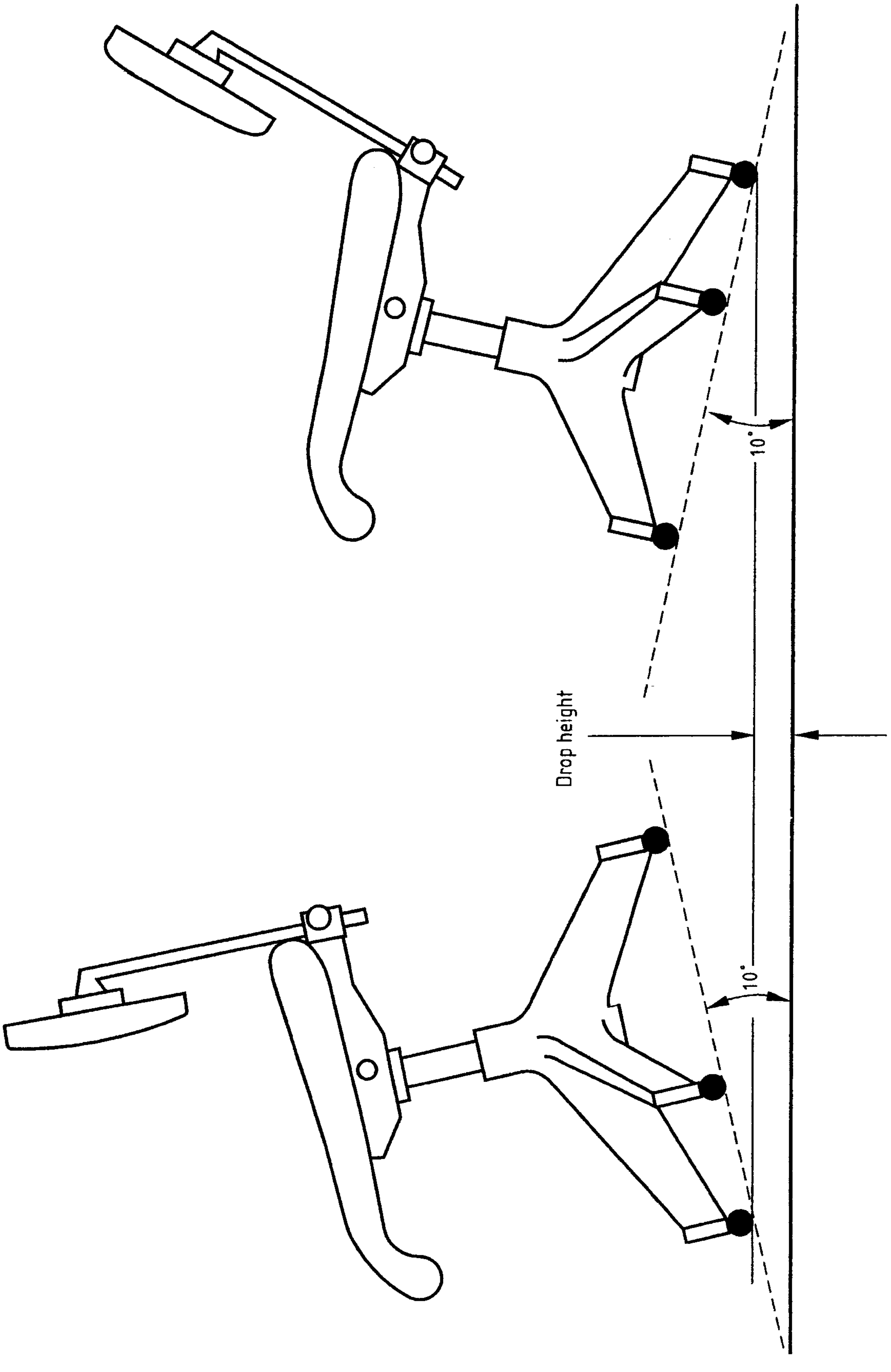


Figure A.14 — Back impact test



a) Drop on a front leg

b) Drop on a back leg

Figure A.15 — Drop test

Dimensions in millimetres

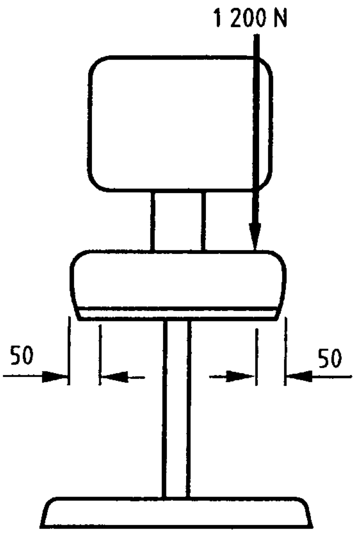
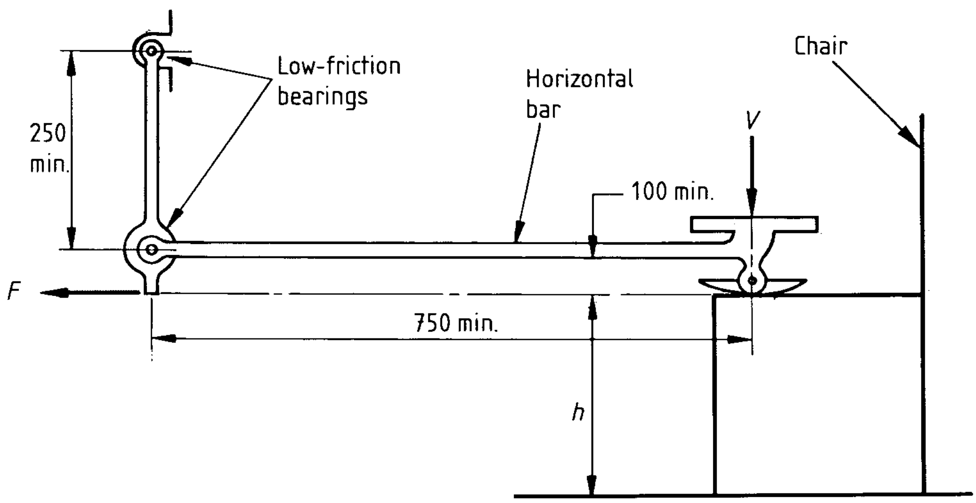


