BRITISH STANDARD

BS EN
13200-4:2006

Spectator facilities —

Part 4: Seats — Product characteristics

The European Standard EN 13200-4:2006 has the status of a British Standard

ICS 91.040.10; 97.200.10; 97.220.10

BSI
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National foreword

This British Standard was published by BSI. It is the UK implementation of EN 13200-4:2006.

The UK participation in its preparation was entrusted to Technical Committee B/552, Spectator facilities.

A list of organizations represented on B/552 can be obtained on request to its secretary.

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

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Foreword

This document (EN 13200-4:2006) has been prepared by Technical Committee CEN/TC 315 “Spectators facilities”, 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of an identical text or by endorsement, at the latest by April 2007, and conflicting national standards shall be withdrawn at the latest by April 2007.

EN 13200 *Spectator facilities* consists of the following parts:

Part 1: Layout criteria for spectator viewing area — Specification

Part 3: Separating elements — Requirements

Part 4: Seats-product characteristics

Part 5: Telescopic stands

Part 6: Demountable (temporary) stands

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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard specifies the mechanical, physical and chemical product characteristics of fixed seating used in sports venues (indoor and outdoor) in the spectator viewing area (S.V.A.). It also specifies the criteria for fixing the seating to the structure.

These characteristics and criteria are determined in order to assure an adequate resistance to static and dynamic stresses and to atmospheric agents. This European Standard specifies comfort, functionality and safety requirements to prevent serious injury through normal functional use, as well as misuse that might reasonably be excepted to occur. This European Standard does not include any fire behaviour or resistance requirements.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12727, *Furniture — Ranked seating — Test methods and requirements for strength and durability*

EN 13200-1, *Spectator facilities — Part 1: Layout criteria for spectator viewing area — Specification*

ENV 581-2:2000, *Outdoor furniture — Seating and tables for camping, domestic and contract use — Part 2: Mechanical safety requirements and test methods for sampling*

EN ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:1993 including Corr. 1:1994)*

EN ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps (ISO 4892-2:2006)*

ISO 105-A02, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

ISO 179-1:2000, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test (ISO 179-1:2000)*

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications*

3 Terms and definitions

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

3.1
seating place
space intended for a single spectator in a sitting position (see figures in Annex B)

3.2
seats

— bench, a continuous element, forming a raised seat level with respect to the footway (Figure B.1);

— low back seat, a shaped element or an assembly fixed to the step or on to a support. It has a backrest with a maximum height of 15 cm above the seat level and may be fitted with armrests (Figure B.2);

— high back seat, a shaped element or an assembly fixed to the step or on to a support. It has a backrest with a minimum height of 15 cm above the seat level and may be fitted with armrests (Figure B.3);

— tip-up seat, a seating place where in the seat elements automatically returns to the upright position on the departure of the occupant (Figure B.4)

3.3
fixing elements
elements for attaching the seat to the fixed support

3.4
fixing method
assembly of elements for attaching the support or the seats to a stand

3.5
seat numbering
means of identifying seat position

NOTE 1 The different types of seating places which are shown in the figures are only examples.

NOTE 2 For general terms relating to the structures of spectator facilities, see EN 13200-1.

4 Abbreviations

For the purposes of this document, the abbreviations in EN 13200-1 and the following apply.

Bse: dimension of the tread where seating places are (seating row depth);

F: depth of seats including the thickens of the back;

I: width of seats (minimum dimension for lateral boundaries of a single seating place);

E: distance between the foremost projection of one seat and the back of the seat in front of it (clearway);

S: height of seat back, including the thickness of the seat.