Figure A.16 — Side-to-side safety test

Dimensions in millimetres



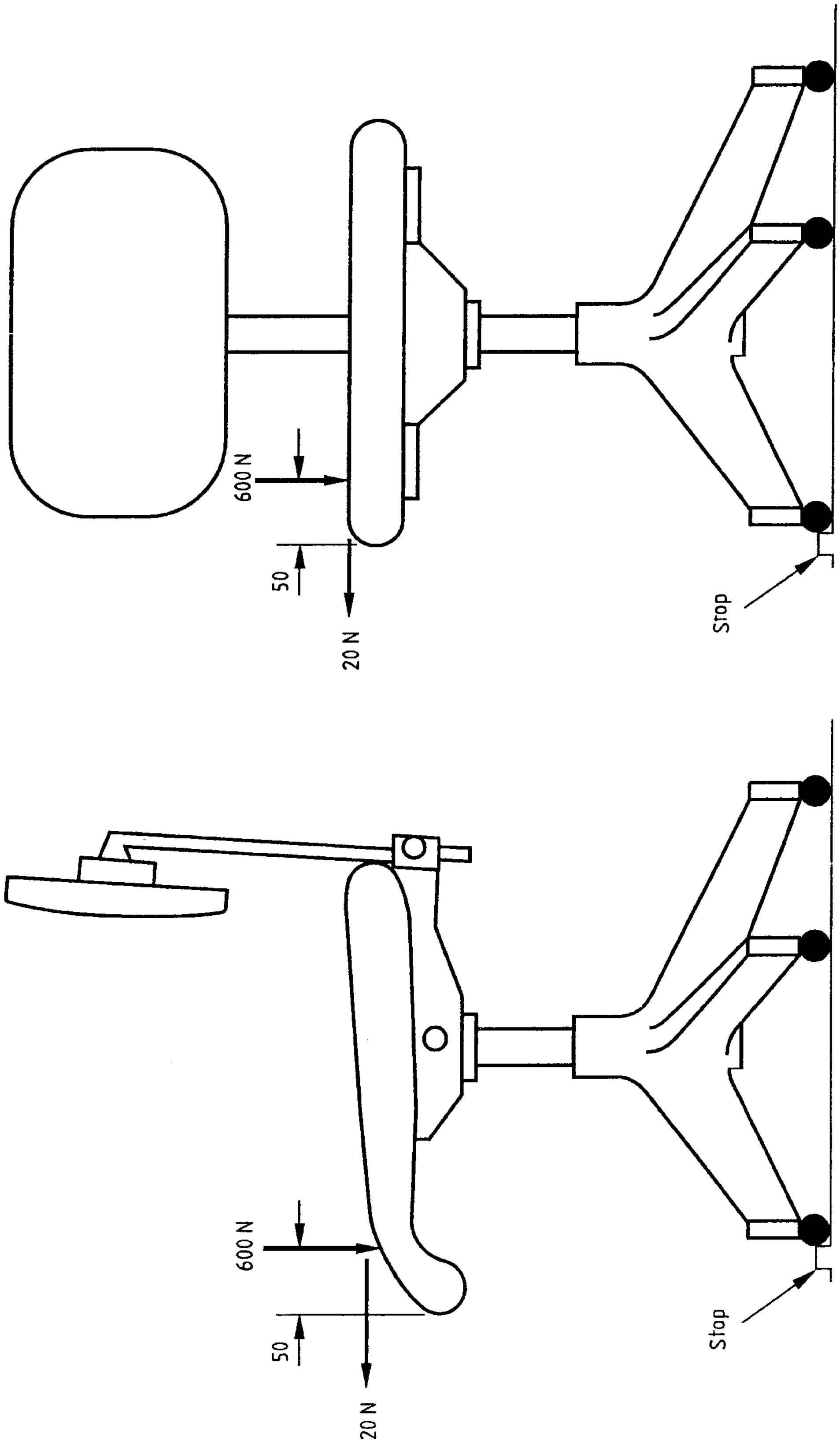
Key

h is the loaded test height

V is the vertical load

F is the horizontal load

Figure A.17 — Suitable linkage arrangement for constraining loading pad



a) Forward overturning

b) Sideways overturning

Figure A.18 — Forward overturning test, and sideways overturning test for chairs without arms