5 General requirements of construction

5.1 Seats

The seats shall comply with the following general requirements.

a) it shall be so designed to not cause injury to the user. All parts of the seating place with which the user comes into contact, during the intended use, shall be so designed that physical injury and damage to spectator property are avoided. The following consideration are necessary:

   — the safety distance of accessible movable parts is addressed to EN 294 in any position during movement;

   — all accessible parts are without sharp edges/corners;

   — the edges of the seat, backrest and armrests which are in contact with the user when sitting, are rounded with recommended minimum 3 mm radius;

   — the ends of hollow components are closed or capped.

b) all parts which are lubricated to assist sliding (greasing, lubricating etc.) shall be designed to protect users from lubricant stains when in normal use;

c) seats shall be securely fixed to the steps or to the supports;

d) the shape of the seats shall be such as to allow rain and water to drain and shall allow easy cleaning of it and of the underlying steps;

e) if the components are made of different materials, they shall be compatible with each other;

f) the seating place shall comply the minimum dimensions given in EN 13200-1;

g) the recommended values are given in Table 1.

Table 1 — Recommended dimensional criteria for seats

Seat type	**F** (mm)	**l** (mm)	**S** (mm)	**Row depth (B_{se})** (mm)	
				min	**rec**
Bench	300	0	0	700	800
Seat with low back	400	500	< 150	700	800
Seat with high back	400	500	> 150	700	800

5.2 General requirements for fixing elements and fixing methods

5.2.1 General

The fixing of the seats shall comply with the following requirements:

a) the fixing elements of the seats shall withstand the forces generated during the tests described in EN 12727;

b) it shall not be possible to remove the seats without the use of a special tool;

c) the fixing methods shall be compatible with the supporting structure;

d) the metal elements making up the fixing elements and fixing methods shall be protected against corrosion (see 7.2);

e) regarding materials, see Clause 6.

5.2.2 Criteria for presentation of designs

The design including plans, sections and elevations, and details of the seat, of the fixed support and of the fixing elements, at an appropriate scale, shall include the declaration of conformity to this European Standard and a report of the static tests on the seat, and the fixing support structure.

5.2.3 Acceptance testing

An independent agent shall ascertain the compliance between the design and the finished product.

The agent is entitled to accept the declaration of conformity and the calculations contained in the design or to carry out additional checks.

6 Sampling and conditioning

6.1 Sampling

The minimum number of samples to be tested shall be two.

The samples to be tested shall always be inspected before and after each test, any significant changes that have taken place shall be recorded.

6.2 Conditioning

At least two weeks in normal conditions, 23/50 according to ISO 554, shall have elapsed between manufacturing (or assembling) and testing in the case of glued joints in timber and the like.

The tests shall be carried out in normal ambient conditions but, upon agreement, tests may be carried out in special ambient conditions and these shall be recorded in the test report.

The test samples of other materials shall be contained in normal conditions, 23/50 according to ISO 554 for at least 72 h.

7 Characteristics of materials

7.1 General

Assessment of the characteristics of materials used in the seating assembly, shall be carried out on the finished products but might be carried out on test specimens derived from it, after conditioning according 6.2.

The components of seating assembly shall comply with the following requirements.

All components shall comply with the national regulations regarding fire behaviour.

7.2 Corrosion resistance

All metal components of the seating and the fixing elements shall be corrosion resistant.

This requirement is met when, after testing according with ISO 9227 for:

— 500 h of exposure for outdoor use;

— 200 h of exposure for indoor use.

No visual defects are to be noticeable; compliance is checked by visual inspection.

7.3 Resistance to weathering agents/stability to light

Plastic components of the seating shall be exposed to a xenon arc lamp according to EN ISO 4892-2.

They shall be irradiated for a total energy of 8,3 GJ/m² in the wavelength range of 295 nm to 3000 nm.

NOTE In the test conditions of xenon arc lamp described in EN ISO 4892-2 method A, this energy value is achieved with an irradiation period of 2 300 h when a spectral irradiance of 0,50 W/m²·(at 340 nm) is selected.

The test chamber conditions are the following:

— black panel temperature: 63 °C ± 3 °C;

— relative humidity: 65 % ± 5 %;

— 102 min of light;

— 18 min of light and water spray.