Dimensions in millimetres

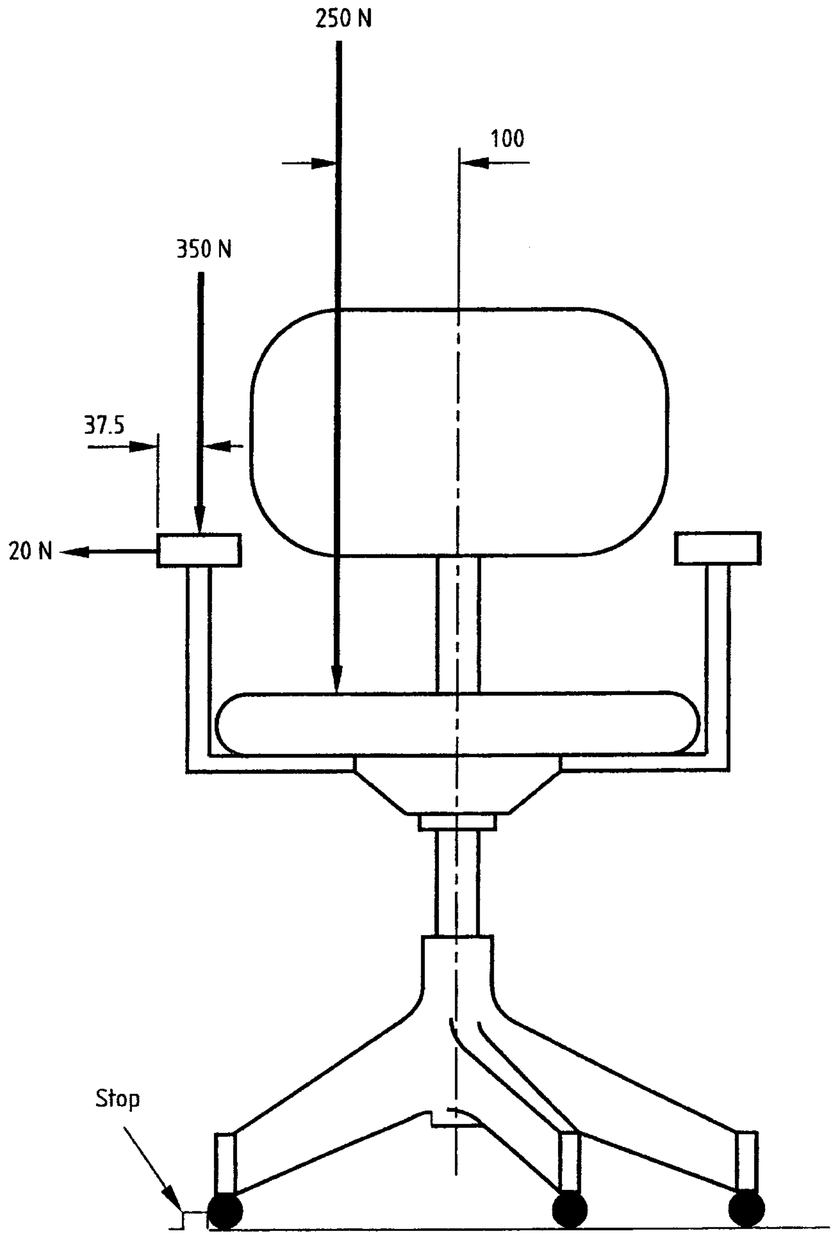


Figure A.19 — Sideways overturning test for chairs with arms

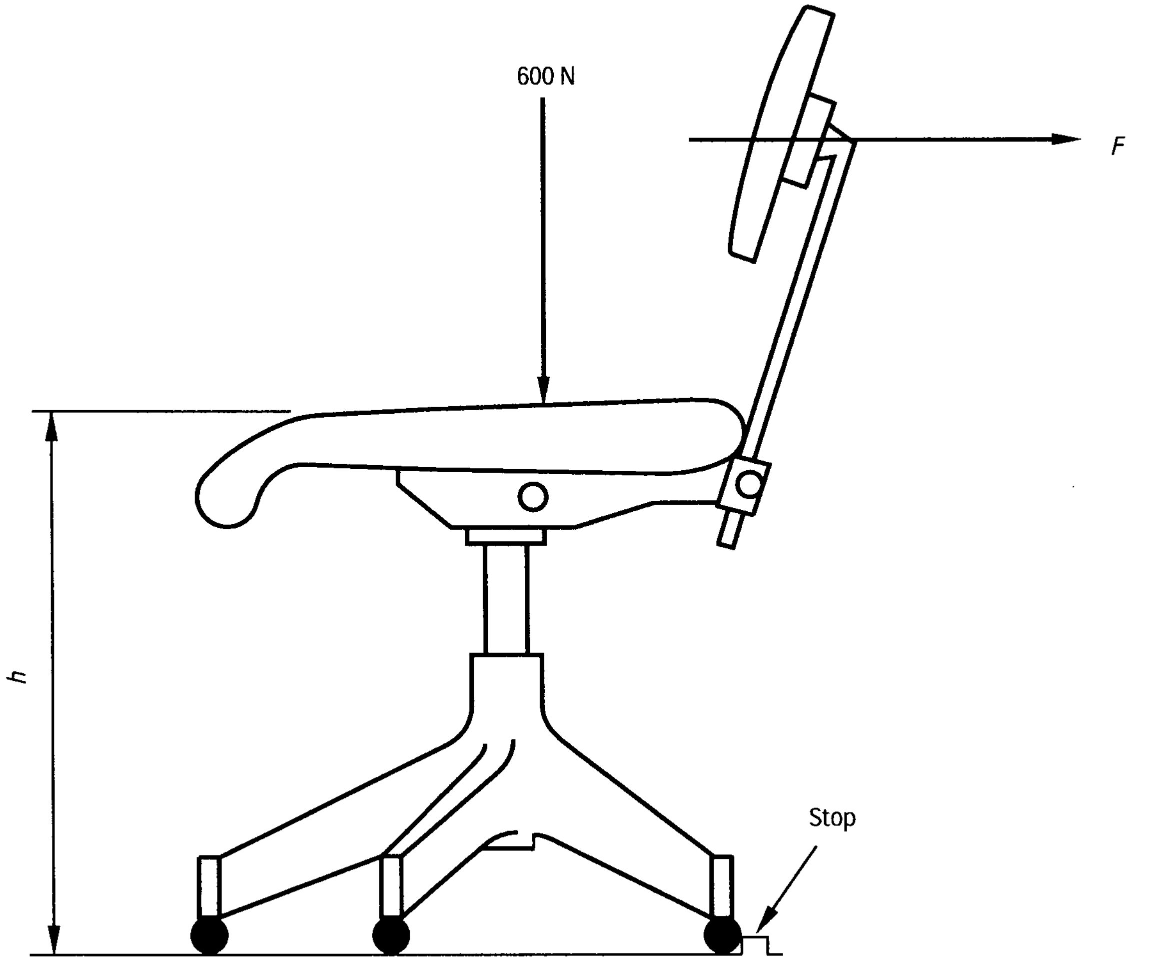


Figure A.20 — Rearward overturning test

Dimensions in millimetres

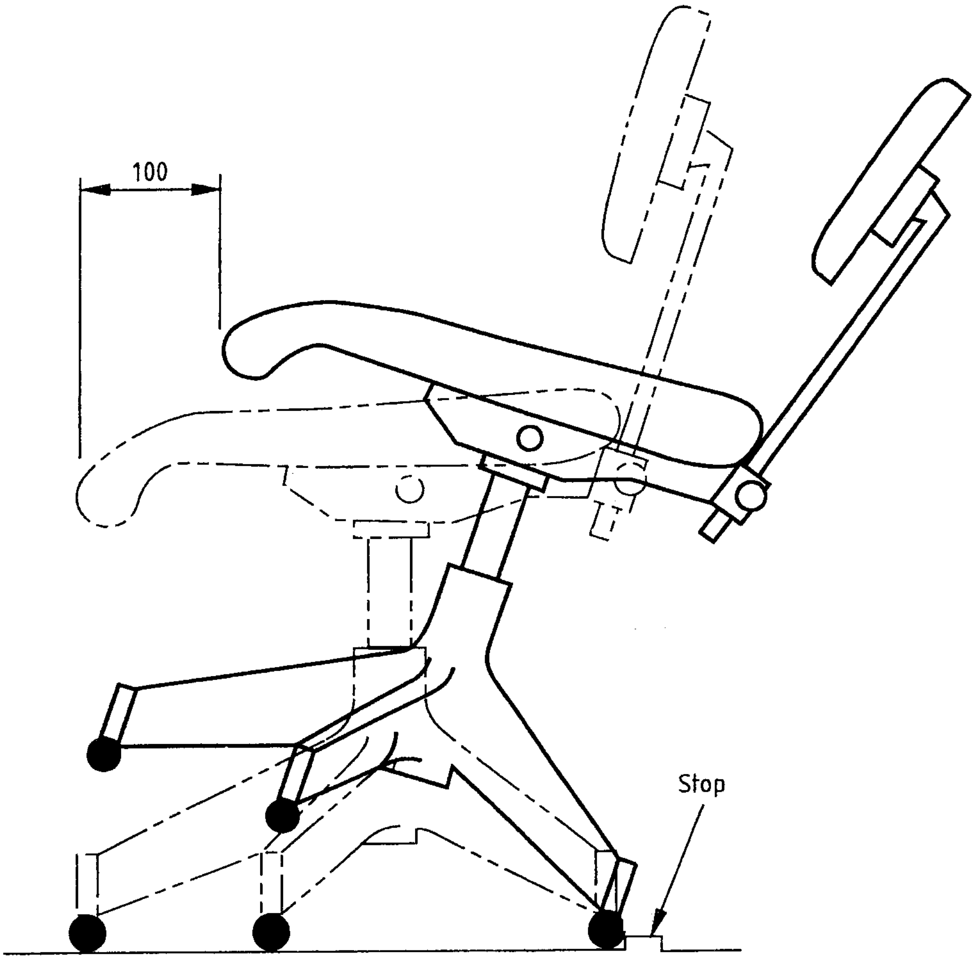


Figure A.21 — Accidental rearward overturning test

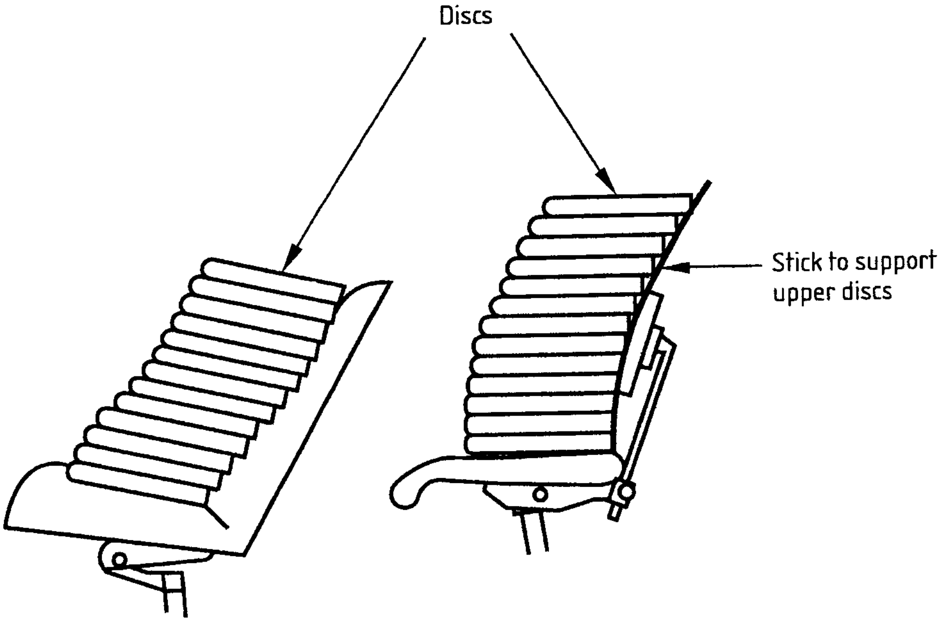


Figure A.22 — Test for tilting and reclining chairs

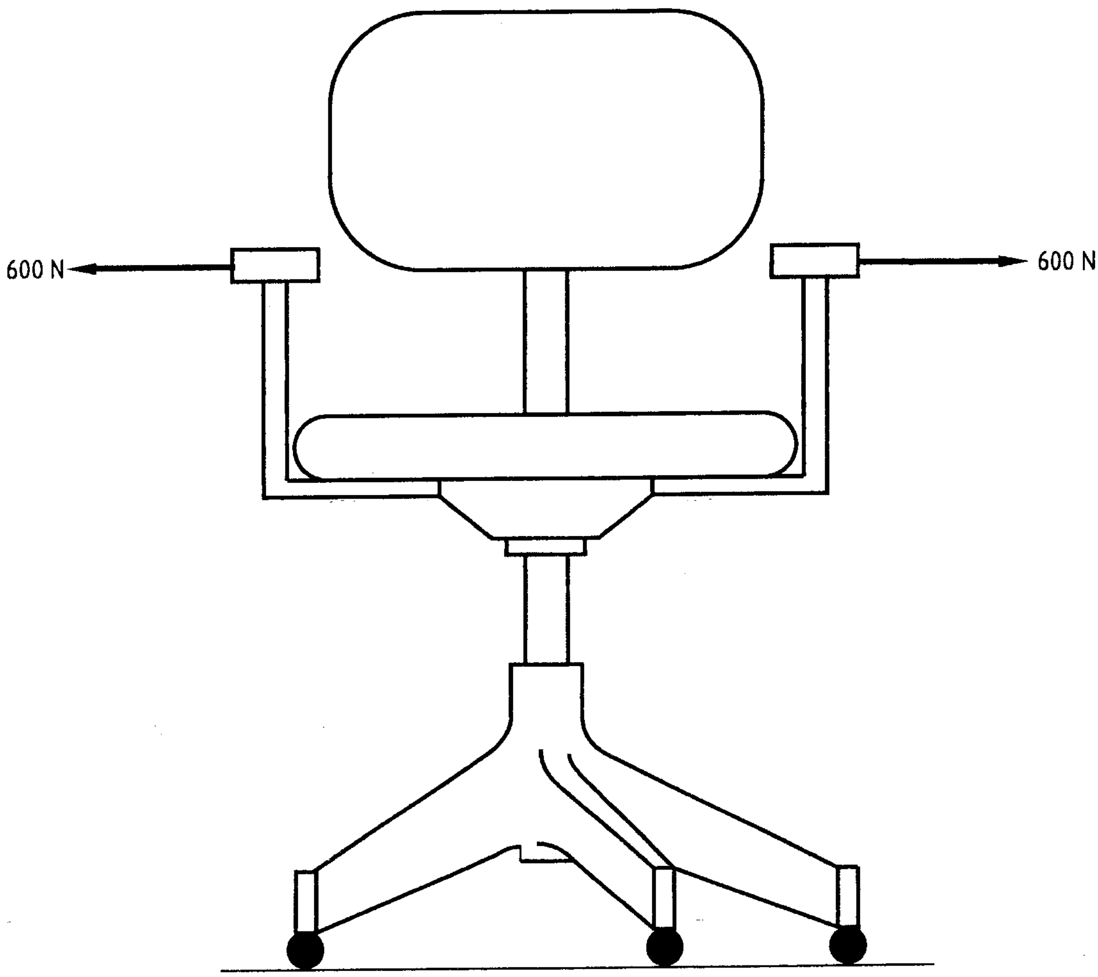


Figure A.23 — Arm sideways static load test

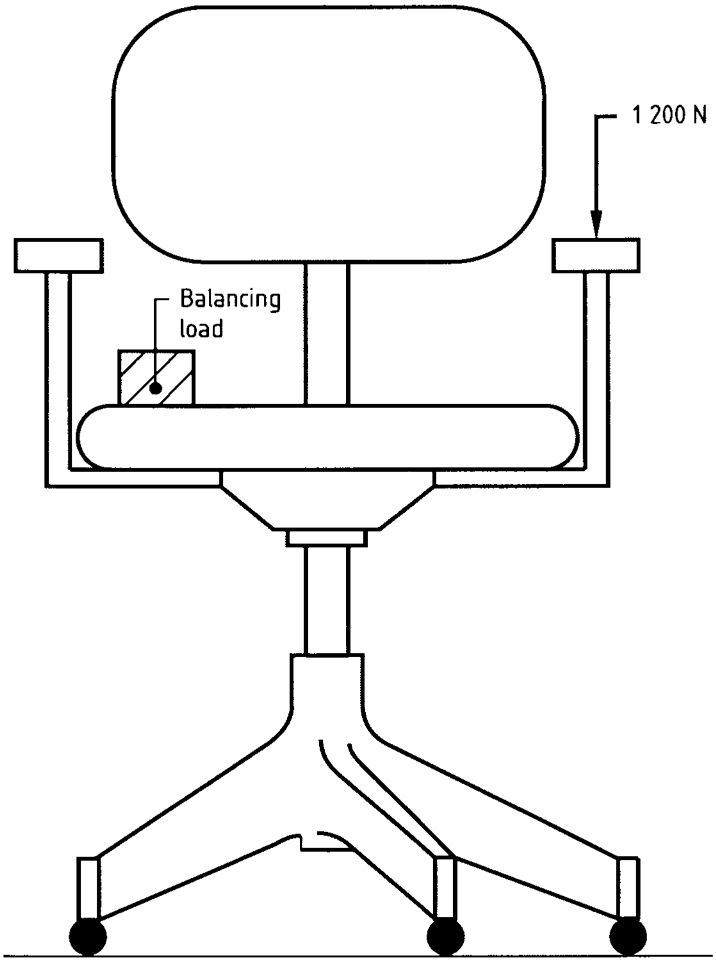


Figure A.24 — Arm downward static load test

Dimensions in millimetres

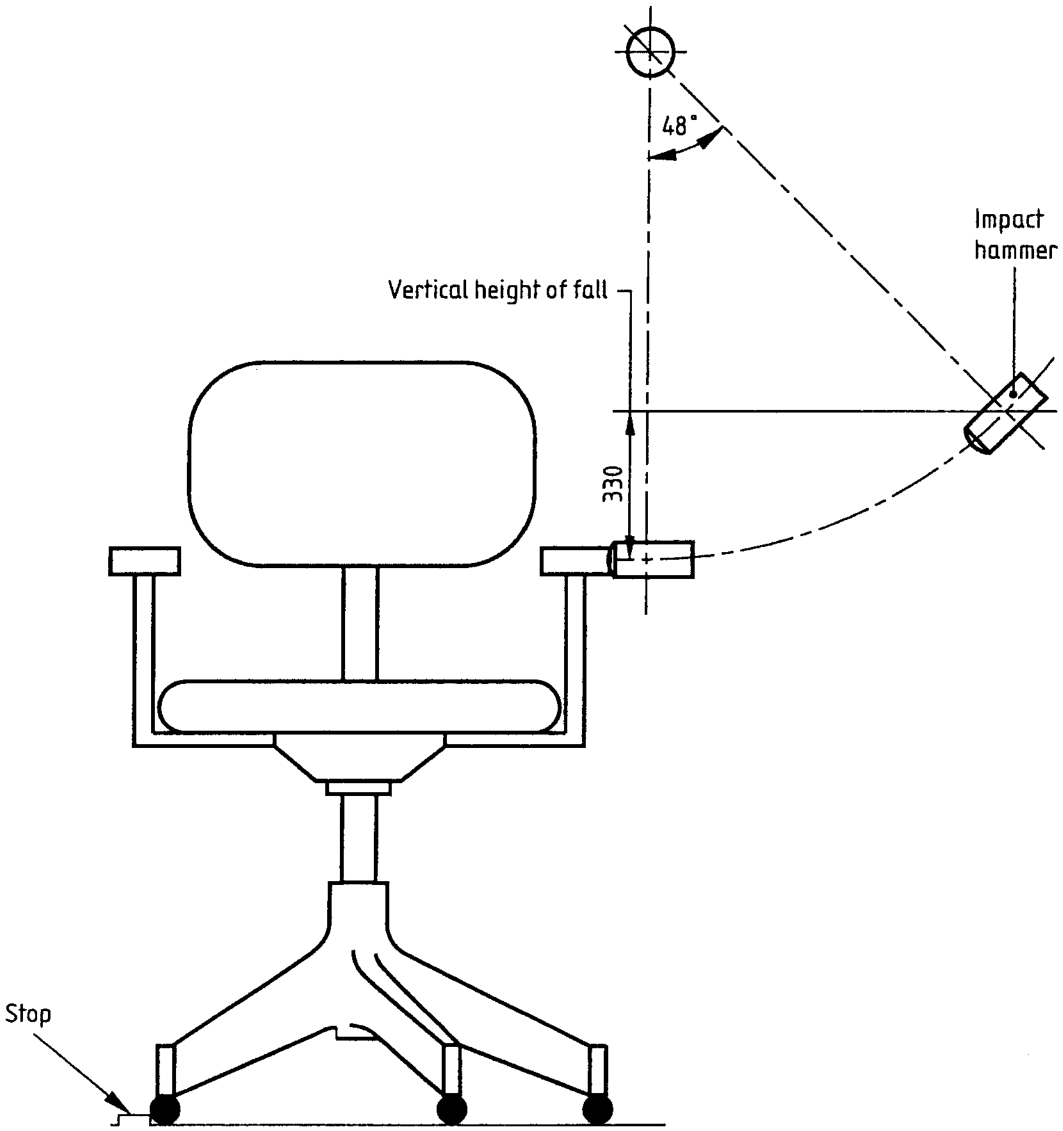


Figure A.25 — Arm impact test

A.7.5 ***Chair swivelling***

A.7.5.1 Using the seat loading pad (**A.3.4**), apply a downward vertical force of 1 200 N to the seat at the seat loading point (see **A.4**).

A.7.5.2 Rotate the seat of the chair through an angle of 45° relative to the base, and then back again. Repeat this operation for a total of 100 000 cycles, maintaining the vertical force throughout.

A.7.6 ***Seat height adjustment***

NOTE 1 This test assesses semi-automatic mechanisms designed to lower the seat under the mass of a sitting person and to raise the seat when unloaded.

NOTE 2 When this test is carried out on a chair previously subjected to the tests specified in **A.5.1** or **A.5.5**, any fatigue failures due to the effective repetition of the seat fatigue loading need not be reported.

A.7.6.1 Set the seat of the chair to its maximum height.

A.7.6.2 Using the seat loading pad (**A.3.4**), apply a downward vertical force of 1 200 N to the seat at the seat loading point (see **A.4**). Maintain the force for at least 3 s, and then remove it.

A.7.6.3 Lower the seat until it rests just above the lowest position of its height adjustment. Reapply the downward force. maintain the force for at least 3 s, and then remove it. Return the seat to its maximum height.

A.7.6.4 Repeat the loading cycle of **A.7.6.2** and **A.7.6.3** for a total of 10 000 cycles. At the end of the test, maintain the seat loading force for 1 h with the seat at its maximum height.

A.7.7 ***Footrest fatigue***

Using the small seat loading pad (**A.3.5**) or the local loading pad (**A.3.7**), apply a downward vertical force of 1 200 N to the periphery of the footrest and/or the centre of the footrest area at any point likely to cause failure. Apply the force for a total 200 000 cycles.

A.7.8 ***Durability of controls***

Apply a force of 100 N to all control levers and knobs at any point and in any direction likely to cause failure. Maintain the force for at least 3 s. Apply the force 10 times in total.

A.7.9 ***Locking device fatigue***

A.7.9.1 Engage the locking device at the middle of its adjustment range and restrain the seat or the pedestal so that it cannot move.