After exposure, the test specimens shall not show any visual defects on the exposed surface.

The assessment of colour variation rating shall be according to ISO 105-A02, grey scale.

The minimum rating shall be agreed between client and supplier.

Alternative measurements can be performed such as:

— colour variation according to ISO 7724 parts 1, 2 and 3 (Lab colour parameters);

— gloss variation according to EN ISO 2813.

When tested according to EN ISO 527-2, the exposed specimen shall have a maximum yield strain variation from the unexposed specimen of 30 %.

When tested according to EN ISO 179-1:2000, test method 1 e A, the exposed specimen shall have a maximum Charpy impact strength variation from the unexposed specimen of 30 %.

7.4 Temperature resistance

See Annex A.

8 Strength and durability requirements

Seats shall be tested according to EN 12727 to assess the mechanical resistance. Several loads and cycles can be performed according to 4 different levels of severity (1, 2, 3 and 4). At the end of the tests, there shall be no damage or deformation that will affect the safe use of the seating and the functions shall be maintained.

NOTE It is recommended to perform tests according to level 4 of EN 12727.

Table 2 — List of test methods and requirements for strength and durability according to EN 12727

Test	Loading	1	2	3	4
Type of use		**Light**	**Moderate**	**General**	**Severe**
Seat static load))) combined	force N 10 times	1 300	1 600	2 000	2 000
Back static load))	force N 10 times	560	760	760	760
Horizontal static load to back	force N	-	-	760	760
Vertical static test on back	force N	-	600	900	900
Arm sideways static load	force N	400	600	900	1 000
Arm downwards static load	force N	800	900	1 000	1 000
Seat fatigue test))) combined Back fatigue test)))	cycles Seat load 950 N Back load 330 N	50 000	100 000	150 000	200 000
Seat front edge fatigue test	cycles	50 000	100 000	150 000	200 000
	Seat load 950 N				

Table 2 — (*concluded*)

Test	Loading	1	2	3	4
Horizontal fatigue test	cycles	-	20 000	50 000	100 000
	Back load				
	330 N				
Seat impact test	Drop height mm	180	240	300	300
	10 times				
Back impact test	Height mm	210	330	620	620
	angle, degrees	38	48	68	68
	10 times				
Arm impact test	Height mm	210	330	620	620
	angle, degrees	38	48	68	68
	10 times				
Tipping seat operation test	cycles	25 000	25 000	50 000	100 000
Vertical static test on auxiliary writing surface	force N 10 times	150	200	300	300
Auxiliary writing surface Fatigue test	Cycles 150 N	10 000	10 000	25 000	25 000

9 Test report

The test report shall include the following items:

a) reference to this European Standard, i.e. EN 13200-4;

b) details of the piece of furniture tested;

c) manner of mounting if appropriate;

d) any defects observed before testing;

e) test results according to the applicable clauses;

f) details of any deviations from this European Standard;

g) name and address of the test facility;

h) date of test.

10 Seating numbers

If a numbering is required, the identification product shall be permanently identified in accordance with EN 13200-1.

11 Instruction for use

Each seating shall be accompanied by information for use and installation in the language of the country in which it will be delivered

It shall contain at least the following details:

— information regarding the intended use;

— instruction on installation, care and maintenance;

— list of parts supplied;

— list of tools required;

— diagram of the bolts and other fastening required;

— minimum rating of colour variation.

12 Marking

All seating elements for which a claim for conformity to this standard is made shall be permanently marked with the following:

— name, identification, or trademark of the manufacturer;

— means of identifying the product;

— lot number;

— year of manufacture;

— number and date of this standard.

Annex A
(informative)

Temperature resistance

A.1 Temperature resistance

A.1.1 General

These tests only apply to seats for outdoor use in order to assess that the plastic parts are able to perform their function when exposed to hot and cold climates.

A.1.2 Low temperature test

Test shall be carried out according to A.2 of ENV 581-2:2000.

At the end of the test there shall be no damage affecting safety or function.