A.7.9.2 Apply the load H_1, as specified in **A.5.1**, at the back loading point (see **A.4**). Apply the load for a total of 500 000 cycles.

A.8 Type-approval tests for columns, bases, actions, back stems and locking devices

A.8.1 ***General***

A.8.1.1 When applying the 90 kg·m or 75 kg·m bending moment (see Table A.3), the rate of application shall be (300 ± 15) kgm/s. When applying all other bending moments, the rate of application shall not exceed 1 cycle per second.

A.8.1.2 A total of 20 samples are required for the seat height adjustment components test. A total of 12 samples are required for all other type-approval tests.

A.8.2 ***Columns incorporating seat height adjustment components***

A.8.2.1 Using a full cone (**A.3.13**), apply alternating bending moments, as specified in **A.8.2.2**, acting at a distance of 300 mm on either side of the centreline of the column.

If the column is not symmetrical about its longitudinal axis, apply the bending moments in the directions that will generate the highest stress on the outer casing.

A.8.2.2 Apply the bending moments as specified for the appropriate type of seat height adjustment component in Table A.3, each for the number of cycles specified in Table A.3. Apply the bending moments in the sequence given in Table A.3 (i.e. a total of 1 101 010 cycles).

A.8.2.3 Repeat the procedure of **A.8.2.2** on a further nine columns.

A.8.2.4 Using the plate cone (**A.3.13**), repeat the procedure of **A.8.2.2** using a further 10 samples.

Table A.3 — Type approval for seat height adjustment components

Number of cycles	Bending moment kg·m	
	Mechanical	Gas spring
10	90	75
1 000	70	60
100 000	37	37
1 000 000	24	24

A.8.3 ***Bases***

A.8.3.1 *All bases*

A.8.3.1.1 Support the base on castor spigots and position it in the orientation most likely to cause failure. Load the base through the base test spigot (**A.3.14**).