A.1.3 High temperature test

Test shall be carried out according to A.3 and A.3.1 of ENV 581-2:2000.

At the end of the test there shall be no damage affecting safety or function.

Annex B
(informative)

Examples of seats

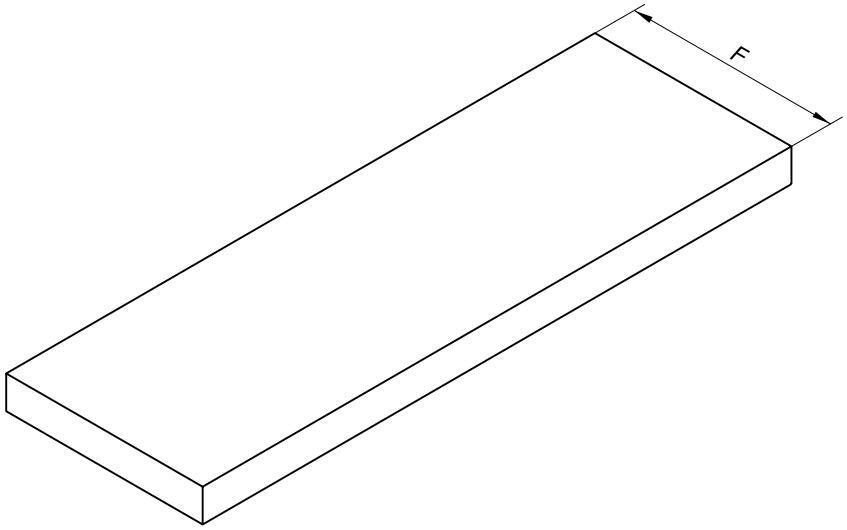


Figure B.1 — Example of bench

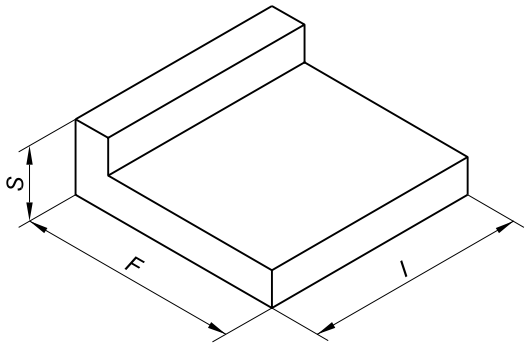


Figure B.2 — Example of low back seats

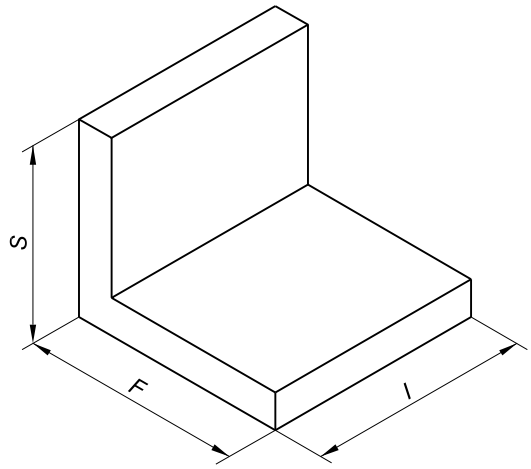


Figure B.3 — Example of high back seats

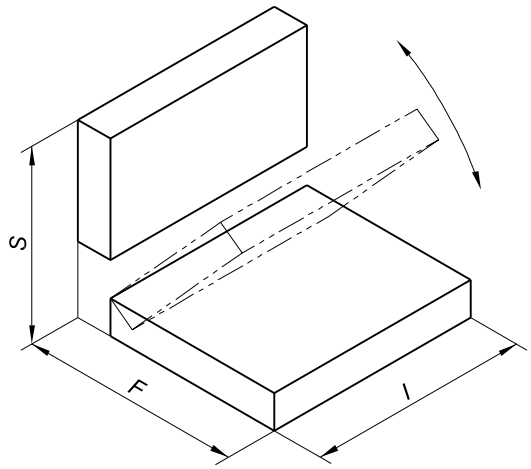


Figure B.4 — Example of tip-up seats

Annex C
(informative)

Ergonomy

C.1 Ergonomy

C.1.1 Anthropometric aspects and data

The dimensions of the human body vary considerably from individual to individual within the same population. The so-called “average” man or woman is hypothetical. There are persons who might have an average stature, or an average weight; persons who are “average” for two size values make up only 7 % of the population; 3 % match three size values; less than 2 % match four size values. In order to be operatively efficient, working environments need to conform to the variability of measurements of the human body.

C.1.2 Design requirements

When designing a chair, anthropometric aspects need to be assessed in tandem with biomechanical data. Body stability is given by both the support surface of the seat and the contact of the legs, feet and back with other supports. Muscular effort is also indispensable for stability. Seated users need therefore to be allowed to have contact (through the leg, back etc.) with support surfaces in order to increase equilibrium and reduce muscular work.

Basic sizes that need to be considered in the design of a chair are:

— height of seat from ground (min./max.);

— depth of seat;

— width and height of backrest;

— height of and distance between armrests;

— properties of headrest.

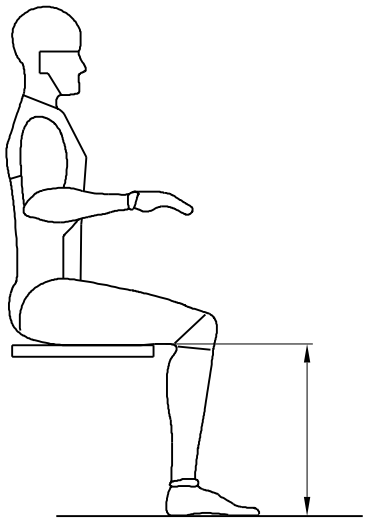
To make a chair comfortable, padding needs to be well designed.

It is also important to consider the changes of position (movement – adjustment) pertinent to a seating place in relation to human body joints.

C.1.2.1 Height of seat from ground

The popliteal height, the distance, taken vertically, from the ground to the popliteal fossa, which is the lower tip of the thigh behind the knee, is the fundamental consideration as regards the height of a seat.

Dimensions in millimetres



Height of seat			
men		*women*	
Percentile 5	*Percentile 95*	*Percentile 5*	*Percentile 95*
394	490	356	445

Figure C.1 — Height of seat

The variability of the height of the popliteal fossa, justifies the importance ascribed to flexibility and adjustability for all seat types. When determining the height of the seat, it is important to consider the type of seat, its covering and/or padding.

C.1.2.1.1 Seat set too high

The lower part of the thigh is compressed, and may prevent blood circulation. It does not allow sufficient contact of the sole of the foot with the floor, producing a reduction in body stability.

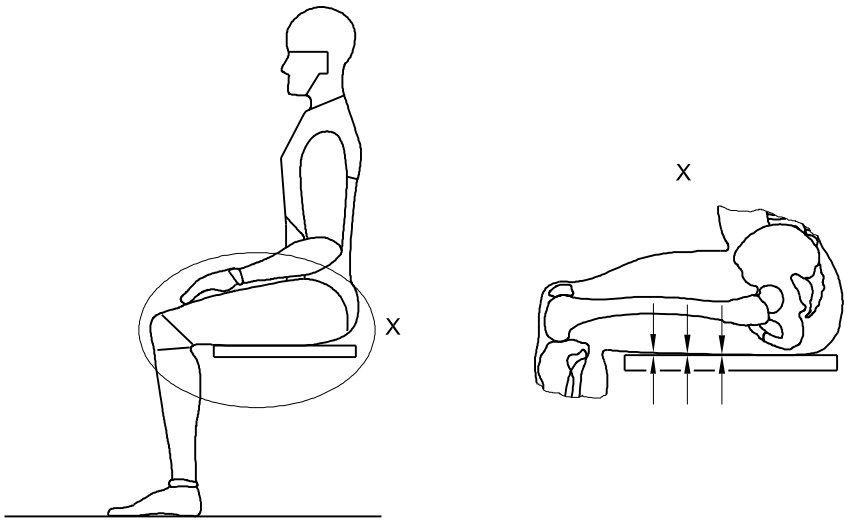


Figure C.2 — Example of seat too high

C.1.2.1.2 Seat set too low

Legs require to be extended. As a result, the feet fail to perform their stabilising function. In addition, with the body moving forward the back is distanced from the backrest, thus depriving the person sitting down of necessary support for the lumbar region.

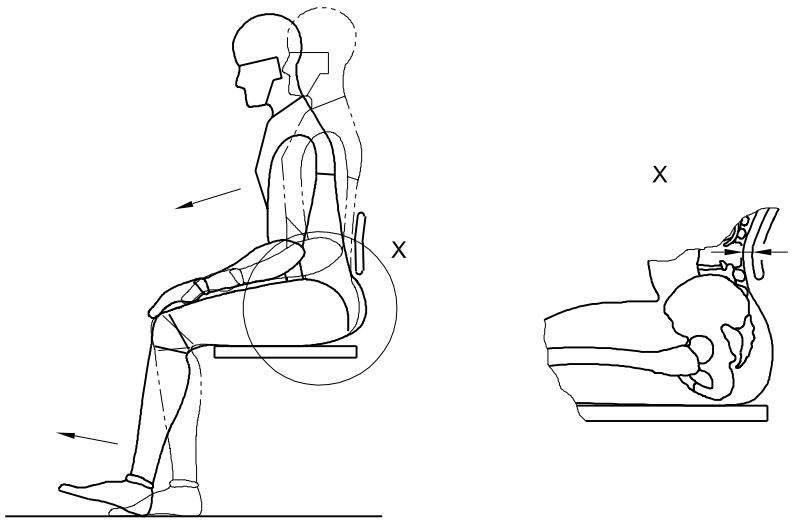
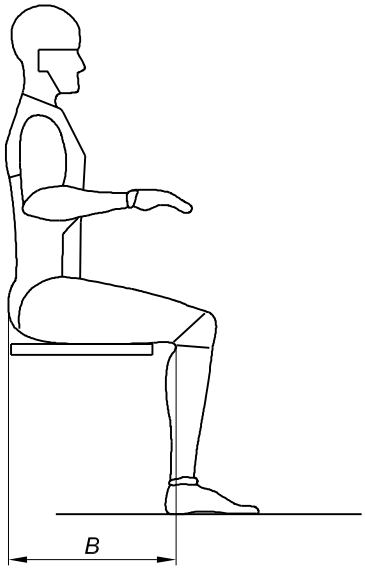


Figure C.3 — Example of seat too low

C.1.2.2 Depth of seat

The gluteal-popliteal distance (the horizontal distance between the back tip of the gluteus and the popliteal fossa), is the appropriate distance for the correct sizing of seat depth.

Dimensions in millimetres



Gluteal-popliteal distance			
men		*women*	
Percentile 5	*Percentile 95*	*Percentile 5*	*Percentile 95*
439	549	432	533

Figure C.4 — Gluteal-popliteal distance

C.1.2.2.1 Excessive seat depth

The front edge of the seat exerts pressure on the popliteal fossa (the area behind the knee), causing discomfort and blood circulation problems. To rectify this, the user tends to move forward the point of support, the gluteus, thus depriving the back of a support. Muscular effort is required to maintain a balanced position.

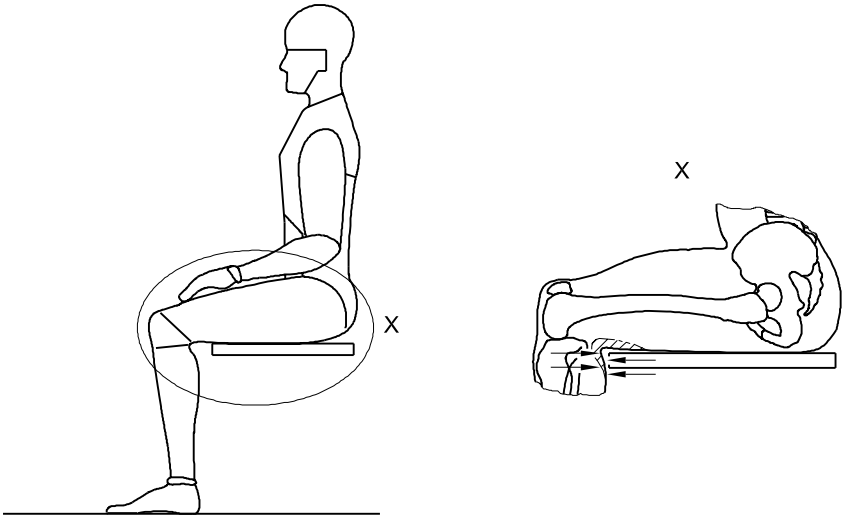


Figure C.5 — Example of excessive seat depth

C.1.2.2.2 Insufficient seat depth

This deprives the user of adequate support for the lower part of the thighs, creating an unpleasant sense of falling from the chair resulting in fatigue, discomfort and back pain.

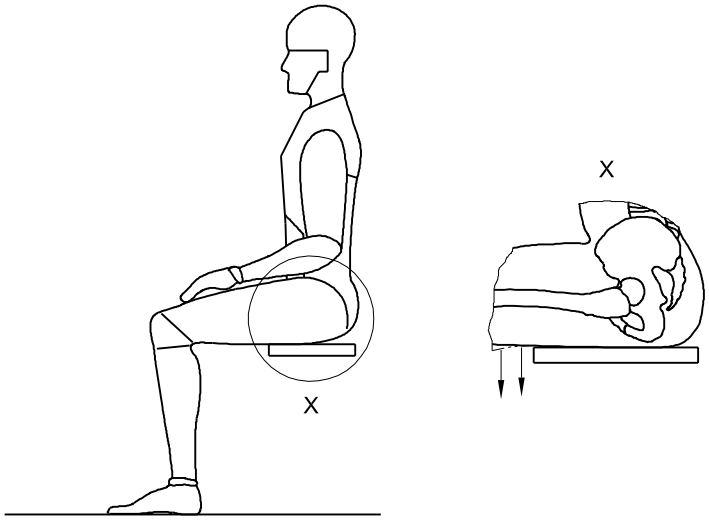


Figure C.6 — Example of insufficient seat depth

C.1.2.3 Armrests

Functions:

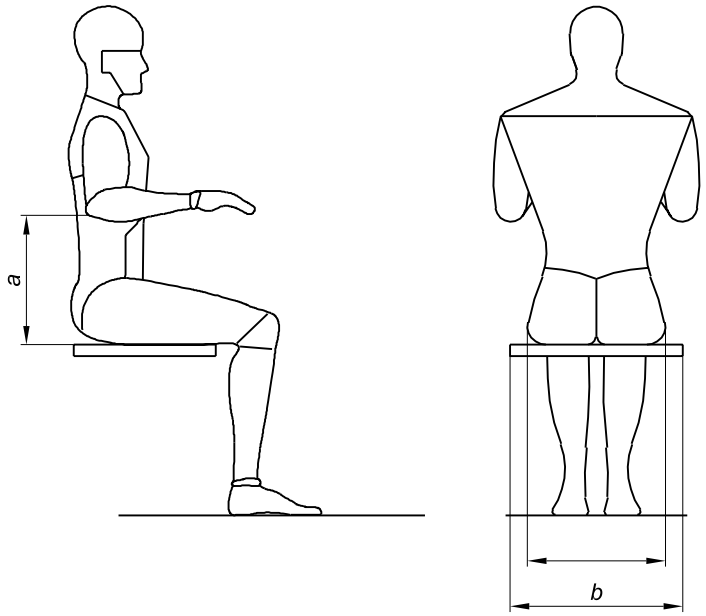
— support the weight of user's arms;

— point of support to assist with sitting down or arising from chair;

— stabilise the user's arm for various tasks.

The height of armrests should derive the height of the elbow (a) in a rest position, by measuring from the tip of the elbow to the seat's upper surface. The distance between the armrests should be evaluated on the basis of the distance between the elbows (b).

Dimensions in millimetres



Key

a) height of the elbow

b) distance between the elbows

Distance of elbow from seat			
men		*women*	
Percentile 5	*Percentile* 95	*Percentile* 5	*Percentile* 95
188	295	180	279

Distance between elbows			
men		*women*	
Percentile 5	*Percentile 95*	*Percentile 5*	*Percentile 95*
348	505	312	490

Width of pelvis			
men		*women*	
Percentile 5	*Percentile 95*	*Percentile 5*	*Percentile 95*
310	404	312	434

Figure C.7 — Arm-rests position

C.1.2.4 Backrest

The correct positioning, configuration and sizing of the backrest is essential for a correct functional relationship between the chair and the user.

The primary function of the backrest is providing support of the *lumbar region*. For this reason the configuration of the backrest should adapt to the anatomical contour of the backbone. The total height of the backrest varies or may vary according to the intended use of the chair. In the vicinity of the *gluteal region* an "adjustment" need to be made, which in design terms may be:

- an open space (between the seat and the backrest for the lumbar region);
- covering or padding with added compression in this area.

Dimensions in millimetres

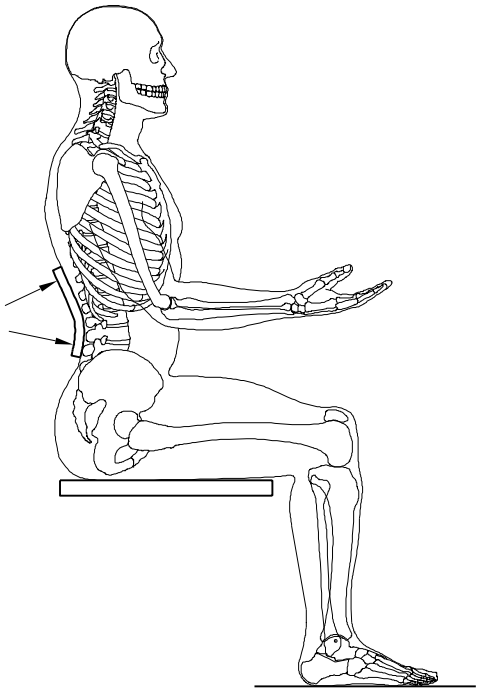
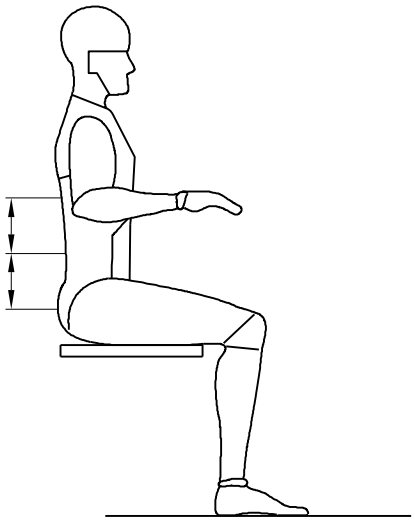


Figure C.8 — Backrest position

Dimensions in millimetres



Height of lumber region			
men		*women*	
Percentile *5*	*Percentile* *95*	*Percentile* *5*	*Percentile* *95*
432	483	330	483

Figure C.9 — Height of lumbar region

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[9] ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

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