A.8.3.1.2 Apply an alternating bending moment, as specified in **A.8.3.1.3**, acting at a distance of 300 mm on either side of the centre.

A.8.3.1.3 Apply the bending moments as specified in Table A.4 for the number of cycles and in the sequence given in Table A.4.

A.8.3.1.4 Repeat the procedure of **A.8.3.1.3** on a further 11 samples.

A.8.3.2 *Additional test for bases with structural components incorporating plastics*

A.8.3.2.1 This test shall be performed after the test specified in **A.8.3.1** and using the same sample.

A.8.3.2.2 Mount the base as specified in **A.8.3.1.1** and apply a load of 300 kg acting downwards on the centreline of the base test spigot. Remove the load and measure the extension of the loading spigot below the lower surface of the base.

A.8.3.2.3 Reapply the 300 kg load and maintain it for 4 days.

A.8.3.2.4 After 4 days, remove the load and again measure the extension of the loading spigot below the lower surface of the base. If there has been movement greater than 0.5 mm, repeat the test.

Table A.4 — Type approval of bases

Number of cycles	Bending moment kg·m
10	90
1 000	70
100 000	45
1 000 000	33

A.8.4 ***Actions***

A.8.4.1 Mount the unlocked action on the action test spigot (**A.3.15**).

A.8.4.2 Apply alternating bending moments, as specified in **A.8.4.3**, acting at a distance of 300 mm on either side of the column mounting point on the fore-and-aft centreline of the action.

A.8.4.3 Apply the bending moments as specified in Table A.5 for the number of cycles and in the sequence given in Table A.5.

A.8.4.4 Repeat the procedure of **A.8.4.3** on a further 11 actions.

A.8.4.5 Mount the action as in **A.8.4.1** and fit a seat board, using the appropriate attachment screws. Apply alternating bending moments of 30 kgm a total of 100 000 times, at a distance of 200 mm on either side of the column mounting point and perpendicular to the fore-and-aft centreline. Repeat the procedure on a further 11 actions.

Table A.5 —Type approval of actions

Number of cycles	Bending moment kg·m
10	90
1 000	70
100 000	37
1 000 000	24

A.8.5 *Back stems*

NOTE Tests **A.8.5** and **A.8.6** may be carried out together.

A.8.5.1 The back stem shall only be tested in conjunction with a designated seat action.

A.8.5.2 Mount the back stem on the designated seat action in the most adverse position, and mount the seat action on the action test spigot (**A.3.15**).

A.8.5.3 Apply the test force at a point 100 mm below the top of the stem up to a maximum of 400 mm above the underside of the action mounting point, using an ancillary loading beam if necessary.

A.8.5.4 Apply the force rearwards on the centreline of the back stem and perpendicular to it. The size of the forces shall be such as to generate the bending moments specified in Table A.6 about a point on the upper surface of the action at the column mounting point.

A.8.5.5 Apply the bending moment for the number of cycles and in the sequence given in Table A.6

A.8.5.6 Repeat the procedure **A.8.5.2** to **A.8.5.5** on a further 11 back stems.

Table A.6 — Type approval of back stems

Test	Number of cycles	Bending moment kg·m
Static load	10	50
Horizontal fatigue	1 000 000	15

A.8.6 *Locking actions*

NOTE Tests **A.8.5** and **A.8.6** may be carried out together.

A.8.6.1 With the locking action mounted on the action test spigot (**A.3.15**) and with the locking device engaged, apply the test force at a point 100 mm below the top of the stem up to a maximum of 400 mm above the underside of the action mounting point, using an ancillary loading beam if necessary.

A.8.6.2 Apply the force rearwards on the centreline of the back stem and perpendicular to it. The size of the forces shall be such as to generate the bending moments specified in Table A.7 about a point on the upper surface of the action at the column mounting point.

A.8.6.3 Apply the bending moment for the number of cycles and in the sequence given in Table A.7

Table A.7 — Type approval of locking actions

Test	Number of cycles	Bending moment kg·m
Static load	10	50
Horizontal fatigue	1 000 000	15

A.9 Test report

The test report shall include the following:

a) the number and date of this British Standard, i.e. BS 5459-2:2000;

b) details of the item tested, or, for components that are type-tested, details of the component and its mounting;

c) details of any defects found during the inspection before testing;

d) details of any defects found during the inspection after testing;

e) whether the chair overturned during the stability test;

f) details of any damage that does not impair the function of the chair, and the number of test cycles at which it occurred;

g) details of any deviation from the test procedures, including any reduction in loads to prevent overturning.

Bibliography

Standards publications

BS 4875-1:1985, *Strength and stability of furniture — Part 1: Methods of determination of strength of chairs and stools.*

BS 7945:1999, *Non-domestic furniture — Seating — Determination of stability.*

BS EN 527-1:2000, *Office furniture — Work tables and desks — Part 1: Dimensions.*

BS EN 1335-2-:2000, *Office furniture — Office work chair — Part 2: Safety requirements.*

BS EN 1335-3:2000, *Office furniture — Office work chair — Part 3: Safety test methods.*

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.
Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001.
Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at http://www.bsi-global.com.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre.
Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.
Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001.
Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsi-global.com/bsonline.

Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL