BS EN 1729-1:2015
Incorporating corrigendum August 2016

BSI Standards Publication

Furniture — Chairs and tables for educational institutions

Part 1: Functional dimensions

bsi.

National foreword

This British Standard is the UK implementation of EN 1729-1:2015, incorporating corrigendum August 2016. It supersedes BS EN 1729-1:2006 which is withdrawn.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by CEN corrigendum August 2016 is indicated in the text by [AC1] 〈AC1〉.

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Ameublement - Sièges et tables pour établissements d'enseignement - Partie 1 : Dimensions fonctionnelles

Möbel - Stühle und Tische für Bildungseinrichtungen - Teil 1: Funktionsmaße

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (EN 1729-1:2015) 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of an identical text or by endorsement, at the latest by June 2016 and conflicting national standards shall be withdrawn at the latest by June 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1729-1:2006.

Compared to EN 1729-1:2006, the following modifications have been made:

a) addition of an annex for functional dimensions of tall chairs (Annex D);

b) addition of an annex for functional dimensions of stools and associated worksurfaces (Annex E);

c) key dimensions of chairs in Annexes A and D are measured using the school chair measuring device (see Annex F), some of them when the chair is loaded with specified loads;

d) a rationale for the functional dimensions of chairs and tables is provided (Annex I).

EN 1729 is composed of the following parts:

— *Part 1: Functional dimensions* [the present document];

— *Part 2: Safety requirements and test methods*.

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

Introduction

This part of EN 1729 is based on the principle that chairs and tables, intended for use in educational institutions for general-purpose education, should be designed to encourage good postures.

This part of EN 1729 takes selected national standards into consideration.

It does not specify design, but only those dimensions which promote good posture for either fixed or adjustable furniture. The dimensional requirements of this European Standard permit various interpretations of design; hence customs, educational practices, technical and financial circumstances of individual countries can be satisfied. It includes a rationale for the determination of functional dimensions.

The minimum dimensions specified are considered as the absolute minimum. They can be exceeded. The maximum dimensions specified are considered as the absolute maximum; smaller dimensions can be used.

EN 1729-2 specifies safety requirements and test methods.

1 Scope

This European Standard specifies functional dimensions and markings for all chairs, stools and tables, for educational institutions, including fixed and adjustable chairs and tables.

It applies to both un-upholstered and upholstered chairs and stools as well as to both non-swivel and swivel chairs. It applies to furniture for use with laptop computers or portable devices.

It does not apply to ranked seating or special purpose workstations.

It does not apply to furniture used by teaching personnel.

Annex A (normative) includes single-sloped chairs and associated tables.

Annex B (normative) includes double-sloped high chairs and associated tables.

Annex C (normative) includes standing-height tables.

Annex D (normative) includes tall chairs and associated tables.

Annex E (normative) includes stools and associated worksurfaces.

Annex F (normative) includes measurement methods.

Annex G (informative) includes guidance on size marks for adjustable chairs and tables.

Annex H (informative) includes guidance on calculating heights of double-sloped chairs and associated tables.

Annex I (informative) includes a rationale for functional dimensions.

2 Normative references

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

EN 1729-2, *Furniture - Chairs and tables for educational institutions - Part 2: Safety requirements and test methods*

3 Terms and definitions

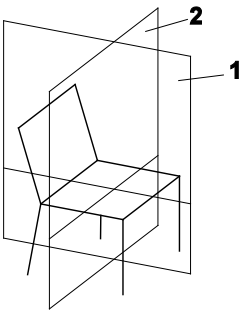
For the purposes of this document, the following terms and definitions apply.

3.1
median plane
vertical plane running from front to rear through the centre of the seat, dividing the chair into two equal parts

Note 1 to entry: See Figure 1.

3.2
transverse plane
vertical plane perpendicular to the median plane passing through the centre of the seat

Note 1 to entry: See Figure 1.



Key

1 median plane

2 transverse plane

Figure 1 — Illustration of the median and transverse planes

3.3
most forward point of the backrest (Point S)
most forward point in the specified range of the backrest on the median plane

Note 1 to entry: The specified range of the backrest is shown in Table F.2.

Note 2 to entry: See Figure A.3, Figure B.3 and Figure D.3.

3.4
adjustable furniture
furniture that can be adjusted by the users (pupils), without the need for tools

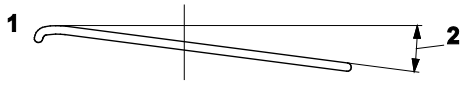
3.5
multi-size furniture
furniture that is adjustable at installation (not by the users) to change dimensions from one size mark to another

3.6
double-sloped seat
seat intended for sitting using either the front part of the seat (leaning forward) or the rear part of the seat (leaning backward), with the feet resting on a footrest or the floor

Note 1 to entry: See Figure 5 and Figure B.5.

3.7
inclination of a single-sloped seat and of the front part of a double-sloped seat (α)
angle formed by the front part of the seat and the horizontal

Note 1 to entry: See Figure 2, Figure 3, Figure 4 and Figure 5.

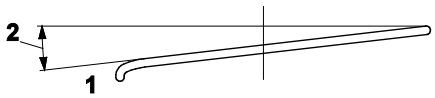


Key

1 front

2 $\alpha < 0°$ (negative for rearward-sloping seats)

Figure 2 — Example of a single-sloped seat with a negative seat angle

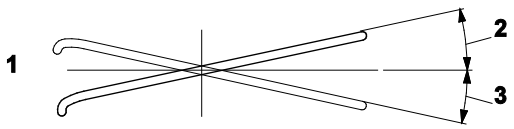


Key

1 front

2 $\alpha > 0°$ (positive for forward-sloping seats)

Figure 3 — Example of a single-sloped seat with a positive seat angle



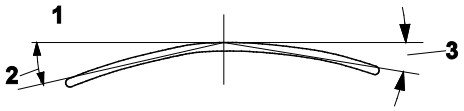
Key

1 front

2 $\alpha > 0°$

3 $\alpha < 0°$

Figure 4 — Examples of a single-sloped tiltable seat



Key

1 front

2 $\alpha > 0°$

3 $\delta < 0°$

Figure 5 — Example of a double-sloped seat (see Annex B)

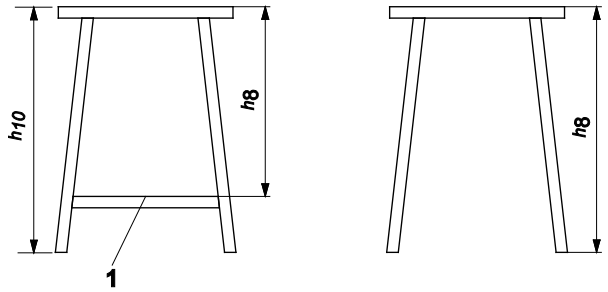
3.8
inclination of the rear part of a double-sloped seat (δ)
angle formed by the horizontal and the rear part of the seat, determined in the median plane

Note 1 to entry: See Figure 5.

3.9
stool
seating without backrest or armrests and intended for use for short periods

Note 1 to entry: See Figure 6. The seat height to the footrest, h_8, can be to one size mark and the seat height to the floor, h_8, can be to another size mark, as defined in Table E.1.

Note 2 to entry: Any upward extension at the back of the stool below the Point S range specified in Table F.2 cannot be considered to be a backrest and the seating can be considered to be a stool (see Figure E.3).



Key

1 footrest

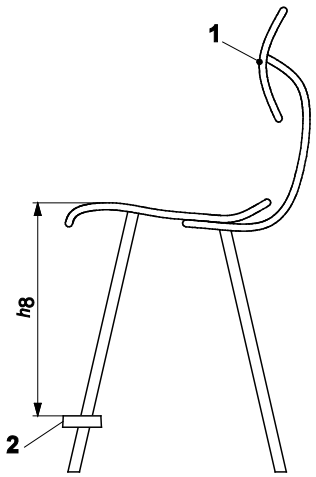
h_8 seat height for stools as specified in Table E.1

h_{10} total stool height

Figure 6 — Stools with and without footrest

3.10
tall chair
chair with the height of seat from the floor higher than the seat height specified in Table A.1 and with a footrest as shown in the figure below

Note 1 to entry: See Figure 7.



Key

1 Point S

2 footrest

h_8 seat height for tall chair as specified in Table D.1

Figure 7 — Tall chair with footrest

3.11
school chair measuring device
SCMD
measuring device intended for determining Point S, buttock zone and chair dimensions of school chairs

Note1 to entry: Details of the SCMD and the method of use are given in Annex F.

4 Functional dimensions for chairs and tables

The functional dimensions and corresponding size marks and colour codes for chairs with slopes between −5° and +7° and associated tables shall be as specified in the normative Annex A.

The functional dimensions and corresponding size marks and colour codes for high chairs with double-sloped seats and associated tables shall be as specified in the normative Annex B.

The functional dimensions and corresponding size marks and colour codes for standing-height tables shall be as specified in normative Annex C.

The functional dimensions and corresponding size marks and colour codes for tall chairs shall be as specified in the normative Annex D. Tables suitable for tall chairs cannot be size marked. Tables shall correspond to the height of tall chairs as in Table D.2.

The functional dimensions and corresponding size marks and colour codes for stools shall be as specified in the normative Annex E. Worksurfaces shall correspond to the height of stools as in Table E.3.

Adjustable and multi-size furniture shall fulfil the requirements specified in Annex A, Annex B, Annex C, Annex D or Annex E.

The stature and popliteal height ranges shown in Table A.1, Table A.2, Table B.1, Table B.2, Table C.1 and Table D.1 do not include any allowance for shoes. All chair and table heights include an allowance for shoes.

Assessment needs to be carried out according to EN 1729-1 before being tested according to EN 1729-2.

5 Marking

Chairs and tables in Annex A shall be marked as 0 to 7. Chairs and tables in Annex B shall be marked as B0 to B7. Standing-height tables in Annex C shall be marked as C0 to C7. Tall chairs in Annex D shall be marked as D0 to D7. Stools in Annex E shall be marked as E0 to E7.

The marking of fixed and adjustable chairs and tables shall be legible and indelible and shall include at least the following information:

a) size mark or colour code or both, as specified in Annex A, Annex B, Annex C, Annex D or Annex E;

b) marking on adjustable furniture of the size marks covered;

c) name and/or trade name and/or mark and address of the manufacturer or his or her authorized representative in full or in abbreviated form, provided the abbreviation enables the manufacturer and/or his or her authorized representative to be identified;

d) date of production by stating at least the year and month of production.

Tall chairs shall also be marked with a reference where to find information on the table height they are intended to be used with. This information shall be provided on a label directly or via a web address, QR-code or other suitable application. Tables that are intended for use with tall chairs shall be marked with their height (distance from the floor to the top of the table). This information shall be provided on a label directly or via a web address, QR-code or other suitable application.

6 Instructions

The instructions shall be submitted with the furniture in the official languages(s) of the country where the furniture is sold. They can be given affixed to the furniture, on a label, in a leaflet or in the instructions for use. They shall include at least the following:

a) **Size mark reference**: size mark identification shall be referenced to this European Standard;

b) **Maintenance instructions**: including information on maintenance and cleaning;

c) **Installation instructions for multi-size furniture**: instructions on how to adjust the furniture to fit a specific group of pupils;

d) **Adjustability information**: instructions for the users (pupils) of adjustable furniture shall include information on how to operate the adjustments and information on how to recognize correct settings and therefore a good posture;

e) **Warning concerning the hazard when working with gas lifts**: “Attention: Any repair or service work with gas cylinders shall be carried out by trained persons only.”

If the height adjustment is continuous, there is no need to show each size mark explicitly. It is sufficient to have an indication showing the size marks it covers and to have a set of clear instructions, with drawings, on how to adjust the chair to achieve a good posture. This also applies to tables.

NOTE Appropriate drawings or pictures can be used to reinforce the information in instruction leaflets.

7 Approval of range

In order to approve a range of chairs, stools or tables, each size mark within the range shall be measured separately.

When assessing table top dimensions for a range of tables, if there are six or fewer different table top shapes or sizes in the range, all table tops shall be measured. If there are more than six different table top shapes or sizes, six shall be measured and the additional table top shapes or sizes shall be assessed from the manufacturer's drawings of them. The drawings shall show full details (dimensions) of each table top and its under frame structure. The information provided shall be used to assess whether the size of table top and legroom clearance fulfil the requirements of the standard.

The test report shall state which table tops have been measured and which have been assessed from drawings. These drawings shall be attached to the report.

Annex A
(normative)

Functional dimensions for chairs with slopes between −5° and +7° and associated tables

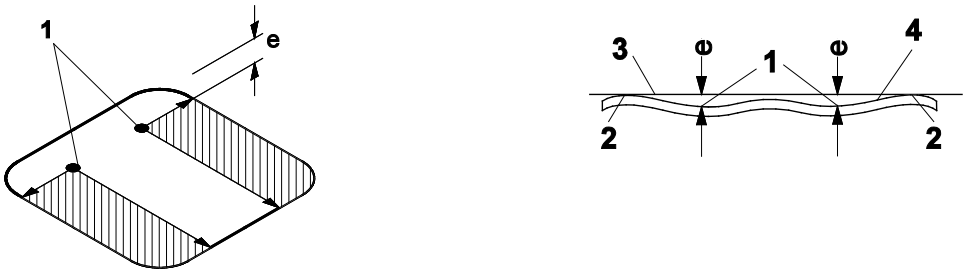
A.1 Functional dimensions and size marks for chairs

The dimensions, angles, size marks and colour codes for chairs shall be as given in Table A.1. Where dimensions are stated as ranges, the measured dimension shall be any value in this range.

All accessible edges shall be rounded or chamfered.

Room for free movement of the buttocks shall be ensured. If the backrest extends below Point S, it shall be angled rearwards such as to maintain the buttock zone as shown in Figure A.3.

Raised edges and surfaces shall not dig into thighs. This applies to points or edges on the seat surface or frame in front of the position indicated by the rear pins on the SCMD, outside the planes through the rear pins which are parallel to the median plane, as shown by the shaded area in Figure A.1. This requirement is fulfilled when these points are not higher than 15 mm above the lowest point on the seat surface in the planes through the rear pins and parallel to the median plane for size marks 0 to 3 and 25 mm above the lowest point for size marks 4 to 7.



a) Isometric view of seat pad **b) Cross-section of seat parallel to transverse plane**

Key

1 position on the seat of the rear pins of the SCMD

2 raised edge or surface

3 horizontal bar

4 top surface of seat

e height of raised edges or surfaces, ≤ 15 mm for size marks 0 to 3 and ≤ 25 mm for size marks 4 to 7

Figure A.1 — Dimensions of raised seat edges

Determination of functional dimensions

The determination of the functional dimensions of chairs is specified below. See also Figure A.2, Figure A.3, Figure A.4, Figure A.5 and Figure A.6. If the seat and/or backrest is adjustable or tiltable, the seat shall be set to horizontal or as close as possible to horizontal and the backrest shall be set to vertical or as close as possible to vertical. If the SCMD is used, these shall be set after the SCMD is placed on the chair, and if a load is placed on the SCMD these shall be set after loading.

(h_8) The height of the seat is the vertical distance between the highest point on the front of the seat, as determined by the SCMD, and the ground. See Figure A.5 and Figure A.6.

(t_4) The effective depth of the seat is the horizontal distance from Point S along the median plane to the front edge of the seat, the position of which shall be determined by the front edge indicator pins of the SCMD. See Figure A.5 and Figure A.6.

(b_3) The width of the seat shall be determined as the horizontal distance between vertical lines through the side edges of the seat surface at a distance from the front of the seat equal to half of t_4. See Figure A.2. The width of the seat shall include the frame where it is a continuation or integral part of the seat surface.

(h_7) The height of the backrest is the vertical distance between the top and the bottom of the backrest, determined on the median plane. See Figures A.5 and A.6.

〚AC1〛 **(b_4) The width of the backrest** is the greatest horizontal distance between its side edges in the Backrest range as defined by the two pins of the backrest locator (component 12 of the SCMD as shown in Figure F.1). The width of the backrest shall include the frame where it is a continuation or integral part of the backrest. See Figure A.2. 〚AC1〛

(r_2) The horizontal radius of the backrest shall be determined on the horizontal plane, at the same height as Point S. See Figure A.2.

(α) The inclination of a single-sloped seat is the angle between the seat and the horizontal as determined by the SCMD on the chair. It is the angle between the horizontal and the top of the SCMD base plate under load. See Annex F and Figure 2, Figure 3, Figure 4 and Figure F.1.

(γ) The angle between the seat and the backrest shall be determined by the SCMD on the chair under load. On the SCMD, it is the angle between the vertical arm when it is inclined at the angle of the backrest and the top of the base plate. See Annex F and Figure F.1, Figure A.5 and Figure A.6.

(o) The width of the armrest is the minimum distance between the sides of the armrest/armrest pad, measured at 5 mm below the top surface of the armrest. See Figure A.4.

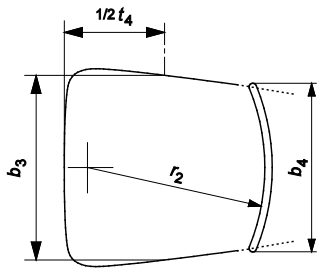
(p) The height of the armrest above the seat shall be determined by the SCMD on the chair. On the SCMD, it is the vertical distance between the top of the armrests and the bottom of the rear pins of the SCMD. See Annex F and Figure F.1 and Figure A.4.

(q) The distance from the backrest to the front of the armrest is the maximum horizontal distance between Point S and the front of the top of the armrest, the position of which is determined by the SCMD. See Figure A.4.

(r) The width between the armrests is the minimum horizontal distance between the armrests/armrest pads. See Figure A.4.

(n) The length of the armrest is the greatest length in the fore and aft direction of the armrest horizontally within 20 mm below the highest point. See Figure A.4.

(x) The distance between Point S and the back of the seat pad is the horizontal distance on the median plane between the rear edge of the seat and the vertical projection of Point S. It shall be determined only if the back of the seat pad does not extend behind Point S. See Figure A.5 and Figure A.6.



Key

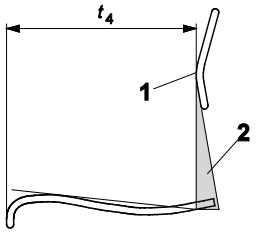
b_3 width of seat

b_4 width of backrest

r_2 horizontal radius of backrest

t_4 effective depth of seat

Figure A.2 — Key dimensions of a chair (plan view)



Key

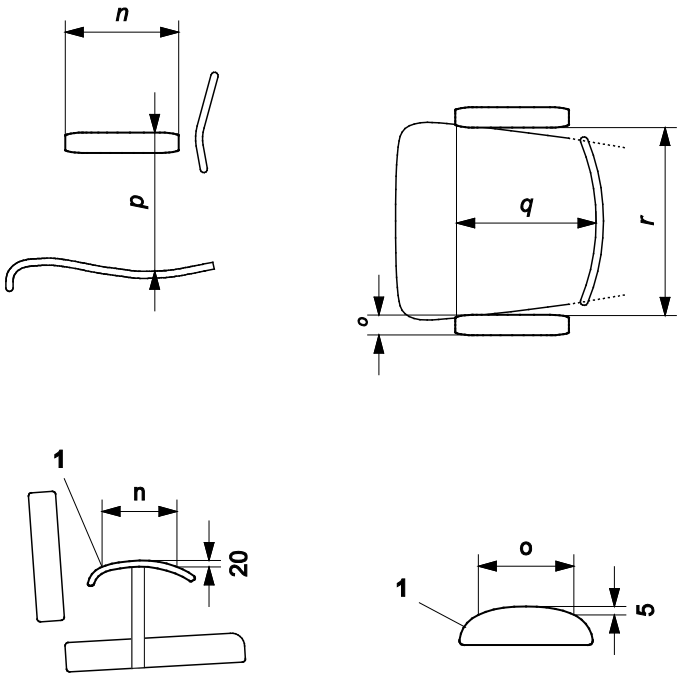
1 Point S

2 buttock zone

t_4 effective depth of seat

Figure A.3 — Key dimensions of a chair (section view) and the buttock zone (shaded area)

All dimensions in millimetres



Key

1 armrest

n length of armrest

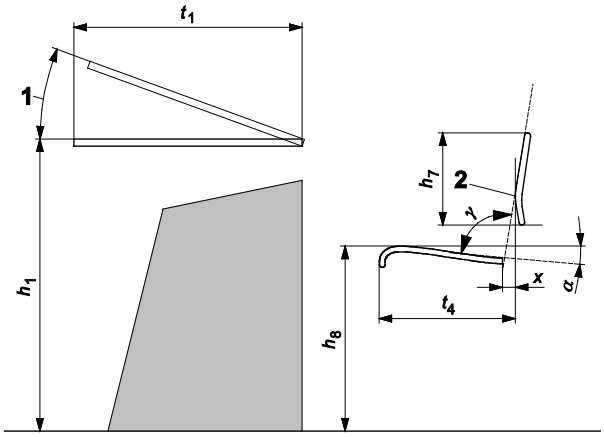
o width of armrest

p height of armrest above the seat

q distance from backrest to front of armrest

r width between armrests

Figure A.4 — Key dimensions for armrests



Key

1 inclination of the table top (the maximum value for a fixed or inclinable table top is 20°)

2 Point S

α inclination of single-sloped seat

γ angle between seat and backrest

h_1 height of table top

h_7 height of backrest

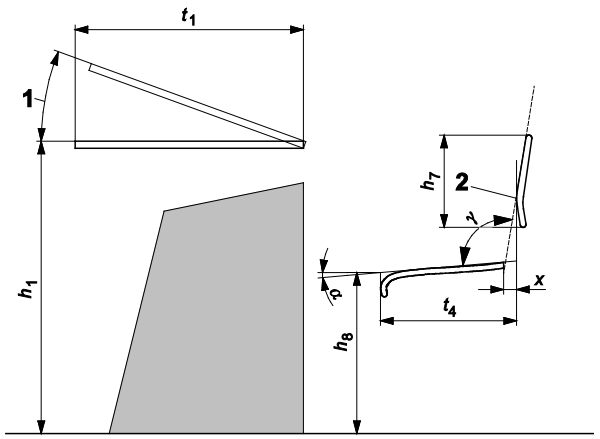
h_8 height of seat

t_1 depth of table top

t_4 effective depth of seat

x distance between Point S and back of seat pad

Figure A.5 — Key dimensions of a chair with a negative seat angle and associated table



Key

1 inclination of the table top (the maximum value for a fixed or inclinable table top is 20°)

2 Point S

α inclination of single-sloped seat

γ angle between seat and backrest

h_1 height of table top

h_7 height of backrest

h_8 height of seat

t_1 depth of table top

t_4 effective depth of seat

x distance between Point S and back of seat pad

Figure A.6 — Key dimensions of a chair with a positive seat angle and associated table

Table A.1 — Dimensions and size marks for chairs with single-sloped seats

All dimensions in millimetres unless otherwise stated

Size mark	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Colour code	**White**	**Orange**	**Violet**	**Yellow**	**Red**	**Green**	**Blue**	**Brown**
Popliteal range (without shoes)	**200–250**	**250–280**	**280–315**	**315–355**	**355–405**	**405–435**	**435–485**	**485+**
Stature range (without shoes)	**800 –950**	**930 –1 160**	**1 080 –1 210**	**1 190 –1 420**	**1 330 –1 590**	**1 460 –1 765**	**1 590 –1 880**	**1 740 –2 070**
h_8 Height of seat ± 10	210	260	310	350	380	430	460	510
t_4 Effective depth of seat ± 15 (0–2), ± 25 (3–7)	n/a	n/a	n/a	300	340	380	420	460
b_3 Seat width (min)	210	240	280	320	340	360	380	400
x Distance between Point S and back of seat pad (max)	n/a	n/a	n/a	30	30	50	50	50
h_7 Backrest height (min)	100	100	100	100	100	100	100	100
b_4 Width of backrest (min)	n/a	n/a	n/a	260	270	300	330	360
r_2 Horizontal radius of backrest (min)	n/a	n/a	n/a	300	300	300	300	300
α Inclination of seat	n/a	n/a	n/a	-5° to +7°	-5° to +7°	-5° to +7°	-5° to +7°	-5° to +7°
γ Angle between seat and backrest	n/a	n/a	n/a	95° to 110°	95° to 110°	95° to 110°	95° to 110°	95° to 110°
p Height of armrest above seat –20 to +10	n/a	n/a	n/a	170	190	210	230	250
r Width between arms	n/a	n/a	n/a	360–410	390–440	420–470	460–510	510 - 570
q Distance from backrest to front edge of armrest (max)	n/a	n/a	n/a	n/a	225	250	275	300
o Width of armrest (min)	n/a	n/a	n/a	n/a	20	20	20	20
n Length of armrest (min)	n/a	n/a	n/a	n/a	80	80	80	80

A.2 Functional dimensions and size marks for tables

Table tops may be horizontal, with a fixed inclination or inclinable by the user. If the table top is user inclinable, it shall be possible to adjust it to a horizontal position.

Table tops which are or can be inclined are recommended.

Table A.2 — Dimensions and size marks for tables for use with chairs with seat slopes between −5° and +7°

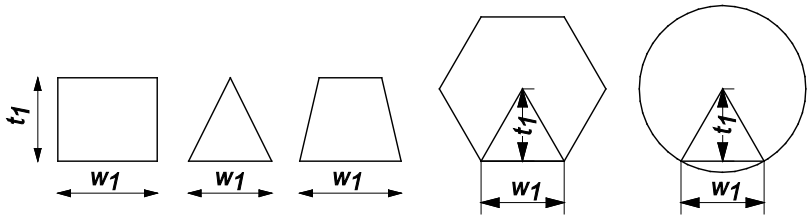
All dimensions in millimetres unless otherwise stated

Size mark	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Colour code	**White**	**Orange**	**Violet**	**Yellow**	**Red**	**Green**	**Blue**	**Brown**
Popliteal range (without shoes)	**200–250**	**250–280**	**280–315**	**315–355**	**355–405**	**405–435**	**435–485**	**485+**
Stature range (without shoes)	**800–950**	**930 –1 160**	**1 080 –1 210**	**1 190 –1 420**	**1 330 –1 590**	**1 460 –1 765**	**1 590 –1 880**	**1 740 –2 070**
h_1 Height of top ± 20	400	460	530	590	640	710	760	820
t_1 Depth of top (min)	-	500 [a]	500 [a]	500 [a]	500	500	500	500
w_1 Width of top, per person at front edge, where pupils sit (min)	-	600 [b]	600 [b]	600 [b]	600 [b]	600	600	600
Surface area per person (min)	-	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2
Horizontal distance between front legs/structure, where pupils sit, per person (min)	-	500 [c]	500 [c]	500 [c]	500 [c]	500	500	500

[a] Can be reduced to 400 mm (only when required by educational conditions).

[b] Can be reduced to 550 mm (only when required by educational conditions).

[c] Can be reduced to 450 mm (only when required by educational conditions).



a) Table for one pupil **b) Shared table**

Key

t_1 depth of top

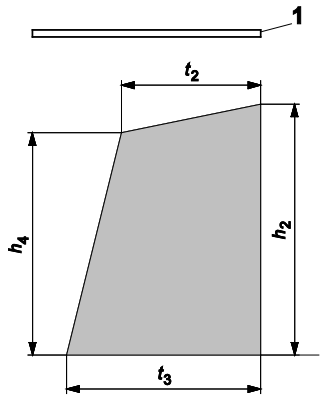
w_1 width of top, per person at front edge, where pupils sit

Figure A.7 — Examples of different table tops

A.3 Legroom

Legroom beneath the worksurfaces (tables and desks) shall be provided for each size mark in accordance with the minimum dimensions as shown in Table A.3 and Figure A.8.

The legroom shall be measured by placing the template on the floor with its higher end in line with the front edge of the table, where pupils sit, transversing between the legs of the table. Overlapping of legroom templates is acceptable for a group of tables.



Key

1 front of table top

h_2 legroom height at front of table top

h_4 height of back of legroom

t_2 depth of top of legroom

t_3 depth of bottom of legroom

Figure A.8 — Legroom template

Table A.3 — Minimum legroom template dimensions for tables for use with chairs with seat slopes between −5° and +7°

All dimensions in millimetres

	Size marks							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
h_2	325	380	440	495	545	610	665	725
h_4	275	325	375	420	465	520	565	620
t_2	300	300	300	300	400	400	400	400
t_3	400	400	400	400	500	500	500	500

The minimum width of the legroom is given in Table A.2 (horizontal distance between front legs/structure, where pupils sit, per person).

A.4 Requirements for adjustable chairs and tables

Adjustment controls shall:

a) be easily accessible to the user;

b) be possible to operate without the need for tools.

Adjustable furniture shall cover two or more size marks. It shall be possible to identify the size marks to which the furniture can be adjusted.

Adjustable furniture (chairs and tables) designed to cover a range of size marks shall comply with the dimensional requirements of each size mark covered (see Table A.1 and Table A.2).

Adjustments may be continuous or in fixed steps.

Examples of dimensions of adjustable chairs and tables are given in Annex G.

Annex B
(normative)

Functional dimensions for high chairs with double-sloped seats and associated tables

B.1 Functional dimensions and size marks for chairs

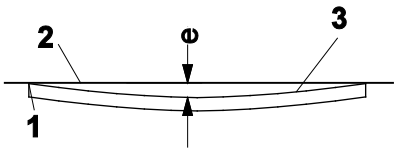
The dimensions, angles, size marks and colour codes for chairs shall be as given in Table B.1. Where dimensions are stated as ranges, the measured dimension shall be any value in this range.

The depth of the rear part of the seat (t_6) shall not be less than 50 % of the seat depth (t_4).

All accessible edges shall be rounded or chamfered.

Room for free movement of the buttocks shall be ensured. If the backrest extends below Point S, it shall be angled rearwards so as to maintain the buttock zone as shown in Figure B.3.

Raised edges and surfaces shall not dig into thighs. They shall not be higher than 15 mm above the lowest point on the seat surface in the transverse direction of the seat for size marks 0 to 3 and 25 mm above the lowest point in the transverse direction for size marks 4 to 7. See Figure B.1.



Key

1 raised edge or surface

2 horizontal bar

3 top surface of seat

e height of raised edges or surfaces, ≤ 15 mm for size marks 0 to 3 and ≤ 25 mm for size marks 4 to 7

Figure B.1 — Dimensions of raised seat edges

Determination of functional dimensions

The determination of the functional dimensions of chairs is specified below. See also Figure B.2, Figure B.3, Figure B.4 and Figure B.5. If the seat and/or backrest is adjustable or tiltable, the seat shall be set to horizontal or as close as possible to horizontal and the backrest shall be set to vertical or as close as possible to vertical.

Guidance for the calculation of the height of chairs and tables can be found in Annex H (informative).

(h_8) The height of the seat is the vertical distance between the highest point of the seat, in the median plane, and the ground. See Figure B.5.

(t_4) The effective depth of the seat is the horizontal distance from Point S along the median plane to the front edge of the seat. See Figure B.5.

(t_5) The depth of the front part of the seat shall be determined on the median plane. It is the horizontal distance between the front edge of the seat and the apex of the seat. See Figure B.5.

(t_6) The depth of the rear part of the seat shall be determined on the median plane. It is the horizontal distance between Point S and the apex of the seat. See Figure B.5.

(b_3) The width of the seat shall be determined as the horizontal distance between vertical lines through the side edges of the seat surface at a distance from the front of the seat equal to half of t_4. See Figure B.2. The width of the seat shall include the frame where it is a continuation or integral part of the seat surface.

(h_7) The height of the backrest is the vertical distance between the top and the bottom of the backrest, determined on the median plane. See Figure B.5.

(b_4) The width of the backrest is the greatest horizontal distance between its side edges in the Point S range as specified in Table F.2. The width of the backrest shall include the frame where it is a continuation or integral part of the backrest. See Figure B.2.

(r_2) The horizontal radius of the backrest shall be determined on the horizontal plane, at the same height as Point S. See Figure B.2.

(α) The inclination of the front part of a double-sloped seat is measured on the median plane, as the angle between the horizontal and the line passing through the upper part of the front edge of the seat and the apex of the seat. See Figure 5 and Figure B.5.

(δ) The inclination of the rear part of a double-sloped seat is measured on the median plane, as the angle between the horizontal and the line passing through the upper part of the rear edge of the seat and the apex of the seat. See Figure 5 and Figure B.5.

(γ) The angle between the seat and the backrest is defined as the angle between the rear part of the seat and the backrest. It is measured on the median plane, as the angle between the backrest and the line passing through the upper part of the rear edge of the seat and the apex of the seat. See Figure B.5.

(o) The width of the armrest is the minimum distance between the sides of the armrest/armrest pad, measured at 5 mm below the top surface of the armrest. See Figure B.4.

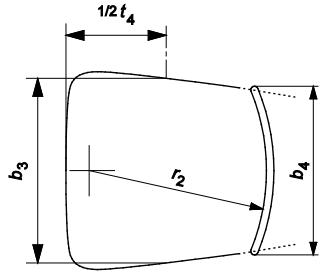
(p) The height of the armrest above the seat is the vertical distance between the top of the armrest and the apex of the seat. See Figure B.4.

(q) The distance from the backrest to the front of the armrest is the maximum horizontal distance between Point S and the front of the top of the armrest. See Figure B.4.

(r) The width between the armrests is the minimum horizontal distance between the armrests/armrest pads. See Figure B.4.

(n) The length of the armrest is the greatest length in the fore and aft direction of the armrest horizontally within 20 mm below the highest point. See Figure B.4.

(x) The horizontal distance between Point S and the back of the seat pad is the horizontal distance on the median plane between the rear edge of the seat and the vertical projection of Point S. It shall be determined only if the back of the seat pad does not extend behind Point S. See Figure B.5.



Key

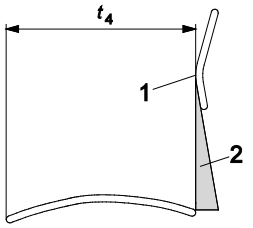
b_3 width of seat

b_4 width of backrest

r_2 horizontal radius of backrest

t_4 effective depth of seat

Figure B.2 — Key dimensions of a chair (plan view)



Key

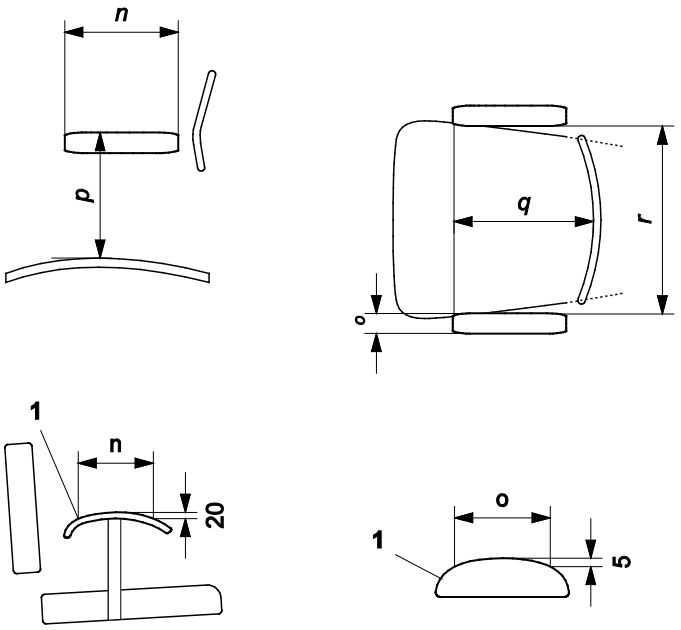
1 Point S

2 buttock Zone

t_4 effective depth of seat

Figure B.3 — Key dimensions of a chair (section view) and the buttock zone (shaded area)

All dimensions in millimetres



Key

1 armrest

n length of armrest

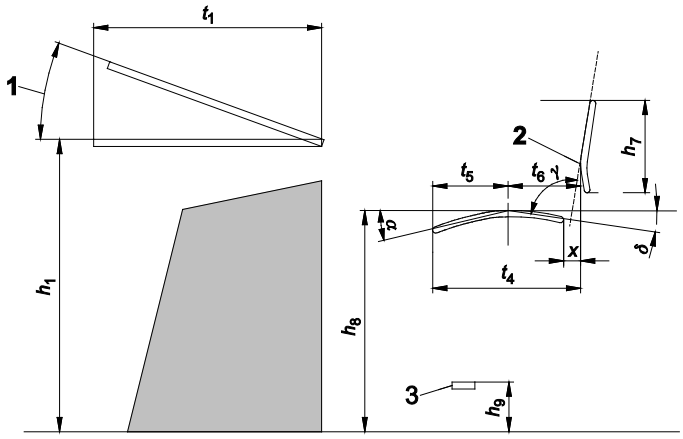
o width of armrest

p height of armrest above the seat

q distance from backrest to front of armrest

r width between armrests

Figure B.4 — Key dimensions for armrests



Key

1 inclination of the table top (the maximum value for a fixed or inclinable table top is 20°)

2 Point S

3 footrest

α inclination of front part of double-sloped seat

γ angle between seat and backrest

δ inclination of rear part of double-sloped seat

h_1 height of table top

h_7 height of backrest

h_8 height of seat

h_9 height of footrest

t_1 depth of table top

t_4 effective depth of seat

t_5 depth of front part of seat

t_6 depth of rear part of seat

x distance between Point S and back of seat pad

Figure B.5 — Key dimensions of a double-sloped seat and associated table

Table B.1 — Dimensions and size marks for high chairs with double-sloped seats

All dimensions in millimetres unless otherwise stated

Size mark	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Colour code	**White**	**Orange**	**Violet**	**Yellow**	**Red**	**Green**	**Blue**	**Brown**
Popliteal range (without shoes)	**200–250**	**250–280**	**280–315**	**315–355**	**355–405**	**405–435**	**435–485**	**485+**
Stature range (without shoes)	**800–950**	**930–1160**	**1 080–1 210**	**1 190–1 420**	**1 330–1 590**	**1 460–1 765**	**1 590–1 880**	**1 740–2 070**
α Inclination of the front part of the seat (max)	+15°	+15°	+15°	+15°	+15°	+15°	+15°	+15°
δ Inclination of the rear part of the seat	0° to –5°	0° to –5°	0° to –5°	0° to –5°	0° to –5°	0° to –5°	0° to –5°	0° to –5°
h_8 Height of seat ± 10	210+220(tan 2α)	260+240(tan 2α)	310+270(tan 2α)	350+300(tan 2α)	380+340(tan 2α)	430+380(tan 2α)	460+420(tan 2α)	510+460(tan 2α)
t_4 Effective depth of seat ± 15 (0–2), ± 25 (3–7)	n/a	n/a	n/a	300	340	380	420	460
b_3 Seat width (min)	210	240	280	320	340	360	380	400
x Distance between Point S and back of seat pad (max)	n/a	n/a	n/a	30	30	50	50	50
h_7 Backrest height (min)	100	100	100	100	100	100	100	100
b_4 Width of backrest (min)	n/a	n/a	n/a	260	270	300	330	360
r_2 Horizontal radius of backrest (min)	n/a	n/a	n/a	300	300	300	300	300
γ Angle between seat and backrest	n/a	n/a	n/a	95° to 110°	95° to 110°	95° to 110°	95° to 110°	95° to 110°
h_9 Height of footrest [a]	n/a	n/a	n/a	h_8 - 350	h_8 - 380	h_8 - 430	h_8 - 460	h_8 - 510
Length of footrest (min)	n/a	n/a	n/a	300	300	300	300	300
Depth of footrest [b] (min)	n/a	n/a	n/a	50	50	50	50	50
p Height of armrest above seat –20 to +10	n/a	n/a	n/a	170	190	210	230	250
r Width between arms	n/a	n/a	n/a	360–410	390–440	420–470	460–510	510–570
q Distance from backrest to front edge of armrest (max)	n/a	n/a	n/a	200	225	250	275	300
o Width of armrest (min)	n/a	n/a	n/a	20	20	20	20	20
n Length of armrest (min)	n/a	n/a	n/a	n/a	80	80	80	80

[a] The footrest can be inclined. The height is measured at the mid point of the depth whether inclined or not.

[b] If the footrest is inclined, the depth shall be determined in the inclined plane

B.2 Functional dimensions and size marks for tables

Table tops may be horizontal, with fixed inclination or inclinable by the user. If the table top is user inclinable, it shall be possible to adjust it to a horizontal position.

Table tops which are or can be inclined are recommended.

Table B.2 — Dimensions and size marks for tables for use with high chairs with double-sloped seats

All dimensions in millimetres unless otherwise stated

Size mark	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Colour code	**White**	**Orange**	**Violet**	**Yellow**	**Red**	**Green**	**Blue**	**Brown**
Popliteal range (without shoes)	**200–250**	**250–280**	**280–315**	**315–355**	**355–405**	**405–435**	**435–485**	**485+**
Stature range (without shoes)	**800–950**	**930–1 160**	**1 080 –1 210**	**1 190 –1 420**	**1 330 –1 590**	**1 460 –1 765**	**1 590 –1 880**	**1 740 –2 070**
h_1 Height of top ± 20	h_8 + 190	h_8 + 200	h_8 + 220	h_8 + 240	h_8 + 260	h_8 + 280	h_8 + 300	h_8 + 310
t_1 Depth of top (min)	-	500 [a]	500 [a]	500 [a]	500	500	500	500
w_1 Width of top, per person at front edge, where pupils sit (min)	-	600 [b]	600 [b]	600 [b]	600 [b]	600	600	600
Surface area per person (min)	-	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2
Horizontal distance between front legs/structure, where pupils sit, per person (min)	-	500 [c]	500 [c]	500 [c]	500 [c]	500	500	500
h_9 Height of footrest [d] [e]	-	h_8 - 260	h_8 - 310	h_8 - 350	h_8 - 380	h_8 - 430	h_8 - 460	h_8 - 510
Length of footrest (min)	-	240	280	300	300	300	300	300
Depth of footrest (min)	-	100	100	100	200	200	200	200

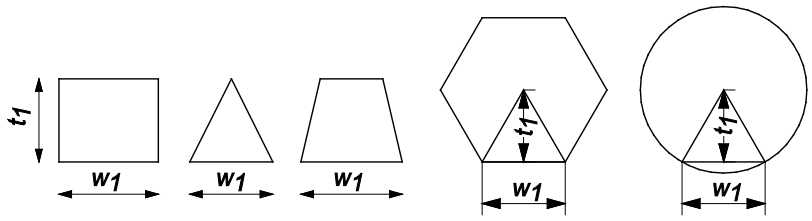
[a] Can be reduced to 400 mm (only when required by educational conditions).

[b] Can be reduced to 550 mm (only when required by educational conditions).

[c] Can be reduced to 450 mm (only when required by educational conditions).

[d] The footrest can be placed in the lower leg zone.

[e] The footrest can be inclined. The height is measured at the mid point of the depth whether inclined or not.



a) Table for one pupil **b) Shared table**

Key

t_1 depth of top

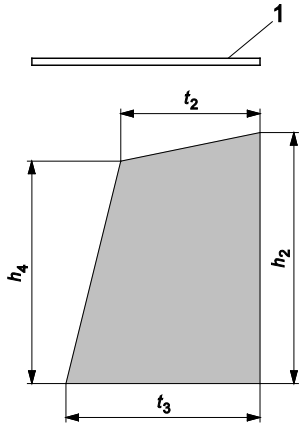
w_1 width of top, per person at front edge, where pupils sit

Figure B.6 — Examples of different table tops showing table top width and depth

B.3 Legroom

Legroom beneath the worksurfaces (tables and desks) shall be provided for each size mark in accordance with the minimum dimensions as shown in Table B.3 and Figure B.7.

The legroom shall be measured by placing the template on the floor with its higher end in line with the front edge of the table, where pupils sit, transversing between the legs of the table. Overlapping of legroom templates is acceptable for a group of tables.



Key

1 front of table top

h_2 legroom height at front of table top

h_4 height of back of legroom

t_2 depth of top of legroom

t_3 depth of bottom of legroom

Figure B.7 — Legroom template

Table B.3 — Minimum legroom template dimensions for tables for use with chairs with double-sloped seats

All dimensions in millimetres

Size marks								
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
h_2	h_1-75	h_1-80	h_1-90	h_1-95	h_1-95	h_1-100	h_1-95	h_1-95
h_4	h_1-125	h_1-135	h_1-155	h_1-170	h_1-175	h_1-190	h_1-195	h_1-200
t_2	300	300	300	300	400	400	400	400
t_3	400	400	400	400	500	500	500	500

The minimum width of the legroom is given in Table B.2 (horizontal distance between front legs/structure, where pupils sit, per person).

B.4 Requirements for adjustable high chairs with double-sloped seats and tables

Adjustment controls shall:

a) be easily accessible to the user;

b) be possible to operate without the need for tools.

Adjustable furniture shall cover two or more size marks. It shall be possible to identify the size marks to which the furniture can be adjusted.

Adjustable furniture (chairs and tables) designed to cover a range of size marks shall comply with the dimensional requirements of each size mark covered (see Table B.1 and Table B.2).

Adjustments may be continuous or in fixed steps.

Examples of dimensions of adjustable chairs and tables are given in Annex G.

Annex C
(normative)

Functional dimensions for standing-height tables

The dimensions, size marks and colour codes for standing-height tables shall be as given in Table C.1.

Height adjustable tables are recommended.

The ergonomic criterion for the height of standing-height tables is the standing elbow height plus shoe allowance. In order to undertake general classroom work at a fixed height standing-height table, shorter pupils are caused to raise their arms and elbows while taller pupils are caused to stoop, which can result in backache. Hence the dimensions given in Table C.1 are a compromise to minimize stooping without forcing the shorter pupils to raise their elbows excessively.

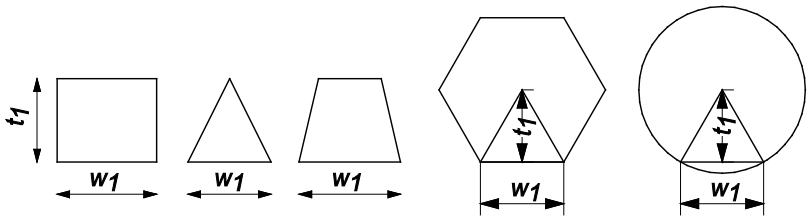
Table C.1 — Dimensions and size marks for standing-height tables

All dimensions in millimetres unless otherwise stated

Size mark	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Colour code	**White**	**Orange**	**Violet**	**Yellow**	**Red**	**Green**	**Blue**	**Brown**
Popliteal range (without shoes)	**200–250**	**250–280**	**280–315**	**315–355**	**355–405**	**405–435**	**435–485**	**485+**
Stature range (without shoes)	**800–950**	**930 –1 160**	**1 080 –1 210**	**1 190 –1 420**	**1 330 –1 590**	**1 460 –1 765**	**1 590 –1 880**	**1 740 –2 070**
h_1 Height of top ± 20	530	590	670	760	880	1000	1060	1200
t_1 Depth of top (min)	-	500 [a]	500 [a]	500 [a]	500	500	500	500
w_1 Width of top, per person at front edge, where pupils sit (min)	-	600 [b]	600 [b]	600 [b]	600 [b]	600	600	600
Surface area per person (min)	-	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2	0,15 m^2

[a] Can be reduced to 400 mm (only when required by educational conditions).

[b] Can be reduced to 550 mm (only when required by educational conditions).



a) Table for one pupil **b) Shared table**

Key

t_1 depth of top

w_1 width of top, per person at front edge, where pupils sit

Figure C.1 — Examples of different table tops showing table top width and depth

Annex D
(normative)

Functional dimensions for tall chairs with slopes between −5° and +7° and associated tables

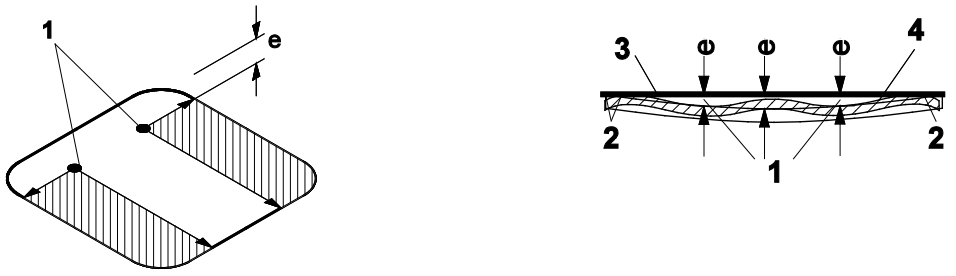
D.1 Functional dimensions and size marks for chairs

The dimensions, angles, size marks and colour codes for chairs shall be as given in Table D.1. Where dimensions are stated as ranges, the measured dimension shall be any value in this range.

All accessible edges shall be rounded or chamfered.

Room for free movement of the buttocks shall be ensured. If the backrest extends below Point S, it shall be angled rearwards such as to maintain the buttock zone as shown in Figure D.3.

Raised edges and surfaces shall not dig into thighs. This applies to points or edges on the seat surface or frame in front of the position indicated by the rear pins on the SCMD, outside the planes through the rear pins which are parallel to the median plane, as shown by the shaded area in Figure D.1. This requirement is fulfilled when these points are not higher than 15 mm above the lowest point on the seat surface in the planes through the rear pins and parallel to the median plane for size marks 0 to 3 and 25 mm above the lowest point for size marks 4 to 7.



a) Isometric view of seat pad **b) Cross-section of seat parallel to transverse plane**

Key

1 position on the seat of the rear pins of the SCMD

2 raised edge or surface

3 horizontal bar

4 top surface of seat

e height of raised edges or surfaces, ≤ 15 mm for size marks 0 to 3 and ≤ 25 mm for size marks 4 to 7

Figure D.1 — Dimensions of raised seat edges

Determination of functional dimensions

The determination of the functional dimensions of chairs is specified below. See also Figure D.2, Figure D.3, Figure D.4, Figure D.5 and Figure D.6. If the seat and/or backrest is adjustable or tiltable, the seat shall be set to horizontal or as close as possible to horizontal and the backrest shall be set to

vertical or as close as possible to vertical. If the SCMD is used, these shall be set after the SCMD is placed on the chair, and if a load is placed on the SCMD these shall be set after loading.

(h_8) The height of the seat is the vertical distance between the highest point on the front of the seat, as determined by the SCMD, and the footrest. See Figure D.5 and Figure D.6.

(t_4) The effective depth of the seat is the horizontal distance from Point S along the median plane to the front edge of the seat, the position of which shall be determined by the front edge indicator pins of the SCMD. See Figure D.4 and Figure D.5.

(b_3) The width of the seat shall be determined as the horizontal distance between vertical lines through the side edges of the seat surface at a distance from the front of the seat equal to half of t_4. See Figure D.2. The width of the seat shall include the frame where it is a continuation or integral part of the seat surface.

(h_7) The height of the backrest is the vertical distance between the top and the bottom of the backrest, determined on the median plane. See Figure D.5 and Figure D.6.

[AC1] **(b_4) The width of the backrest** is the greatest horizontal distance between its side edges in the Backrest range as defined by the two pins of the backrest locator (component 12 of the SCMD as shown in Figure F.1). The width of the backrest shall include the frame where it is a continuation or integral part of the backrest. See Figure D.2. [AC1]

(r_2) The horizontal radius of the backrest shall be determined on the horizontal plane, at the same height as Point S. See Figure D.2.

(α) The inclination of a single-sloped seat is the angle between the seat and the horizontal as determined by the SCMD on the chair. It is the angle between the horizontal and the top of the SCMD base plate under load. See Annex F and Figure 2, Figure 3, Figure 4 and Figure F.1.

(γ) The angle between the seat and the backrest shall be determined by the SCMD on the chair under load. On the SCMD, it is the angle between the vertical arm when it is inclined at the angle of the backrest and the top of the base plate. See Annex F and Figure F.1, Figure D.5 and Figure D.6.

(o) The width of the armrest is the minimum distance between the sides of the armrest/armrest pad, measured at 5 mm below the top surface of the armrest. See Figure D.4.

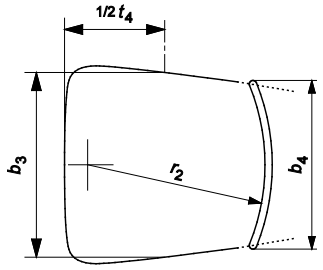
(p) The height of the armrest above the seat shall be determined by the SCMD on the chair. On the SCMD, it is the vertical distance between the top of the armrests and the bottom of the rear pins of the SCMD. See Annex F and Figure F.1 and Figure D.4.

(q) The distance from the backrest to the front of the armrest is the maximum horizontal distance between Point S and the front of the top of the armrest, the position of which is determined by the SCMD. See Figure D.4.

(r) The width between the armrests is the minimum horizontal distance between the armrests/armrest pads. See Figure D.4.

(n) The length of the armrest is the greatest length in the fore and aft direction of the armrest horizontally within 20 mm below the highest point. See Figure D.4.

(x) The distance between Point S and the back of the seat pad is the horizontal distance on the median plane between the rear edge of the seat and the vertical projection of Point S. It shall be determined only if the back of the seat pad does not extend behind Point S. See Figure D.5 and Figure D.6.



Key

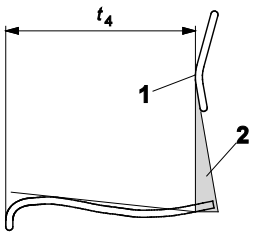
b_3 width of seat

b_4 width of backrest

r_2 horizontal radius of backrest

t_4 effective depth of seat

Figure D.2 — Key dimensions of a chair (plan view)



Key

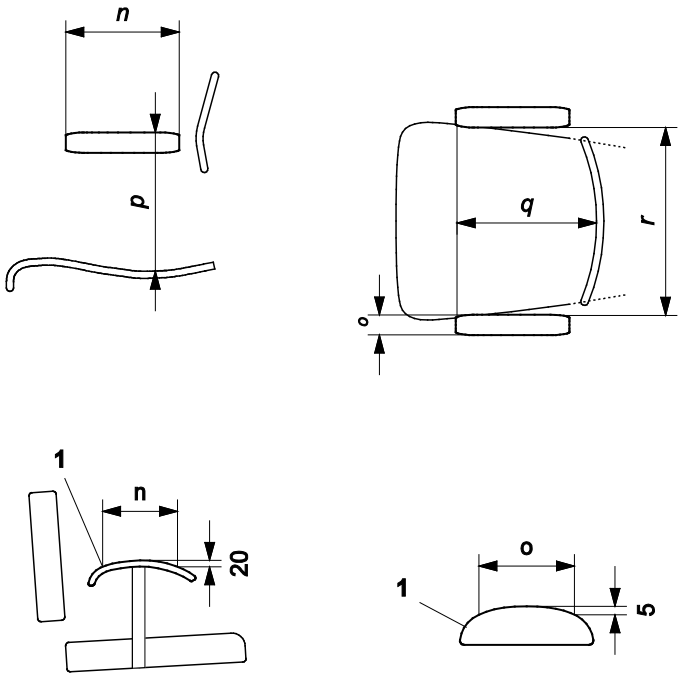
1 Point S

2 buttock zone

t_4 effective depth of seat

Figure D.3 — Key dimensions of a chair (section view) and the buttock zone (shaded area)

All dimensions in millimetres



Key

1 armrest

n length of armrest

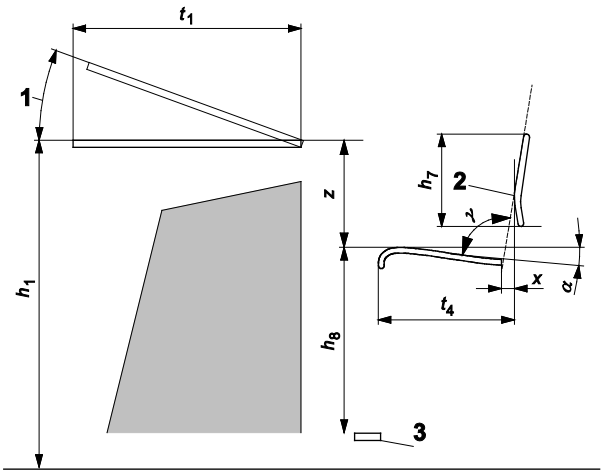
o width of armrest

p height of armrest above the seat

q distance from backrest to front of armrest

r width between armrests

Figure D.4 — Key dimensions for armrests



Key

1 inclination of the table top (the maximum value for a fixed or inclinable table top is 20°)

2 Point S

3 footrest

α inclination of single-sloped seat

γ angle between seat and backrest

h_1 height of table top

h_7 height of backrest

h_8 height of seat

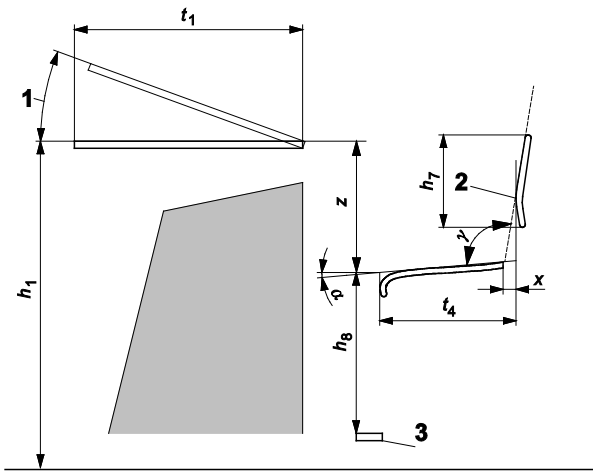
t_1 depth of table top

t_4 effective depth of seat

x distance between Point S and back of seat pad

z vertical distance between the top of the table and the top of the seat

Figure D.5 — Key dimensions of a chair with a negative seat angle and associated table



Key

1 inclination of the table top (the maximum value for a fixed or inclinable table top is 20°)

2 Point S

3 footrest

α inclination of single-sloped seat

γ angle between seat and backrest

h_1 height of table top

h_7 height of backrest

h_8 height of seat

t_1 depth of table top

t_4 effective depth of seat

x distance between Point S and back of seat pad

z vertical distance between the top of the table and the top of the seat

Figure D.6 — Key dimensions of a chair with a positive seat angle and associated table

Table D.1 — Dimensions and size marks for tall chairs with single-sloped seats

All dimensions in millimetres unless otherwise stated

Size mark	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Colour code	**White**	**Orange**	**Violet**	**Yellow**	**Red**	**Green**	**Blue**	**Brown**
Popliteal range (without shoes)	**200–250**	**250 –280**	**280–315**	**315–355**	**355–405**	**405–435**	**435–485**	**485+**
Stature range (without shoes)	**800–950**	**930 –1 160**	**1 080 –1 210**	**1 190 –1 420**	**1 330 –1 590**	**1 460 –1 765**	**1 590 –1 880**	**1 740 –2 070**
h_8 Height of seat ± 10	210	260	310	350	380	430	460	510
t_4 Effective depth of seat ± 15 (0–2), ± 25 (3–7)	n/a	n/a	n/a	300	340	380	420	460
b_3 Seat width (min)	210	240	280	320	340	360	380	400
x Distance between Point S and back of seat pad (max)	n/a	n/a	n/a	30	30	50	50	50
h_7 Backrest height (min)	100	100	100	100	100	100	100	100
b_4 Width of backrest (min)	n/a	n/a	n/a	260	270	300	330	360
r_2 Horizontal radius of backrest (min)	n/a	n/a	n/a	300	300	300	300	300
α Inclination of seat	n/a	n/a	n/a	–5° to +7°	–5° to +7°	–5° to +7°	–5° to +7°	–5° to +7°
γ Angle between seat and backrest	n/a	n/a	n/a	95° to 110°	95° to 110°	95° to 110°	95° to 110°	95° to 110°
p Height of armrest above seat −20 to +10	n/a	n/a	n/a	170	190	210	230	250
r Width between arms	n/a	n/a	n/a	360–410	390–440	420–470	460–510	510–570
q Distance from backrest to front edge of armrest (max)	n/a	n/a	n/a	n/a	225	250	275	300
o Width of armrest (min)	n/a	n/a	n/a	n/a	20	20	20	20
n Length of armrest (min)	n/a	n/a	n/a	n/a	80	80	80	80
Length of footrest (min)	n/a	n/a	n/a	300	300	300	300	300
Depth of footrest (min)	n/a	n/a	n/a	40	40	40	40	40

D.2 Functional dimensions and size marks for tables

Table tops may be horizontal, with a fixed inclination or inclinable by the user. If the table top is user inclinable, it shall be possible to adjust it to a horizontal position.

Table tops which are or can be inclined are recommended.

The height of tables that are intended for use with tall chairs cannot be size marked. It is the vertical distance between the top of the table and the top of the seat that defines the table's suitability. This distance (z) is shown in Table D.2. The distance (z) shall be used in matching table height to tall chairs. All other dimensions for tall tables to be used with tall chairs shall be as given in Table D.3.

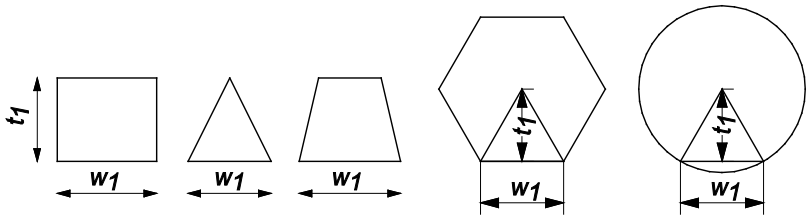
The table shall be marked with its height (distance from the floor to the top of the table). This information could be provided on a label directly or via a web address, QR-code or other suitable application.

Table D.2 — Distance between top of table and top of seat of a tall chair matching each size mark

Size mark	**z (mm)** (±10 mm)
0	150
1	150
2	160
3	170
4	190
5	210
6	230
7	250

Table D.3 — Dimensions of table tops for tall tables

t_1 Depth of top (min)	500 mm
w_1 Width of top, per person at front edge, where pupils sit (min)	600 mm
Surface area per person (min)	0,15 m^2
Horizontal distance between front legs/structure, where pupils sit, per person (min)	500 mm



a) Table for one pupil **b) Shared table**

Key

t_1 depth of top

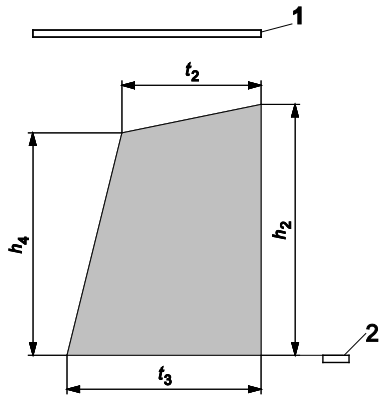
w_1 width of top, per person at front edge, where pupils sit

Figure D.7 — Examples of different table tops showing table top width and depth

D.3 Legroom

Legroom dimensions shall apply above the footrest of the tall chair, not the floor. Where a table is matched with a tall chair, the legroom beneath the table and above the footrest should be in accordance with the minimum dimensions as shown in Table D.4 and Figure D.8.

The legroom shall be measured by placing the template with its base at the level of the footrest and its higher end in line with the front edge of the table, where pupils sit, transversing between the legs of the table. Overlapping of legroom templates is acceptable for a group of tables.



Key

1 front of table top

2 footrest

h_2 legroom height at front of table top

h_4 height of back of legroom

t_2 depth of top of legroom

t_3 depth of bottom of legroom

Figure D.8 — Legroom template

Table D.4 — Minimum legroom template dimensions

All dimensions in millimetres

	Size marks							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
$\mathbf{h_2}$	325	380	440	495	545	610	665	725
$\mathbf{h_4}$	275	325	375	420	465	520	565	620
$\mathbf{t_2}$	300	300	300	300	400	400	400	400
$\mathbf{t_3}$	400	400	400	400	500	500	500	500

The minimum width of the legroom is given in Table D.3 (horizontal distance between front legs/structure, where pupils sit, per person).

D.4 Requirements for adjustable tall chairs

Adjustment controls shall:

a) be easily accessible to the user;

b) be possible to operate without the need for tools.

Adjustable furniture shall cover two or more size marks. It shall be possible to identify the size marks to which the furniture can be adjusted.

Adjustable chairs designed to cover a range of size marks shall comply with the dimensional requirements of each size mark covered (see Table D.1).

Adjustments may be continuous or in fixed steps.

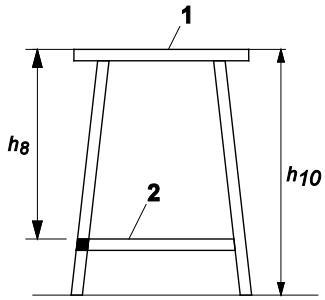
Examples of dimensions of adjustable chairs are given in Annex G.

Annex E
(normative)

Functional dimensions for stools and associated worksurfaces

E.1 Functional dimensions for stools

Heights of stools and stool seat heights to be used at corresponding standing-height work tables and work surfaces shall be as given in Table E.1 and shown in Figure E.1.



Key

1 stool seat

2 footrest

h_8 stool seat height (from seat surface to top of footrest)

h_{10} total stool height

Figure E.1 — Key dimensions of a stool

Table E.1 — Dimensions of stools for use with standing-height work tables

All dimensions in millimetres

Size mark	Colour code	Standing work table height (h_1) (see Table C.1)	Corresponding total stool height (h_{10})	Stool seat height (from seat surface to top of footrest) (h_8)
0	White	530	380	n/a
1	Orange	590	440	315 - 325
2	Violet	670	510	315 - 325
3	Yellow	760	590	420 - 430
4	Red	880	690	420 - 430
5	Green	1000	790	510 - 530
6	Blue	1060	830	510 - 530
7	Brown	1200	950	510 - 530

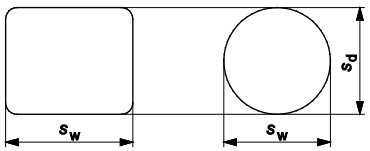
The range of stool seat heights (h_8) given in Table E.1 allows smaller users in the size mark group to sit near the front edge of the stool with their thighs pointing downwards by 7 degrees and taller users to rest their feet on the footrest with their thighs at 90 degrees to their lower legs. The measured dimension shall be any value in this range.

Stool seat sizes shall be as given in Table E.2.

Table E.2 — Dimensions of seat surface for stools

All dimensions in millimetres

Size mark	Minimum width (s_w)	Minimum depth (s_d)
1–2	240	150
3–7	300	200



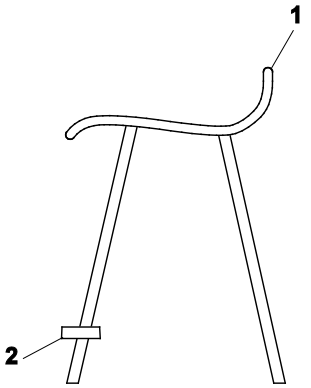
Key

s_d minimum depth

s_w minimum width

Figure E.2 — Width and depth of different types of stool seats

Any upward extension at the back of the stool below the Point S range specified in Table F.2 shall not be considered to be a backrest and the seating shall be considered to be a stool (see Figure E.3).



Key

1 upward extension below the Point S range

2 footrest

Figure E.3 — Stool with an upward extension below the Point S range

E.2 Functional dimensions for corresponding worksurface height

There is a relationship between stool heights and high worksurfaces. It is possible to calculate total stool height for a given height of a fixed height worksurface. Conversely, it is possible to calculate the height of a worksurface for a given stool size.

For an existing worksurface, the corresponding total stool height shall be calculated as follows:

Total stool height (h_{10}) = height of existing worksurface (h_w) - distance between top of worksurface and top of seat surface (z)

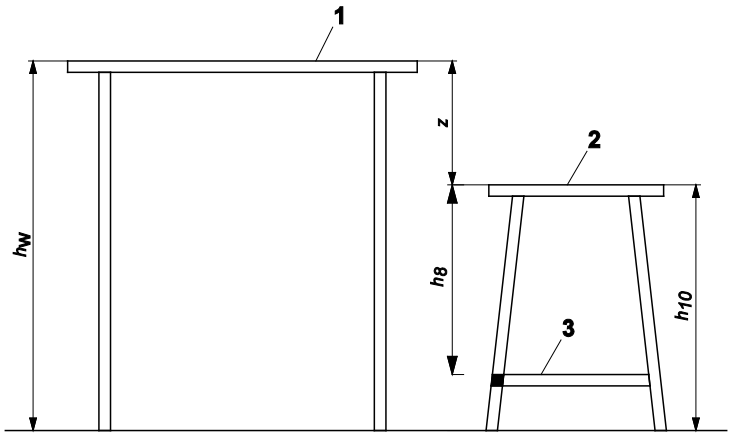
For an existing stool, the corresponding worksurface height shall be calculated as follows:

Height of worksurface (h_w) = total stool height (h_{10}) + distance between top of worksurface and top of seat surface (z)

Dimension “z” corresponds to the anthropometric dimension, sitting elbow height. The values of (z) are given in Table E.3 for all the size marks.

Table E.3 — Distance between top of worksurface and top of stool matching each size mark

Size mark	z (mm) (± 10 mm)
0	150
1	150
2	160
3	170
4	190
5	210
6	230
7	250



Key

1 worksurface

2 stool

3 footrest

h_8 stool seat height (from seat surface to top of footrest)

h_{10} total stool height

h_w worksurface height

z distance between top of worksurface and top of stool

Figure E.4 — Dimensions of stools and corresponding worksurfaces

Annex F
(normative)

Determination of Point S, buttock zone, seat height, seat angles, seat depth and armrest height

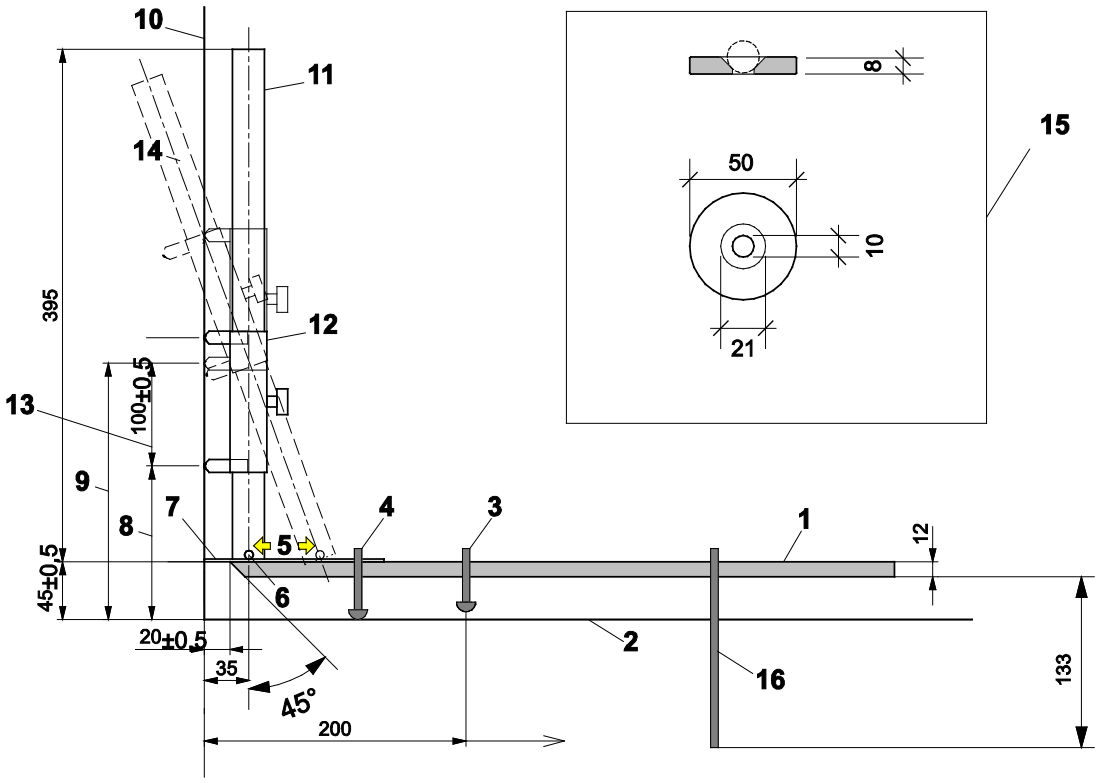
F.1 The school chair measuring device (SCMD)

The school chair measuring device (SCMD) shall be used for determining specified dimensions for chairs in Annex A and Annex D with size marks 3 to 7. The dimensions determined using the SCMD are seat height, seat angles, seat depth, armrest height and distance from backrest to front edge of armrest. For determining each of these, the SCMD shall be loaded with weights as specified. The SCMD shall also be used to determine the position of Point S and whether the chair has the required buttock zone and the required lumbar support. For determining each of these, the SCMD shall not be loaded.

Figure F.1 and Figure F.2 show the necessary dimensions for the functionality of the SCMD, which can be manufactured in different ways. The dimensions in Figure F.1 and Figure F.2 are in millimetres. Unless otherwise stated, tolerances shall be: lengths ± 1 mm, angles ± 1° and weight ± 5 %.

The total weight of the SCMD shall be 2,5 kg. The base of the SCMD shall be made of beech plywood or other material of similar weight and stiffness.

All dimensions in millimetres



Key

1 base plate
2 base datum line
3 front pins (hemispherical) diameter 15 mm (length below the base plate in accordance with Table F.1)
4 rear pins (hemispherical) diameter 15 mm (length 33 mm below the base plate)
5 sliding pivot point
6 pivot pin, centred 6 mm (±0,5) above base plate
7 buttock clearance plate, 2 mm thick, removable
8 120 mm minimum height of bottom pin
9 200 mm maximum height of bottom pin
10 rear datum line
11 vertical arm
12 backrest locator
13 lumbar support zone
14 vertical arm inclined at the angle of the backrest
15 pads to go under the front and rear pins (to be used only with upholstered seats)
16 seat depth indicator pins (diameter 15 mm)

Figure F.1 — Side view of the SCMD

All dimensions in millimetres

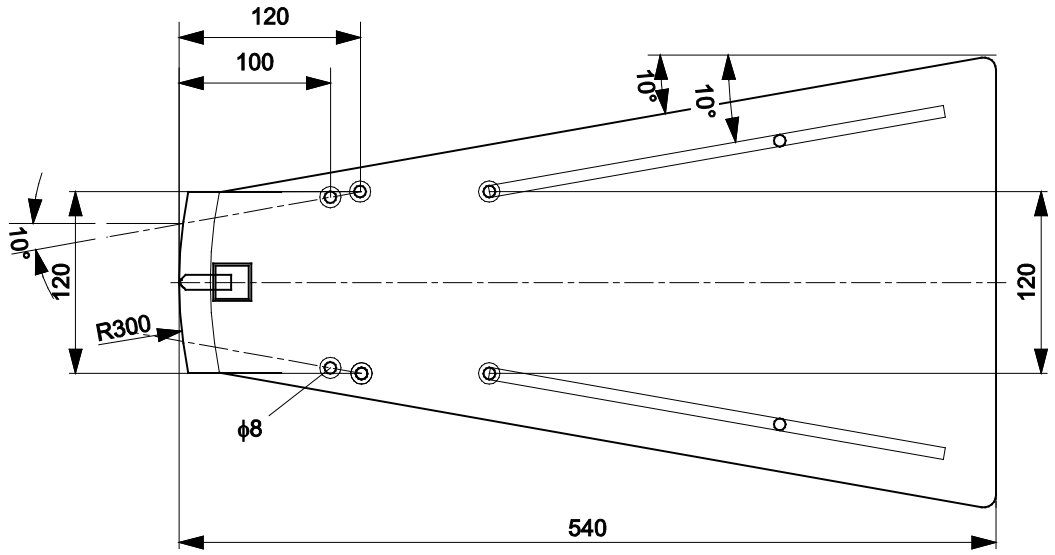


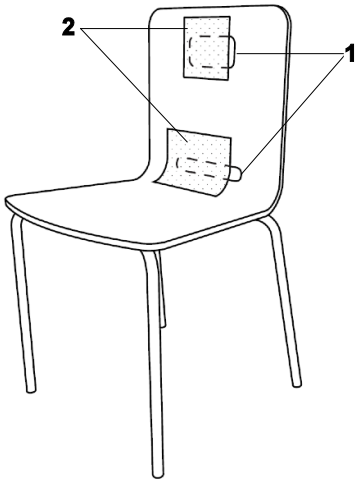
Figure F.2 — Plan view of the SCMD base plate

F.2 Using the SCMD

a) Preparing chairs for use of the SCMD

For an adjustable, tilting or pivoting backrest, the backrest shall be vertical or as near vertical as possible. See Figures A.4, A.5, B.4, D.4 and D.5.

Small gaps and holes on the backrest where the buttock clearance plate (component 7 in Figure F.1) and/or the backrest locator (component 12 in Figure F.1) are likely to be, shall be covered with a suitable thin and strong sheet prior to placing the SCMD on the chair to allow dimensional checks. See Figure F.3.



Key

1 hole

2 thin strong sheet

Figure F.3 — Holes at the back of a chair

b) Placement of the SCMD on the chair

1) Place the two rear pins (component 4 in Figure F.1) in the holes to match the chair size mark according to Table F.1.

2) Insert the two front pins (component 3 in Figure F.1) in the slot to match the chair size mark according to Table F.1.

Table F.1 — Position of rear pins and length of front pins on the SCMD

All dimensions in millimetres

Chair size mark	Distance of holes for rear pins from rear datum line in Figure F.2	Length of front pins below the base plate
3 and 4	100	27
5, 6 and 7	120	25

3) If the seat is upholstered, place 50 mm diameter pads as shown in Figure F.1 (component 15 in Figure F.1) beneath each of the four pins on the SCMD's base plate.

4) Set the vertical arm (component 11 in Figure F.1) at 90 degrees to the base plate. Lock the arm at this angle. Push the arm back so that the line connecting the ends of both pins of the backrest locator (component 12 in Figure F.1) is perpendicular to the buttock clearance plate (component 7 in Figure F.1).

5) Place the SCMD centrally in the chair (in the median plane).

6) Set the height of the lowest pin of the backrest locator (component 12 in Figure F.1) to the lowest point in the Point S range shown for the size mark in Table F.2.

Table F.2 — Point S range for each size mark

Size mark	Point S range (mm)
0	n/a
1	n/a
2	n/a
3	160 - 210
4	170 - 220
5	180 - 230
6	190 - 240
7	200 - 250

7) Push the whole SCMD to the back of the chair as far as it will go. Ensure that the rear and front pins of the SCMD (components 4 and 3 in Figure F.1) are in contact with the seat (see Figures F.4 and F.5).

c) Determination of Point S and whether buttock zone and lumbar support requirements are met

1) While keeping the backrest locator (component 12 in Figure F.1) in contact with the backrest, move the front pins (component 3 in Figure F.1) to the highest position of the seat. This is the point from which the seat height shall be measured. Check whether the rear pins (component 4 in Figure F.1) are in contact with the seat. If both of the rear pins are not in contact with the seat, the chair fails on the grounds that it does not have sufficient buttock zone.

2) Move the backrest locator (component 12 in Figure F.1) until its lower pin touches the backrest at the most forward point within the Point S range shown in Table F.2. Mark this point on the backrest as Point S, the most forward point of the backrest within the range. If moving the backrest locator causes the SCMD to move forwards a little, re-position the front pins (component 3 in Figure F.1) so that they are at the highest position of the seat. If it is not possible to place the lowest pin of the backrest locator so that it touches the backrest within the Point S range, the chair fails on the grounds that it does not have the required buttock zone or it does not have the required lumbar support. If there is a gap or a hole between the backrest and seat surface and if the buttock clearance plate (component 7 in Figure F.1) protrudes into this gap, the top of this gap shall not be less than 50 mm above the buttock clearance plate.

3) For an adjustable, tilting or pivoting backrest, Point S shall be determined when the backrest is vertical or as near vertical as possible.

4) Unlock the vertical arm (component 11 in Figure F.1) and slide the pivot point (component 5 in Figure F.1) of the vertical arm (component 11 in Figure F.1) so that both pins of the backrest locator (component 12 in Figure F.1) touch the backrest. If they do not both touch the backrest, move the backrest locator (component 12 in Figure F.1) up or down within the Point S range (shown in Table F.2) until both pins touch the backrest, adjusting both the backrest locator (component 12 in Figure F.1) and the vertical arm (component 11 in Figure F.1) angle. If it is not possible to place both of the pins in contact with the backrest, the chair fails on the grounds that it does not have the required lumbar support, because it does not provide a backrest that meets the minimum height requirement of 100 mm at an appropriate position.

5) Lock the pivot point (component 5 in Figure F.1) of the vertical arm (component 11 in Figure F.1) against pivoting and sliding.

6) Lower the backrest locator (component 12 in Figure F.1) on the vertical arm (component 11 in Figure F.1). If the bottom pin of the backrest locator (component 12 in Figure F.1) touches the backrest at any point below Point S, the most forward point, the chair fails on the grounds that it does not have the required buttock zone or it does not have the required lumbar support. Return the backrest locator to its previous position and lock it. Unlock the pivot point of the vertical arm.

d) Placement of loads on the SCMD

Place the load specified in Table F.3 on the SCMD at the midpoint between the front pins (component 3 in Figure F.1) and rear pins (component 4 in Figure F.1) of the SCMD. The load shall be applied symmetrically along the transverse plane midway between the front pins and rear pins.

NOTE A bar can be used to support half the load each side of the median plane on the SCMD.

Table F.3 — Loads to be applied on the SCMD

Chair size mark	Seat load (N)
3	350
4	500
5, 6 and 7	600

Leave the load in place during the following measurements unless otherwise stated.

e) Determination of seat angle and the angle between the seat and the backrest

Seat angle (inclination of seat) and the angle between the seat and the backrest shall be measured when the SCMD is loaded.

Adjust the angle of the vertical arm until both pins touch the backrest. Lock the pivot point.

1) Seat angle (α)

   Measure and record the seat angle from horizontal by placing a protractor on the base plate.

2) Angle between the seat and the backrest (γ)

   Measure and record the angle between the base plate and the vertical arm.

f) Determination of seat height (h_8)

For size marks 3 to 7 chairs, seat height shall be measured with the SCMD on the chair and loaded. Seat height shall be measured as the vertical distance between the floor and the points on the seat where the front pins of the SCMD touch it.

For size marks 0, 1 and 2 chairs, seat height is measured without the SCMD placed on it as the vertical distance from the floor to the highest point on the seat in the median plane.

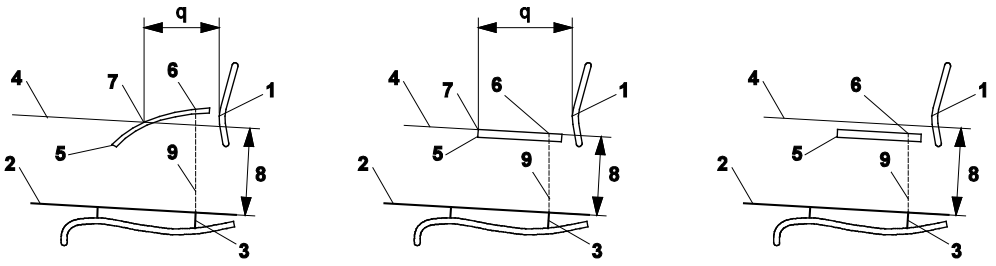
g) Determination of armrest height (p)

Armrest height shall be measured when the SCMD is loaded. Armrest height is the vertical distance from the top of the armrest to the top of the SCMD's base plate plus 45 mm (which is the thickness of the SCMD's base plate plus the protrusion of the rear pins). It is measured in the vertical plane passing through the two rear pins (component 4 in Figure F.1) of the SCMD. Mark the point on the top of the armrest which is in this vertical plane; it is the point where armrest height is determined (shown in Figure F.4). If this point, or any point on the top of the armrest in front of this point, is higher than 45 mm less than the maximum dimension of p (shown in Table A.1 or Table D.1) above the SCMD base plate, the chair fails on the grounds that the armrest is too high.

h) Determination of distance from backrest to front edge of armrest (q)

This dimension is the horizontal distance along the median plane between Point S and the vertical plane through the front of the top of the armrests. It shall be measured when the SCMD is loaded. If a plane at a height of the maximum value of p (shown in Table A.1 and Table D.1) minus 45 mm (p_{max}-45 mm) above and parallel to the base plate of the SCMD intersects the top surface of the armrest at or in front of the point marked for determining the armrest height (point 6 in Figure F.4 a), the horizontal distance from this point (point 7 in Figure F.4a) to Point S determines the value of q. If the plane intersects the top surface of the armrest at more than one point at or in front of the point marked for determining the armrest height, for example along a flat-topped armrest (see Figure F.4 b), the nearest of these points to

the front of the armrest shall be used when determining q. If the plane does not intersect the top surface of the armrest at or in front of the point marked on it for determining armrest height (see Figure F.4 c), then q is deemed to be zero, so the chair fulfils this requirement.



Key

1 Point S

2 base plate of SCMD

3 rear pins of SCMD

4 plane parallel to the SCMD base plate at a height of p_{max} – 45 mm above it

5 armrest

6 point marked on the armrest for determining the armrest height, p

7 point where the plane parallel to the SCMD base plate intersects the top surface of the armrest used for determining q

8 p_{max} – 45 mm

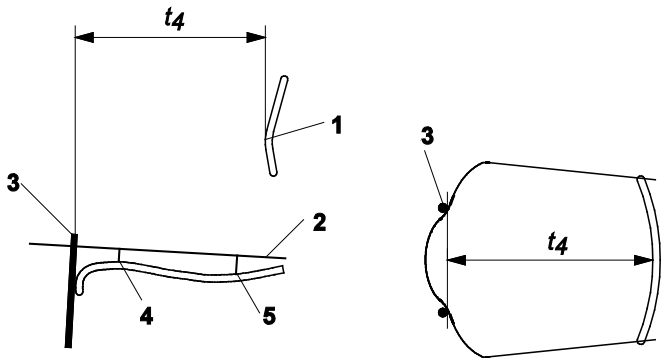
9 vertical plane in which the armrest height (p) is measured

q distance from backrest to front of armrest

Figure F.4 — Determination of q

i) Determination of seat depth (t_4)

Slide the seat depth indicator pins (component 16 in Figure F.1) along the slots on the base plate of the loaded SCMD until they touch the front edge of the seat. Mark on the seat the positions of these two pins. Remove the load and the SCMD from the chair. Measure the horizontal distance in the median plane from Point S to the plane which runs between the two points marked on the seat and is parallel to the transverse plane. See Figure F.5.



Key

1 Point S

2 base plate of SCMD

3 seat depth indicator pins

4 front pins of SCMD

5 rear pins of SCMD

t_4 effective depth of seat

Figure F.5 — Determination of seat depth

Annex G
(informative)

Guidance for the calculation of the height of adjustable chairs and tables in Annex A, Annex B and Annex D

Table G.1 shows examples of dimensions of adjustable chairs covering size marks 3 to 5 and 5 to 7.

Table G.1 — Examples of dimensions of adjustable chairs

All dimensions in millimetres

Size mark	**3**	**4**	**5**	**5**	**6**	**7**
	Adjustable chair A			**Adjustable chair B**		
Popliteal range (without shoes)	**315 - 435**			**405 - 485+**		
Stature range (without shoes)	**1 190 – 1 765**			**1 460 – 2 070**		
h_8 Height of seat ± 10	350 - 430			430 - 510		
t_4 Effective depth of seat ± 15 (0–2), ± 25 (3–7)	300 - 380			380 - 460		

Table G.2 shows examples of dimensions of adjustable tables covering size marks 3 to 5 and 5 to 7.

Table G.2 — Example of dimensions of adjustable tables

All dimensions in millimetres

Size mark	**3**	**4**	**5**	**5**	**6**	**7**
	Adjustable Table A			**Adjustable Table B**		
Popliteal range (without shoes)	**315 - 435**			**405 - 485+**		
Stature range (without shoes)	**1 190 – 1 765**			**1 460 – 2 070**		
h_1 Height of table top ± 20	590 - 710			710 - 820		

Annex H
(informative)

Guidance for the calculation of the height of chairs and tables in Annex B

This standard is based on the principle that, when the front seat angle of the forward-sloping part of the seat is increased, the height of the chair shall be increased as well. For determining the height of the top point of the seat, h_8, a formula is used.

This annex gives examples of the calculation of the height of chairs and tables, using this formula by inserting the value of the front seat angle. The front seat angle (α) of the chair can vary between the values given in Table B.1. The following examples illustrate three selected front seat angles representative of furniture available on the market. All examples are based on size mark 4. Calculated corresponding seat and table heights are given in Table H.1.

Example 1 – Front seat angle: between −5° and +5°

The seat height, h_8, is given in Table A.1 as 380 mm.

The height of the table top, h_1, is given in Table A.2 as 640 mm.

Example 2 – Front seat angle: +10°

The seat height, h_8, is calculated using the formula (see Table B.1):

h_8 = 380 mm + (340 mm x tan 2α)
= 380 mm + (340 mm x tan 2(+10°))
= 380 mm + (340 mm x tan 20°)
= 380 mm + (340 mm x 0,364)
= 504 mm

The height of the table top, h_1, is calculated using the formula (see Table B.2):

h_1 = h_8 + 260
= 504 mm + 260 mm
= 764 mm

Example 3 – Front seat angle: +12°

The seat height, h_8, is calculated using the formula (see Table B.1):

h_8 = 380 mm + (340 mm x tan 2α)
= 380 mm + (340 mm x tan 2(+12°))
= 380 mm + (340 mm x tan 24°)
= 380 mm + (340 mm x 0,445)
= 531 mm

Example 4

The height of the table top, h_1, is calculated using the formula (see Table B.2):

h_1 = h_8 + 260 mm
= 531 mm + 260 mm

= 791 mm

Table H.1 shows the calculated seat height and corresponding table height for the type of furniture shown in Annex B.

Table H.1 — Calculated corresponding seat and table heights

All dimensions in millimetres unless otherwise stated

Seat Angle	Size mark 0		Size mark 1		Size mark 2		Size mark 3		Size mark 4		Size mark 5		Size mark 6		Size mark 7	
	Seat	Table	Seat	Table	Seat	Table	Seat	Table	Seat	Table	Seat	Table	Seat	Table	Seat	Table
−5° to +5°	210	400	260	460	310	530	350	590	380	640	430	710	460	760	510	820
6°	257	447	311	511	367	587	414	654	452	712	511	791	549	849	608	918
7°	265	455	320	520	377	597	425	665	465	725	525	805	565	865	625	935
8°	273	463	329	529	387	607	436	676	477	737	539	819	580	880	642	952
9°	281	471	338	538	398	618	447	687	490	750	553	833	596	896	659	969
10°	290	480	347	547	408	628	459	699	504	764	568	848	613	913	677	987
11°	299	489	357	557	419	639	471	711	517	777	584	864	630	930	696	1 006
12°	308	498	367	567	430	650	484	724	531	791	599	879	647	947	715	1 025
13°	317	507	377	577	442	662	496	736	546	806	615	895	665	965	734	1 044
14°	327	517	388	588	454	674	510	750	561	821	632	912	683	983	755	1 065
15°	337	527	399	599	466	686	523	763	576	836	649	929	702	1 002	776	1 086

Annex I
(informative)

Rationale

Table I.1 Table I.2, Table I.3, Table I.4, Table I.5 and Table I.6 provide a rationale for the functional dimensions of chairs and tables given in this standard. The tables describe how these dimensions are related to children's anthropometric body dimensions. They explain the importance of these dimensions for health and comfort, and the reasoning behind them. They summarize whether the dimensions specified are minima, maxima or ranges and give the percentiles of the population on which they are based.

The data used for determining the dimensions were derived from, and verified against, the anthropometric sources [1] to [11] provided in the Bibliography.

Table I.1 — Rationale for functional dimensions: seat height

Ref	Dimension	Why it is important	What is specified	Other implications
h_8	Seat height	If users sitting on a chair are unable to rest their feet flat on the floor or footrest, flesh on the underside of their thighs and the back of their knees is compressed. This restricts the blood supply to the lower legs and feet. After a while, the users feel a tingling sensation and discomfort. In the longer term, they experience an increased risk of more serious numbness and possible deep vein thrombosis (DVT). This dimension, h_8, differs from the total height, h_{10}, of stools and tall chairs, which is measured from the seat to the floor. If h_{10} is greater than h_8, the stool or chair needs a footrest for users to rest their feet. If the seat is too low for taller users, and this causes the angle between the thighs and torso to be less than 90 degrees, there is an increased risk of slouching, discomfort and loss of concentration in the short term and more serious musculo skeletal disorders in the long term. There is recognition that a fixed seat height cannot accommodate the 5th to 95th percentile in a size mark. The critical maximum height in the size mark range should not exceed the 15th percentile lower leg height (popliteal height) for the size mark, when sitting at 90 degrees. The same seat height can accommodate the 85th percentile comfortably if the lower leg is extended forward by up to 30 degrees. This is because the 15th percentile lower leg height ÷ cos30° approximately the 85th percentile lower leg height. See Figure I.1.	Height and minimum adjustment range to include shorter and taller ends of the user populations, based on their popliteal height. Dimensions include a 25 mm allowance for average shoe thickness.	The 5th percentile of children may find the seat too high but, as children grow rapidly, they will soon be able to fit the chair. The biggest complaint children have about their school chairs is that they are too low.
z	vertical distance between the top of the table / worksurface and the top of the seat / stool	If there is not enough space between the underside of the table/worksurface and the top of the seat/stool, thighs will be squashed, users will not be able to sit close enough to the worksurface or users will need to hunch to reach down to the worksurface. If the gap is too large, users will not be able to place their arms comfortably on the worksurface without having to raise their shoulders. The distance between seat and worksurface is derived from the 50th percentile user's sitting elbow height. For Annex A and Annex B, each size mark matches seat height to table height in this way, but with the addition of extra space for a shallow bookshelf beneath the worksurface that also leaves enough distance above the seat surface for the thickness of the thighs. For tall chairs and stools, the size mark does not determine the height of	The gap is specified for determining the height of the worksurface for a given height of stool or tall chair and vice versa. The gap is used, but not stated explicitly, for determining the heights of tables associated with chairs, allowing extra space for a shallow bookshelf under the table.	The 5th percentile of children may find the tables in Annexes A and B a little too high to rest their arms but, as children grow rapidly, they will soon be able to fit the table. If desks have shelves underneath, it is necessary to check that there is sufficient space for thighs to fit under them.

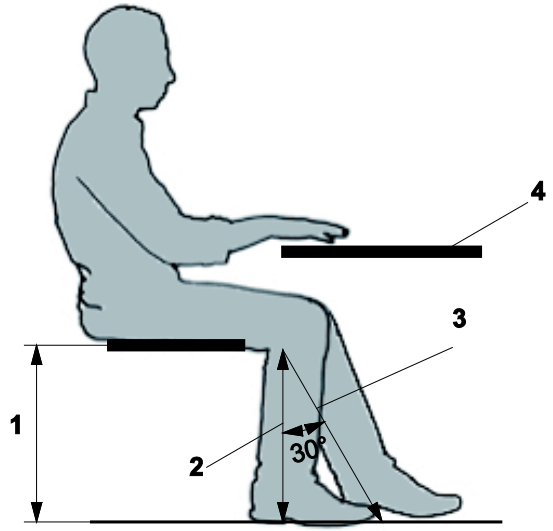
Ref	Dimension	Why it is important	What is specified	Other implications
		the seat above the floor (because a footrest is used), so a corresponding height of worksurface cannot be specified. Therefore, the z value, the distance between the table top and the top of the seat, is specified to determine suitable heights to use when matching tall chairs and stools to worksurfaces. It does not include allowance for a bookshelf under the worksurface, so is smaller than the difference between seat and table height in Annex A and Annex B.		
		 **Key** 1 seat height 2 15th percentile at 90° 3 85th percentile at 90°+30° 4 50th percentile sitting elbow height **Figure I.1 — Seat height**		

Table I.2 — Rationale for functional dimensions: seat depth, width and inclination

Ref	Dimension	Why it is important	What is specified	Other implications
t_4	Seat depth	If the seat is too deep, the front of the seat will press against the back of the knees, causing restricted blood flow to the lower legs. It prevents the user from sitting far enough back on the seat, causing them to slouch in order to reach the backrest.	If the seat depth is fixed, it shall fit the 15th percentile popliteal length in the size mark group. If the seat depth is adjustable, the minimum seat depth shall fit the 15th percentile but the range of travel is not specified.	If the seat depth is too long, the chair may fail the forward stability requirement. The seat depth based on the 15th percentile user may feel too short for taller users in the size mark range. This will not adversely affect them but their perception of comfort may be reduced due to limited thigh support.
b_3	Seat width	The width of the seat pad needs to be at least the minimum that supports the ischial tuberosities, to avoid digging into the crotch region.	Minimum width based on the width between the ischial tuberosities of the 95th percentile female plus extra width for comfort.	Comfort is increased if the seat pad width is wider, especially for longer periods of sitting.
x	Distance between Point S and back of seat pad	The distance between Point S and the back of the seat pad, when considered in conjunction with the seat depth, gives the seat pad sufficient depth to support the buttocks without them having to overhang at the back and feel the back edge cutting into them.	Maximum distance	
α	Inclination of seat	A rearwards tilt of the seat pad of more than (-) 5 degrees will inhibit forward working with a horizontal worksurface. It is likely to roll the pelvis backwards, causing slouching and restriction to the abdomen. It increases the risk of associated discomfort and musculo skeletal disorders, especially when working at a horizontal surface. This risk can be lessened if a tilting worksurface is used. A forwards tilt of the seat pad of more than (+) 7 degrees will cause undue pressure on the feet and a feeling of sliding forward.	Range of inclination of seat pad	Rearward tilting seats are beneficial for listening tasks and forward tilting seats are beneficial for working at horizontal surfaces. A combination of the two tilts for different tasks may be an advantage.

Table I.3 — Rationale for functional dimensions: backrest and lumbar support zone

Ref	Dimension	Why it is important	What is specified	Other implications
Point S	Lumbar support zone	The lumbar support zone is around Point S, the range of which is defined by Table F.2. It helps to maintain the natural S-shape of the spine and reduce the risk of slouching. Increased risk of slouching will cause fatigue and discomfort in the short term and is likely to increase the risk of back pain and other musculo skeletal disorders in the long term.	The SCMD automatically determines whether the backrest provides adequate lumbar support for the given size mark.	If there is no apparent adjustable lumbar support, the optimal S-shape spinal posture can also be achieved by pelvic support, forward tilting seats, adaptable mesh or other flexible materials.
	Buttock zone	Buttocks protrude towards the back of the chair below the lumbar support zone. If there is not enough space for the buttocks, the sitter can be forced to slide forward and lose contact with the lumbar support zone of the chair. This increases the risk of slouching, which will cause fatigue and discomfort in the short term and is likely to increase the risk of back pain and other musculo skeletal disorders in the long term.	The SCMD automatically determines whether the chair provides an adequate buttock zone.	One-piece shell chairs may not have sufficient buttock zone.
$\mathbf{h_7}$	Backrest height	The backrest shall be high enough to provide sufficient lumbar support.	Minimum height, 100 mm	
$\mathbf{b_4}$	Backrest width	The backrest shall be wide enough to provide sufficient support for the back. Too slim a backrest will make users feel unsupported and uncomfortable.	Minimum width	
$\mathbf{r_2}$	Radius of backrest	As the human back has a slight lateral curve, a curved backrest can provide better support than a flat one. If the radius is too small, users can feel restricted and constrained from moving, or feel forced to adopt an unhealthy posture.	Minimum radius, 300 mm	
$\boldsymbol{\gamma}$	Angle between seat and back	Angles between the seat and back of less than 95 degrees cause compression of the abdomen, restriction of the diaphragm, less oxygen to be supplied to the brain and general discomfort. Angles between the seat and back of over 110 degrees are not comfortable for working at horizontal worksurfaces.	A range of angles with the minimum not less than 95 degrees	

Table I.4 — Rationale for functional dimensions: armrests

Ref	Dimension	Why it is important	What is specified	Other implications
r	Width between armrests	The width between armrests needs to be sufficient to allow clearance (hip breadth) for larger users to get on and off the seat. It shall not be too wide for users to rest their arms comfortably on the armrests by the side of their body.	Range, with minimum width based on hip breadth of the 95th percentile user for each size mark range	
p	Armrest height	Armrests support the weight of the arms and reduce fatigue in the shoulders. If they are too low, there may be a tendency to slouch to reach them, causing fatigue and discomfort in the short term. If armrests are too high, shoulders may be shrugged, causing discomfort in the neck and shoulders, headaches, migraines, a drop in concentration and potentially more serious musculo skeletal disorders.	Sitting elbow height for the 50th percentile user in the size mark	Fixed arms increase the risk of dimensional misfit and poor posture. Tables can be used as arm supports but need to match the size mark of the chair.
n	Armrest length	Armrest length shall be sufficient to support the fleshy part of the forearm. If the armrests are too long, they can prevent the user from sitting near enough to the worksurface.	Minimum length, 80 mm	If the armrests can fit under the worksurface, or can be adjusted to do so, they can be longer without preventing the user from getting close enough to the worksurface.
o	Armrest width	Armrest width shall be sufficient to support the forearm adequately. If the armrest is too narrow, it can dig into the forearm.	Minimum width, 20 mm	
q	Distance from backrest to front edge of armrest	If the armrests protrude beyond the thickness of the user's body, they can touch the front edge of the worksurface and prevent the user from getting close enough to it. This increases the risk of the user leaning forward to reach the work or sitting at the front of the seat and slouching in order to use the backrest. Increased risk of slouching will cause fatigue and discomfort in the short term and is likely to increase the risk of back pain and other musculo skeletal disorders in the long term.	Maximum distance, based on the body thickness of thinner users in the size mark.	If the armrests can fit under the worksurface, or can be adjusted to do so, the armrests may protrude beyond the thickness of the human body.

Table I.5 — Rationale for functional dimensions: table surface dimensions and legroom

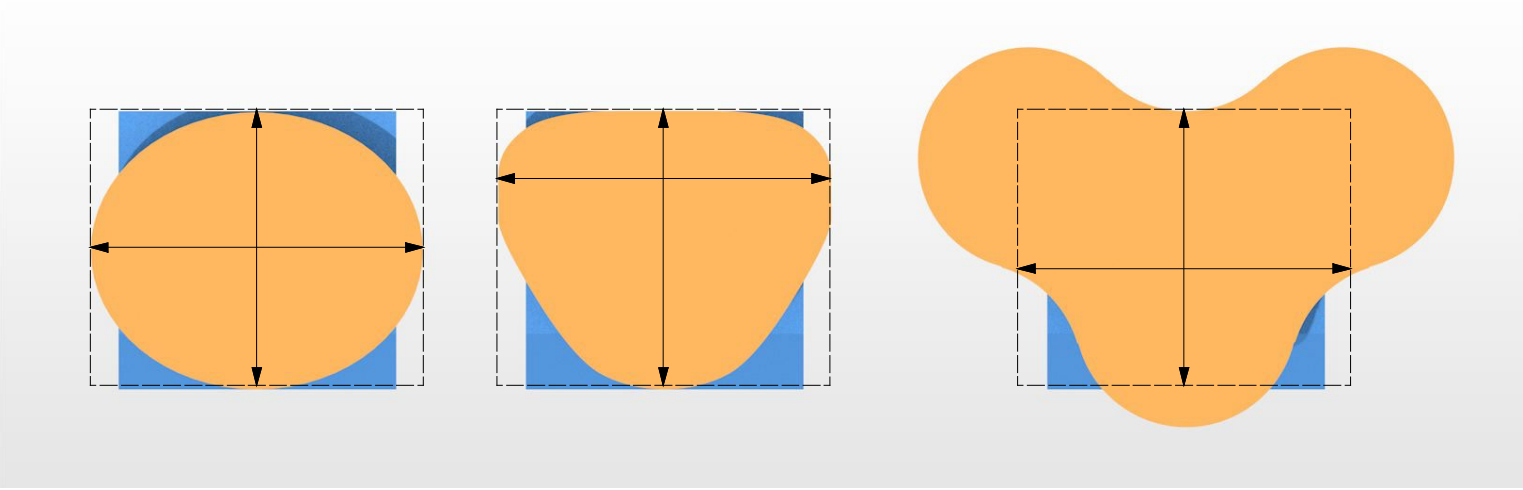
Ref	Dimension	Why it is important	What is specified	Other implications
t_1 w_1	Table surface depth and width	The depth and width should be large enough to take the necessary paperwork and equipment. If the table width is too narrow, users cannot fit both arms onto it. In Figure I.2, table tops are shown in orange, above the blue legroom space.	Minimum dimensions for width and depth of the surface per person.	The surface need not be rectangular.
				
h_2 h_4 t_2 t_3	Table legroom	If legroom is too small, users will feel restricted. Lack of movement will increase the risk of discomfort and fatigue, and lower the level of concentration. Legroom that is too small will increase the likelihood of a twisted posture and make ingress and egress more difficult. The legroom template, shown in blue in Figure I.3, shall be placed below the table surface to ensure sufficient legroom clearance for each size mark.		Surface dimensions and legroom clearance are measured separately. Overlapping legroom areas are permissible, as each legroom zone is measured separately (see Figure I.4).

Figure I.2 — Table surface depth and width

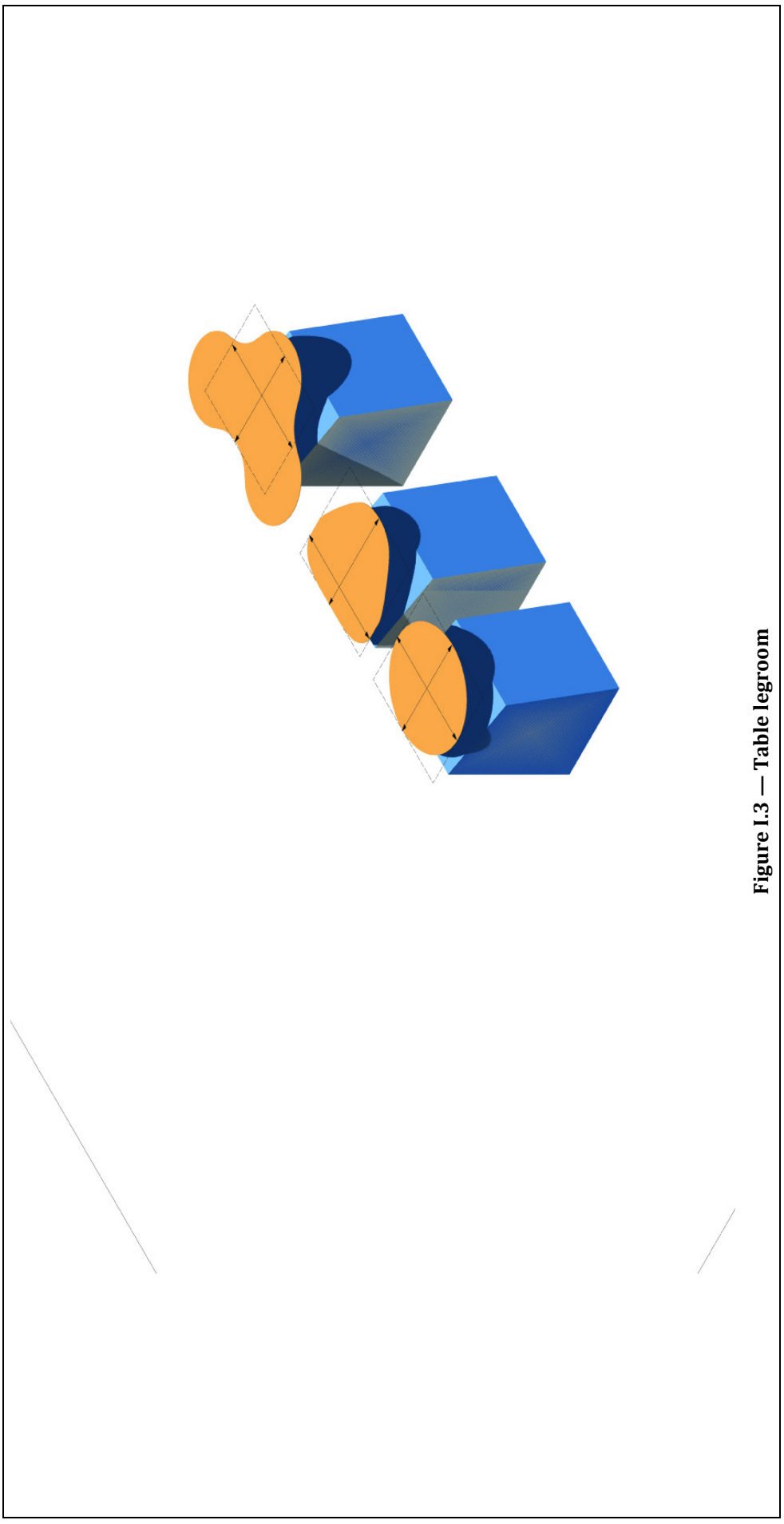


Figure I.3 — Table legroom

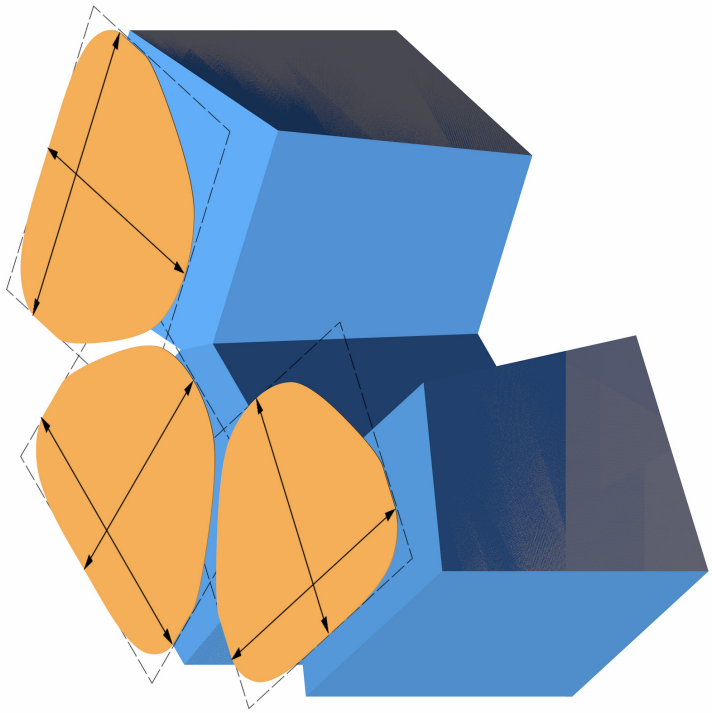
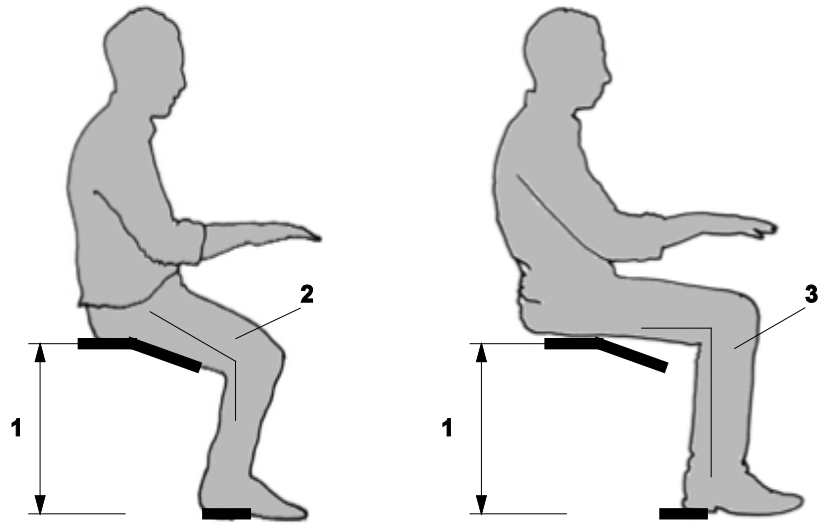


Figure I.4 — Overlapping legroom

Table I.6 — Rationale for functional dimensions: standing worksurfaces and stools

Ref	Dimension	Why it is important	What is specified	Other implications
h_1	Standing worksurface height	The worksurface height shall be sufficient for relaxed standing elbow height so users can rest their forearms and hands comfortably on the worksurface. If the worksurface is too low, it may cause stooping, or discomfort in the neck and shoulders. If the worksurface is too high, users will need to raise their elbows and they may shrug their shoulders, causing discomfort in the neck and shoulders, headaches, migraines and a drop in concentration.	Height, which is the 50th percentile standing elbow height of the size mark group.	If chairs or stools are provided for standing worksurfaces, they should be compatible in height (see Table D.2 and Table E.3).
h_8	Stool seat height	As stools are intended for use for short periods of time, the stool seat height can be larger than the popliteal height for smaller users in the size mark group. It allows smaller users sitting near the front edge of the stool with their thighs pointing downwards by 7 degrees, so caters for a larger percentile range of users. It also allows taller users to rest their feet on the footrest with their thighs at 90 degrees to their lower legs. See Figure I.5.	Range based on popliteal height of 15th and 85th percentile user in the size mark group. The stool seat height is the distance between the top of the stool and the top of the footrest. If there is no footrest, the stool seat height is the distance between the top of the stool and the floor.	



Key

1 stool seat height

2 smaller user with angle between thigh and lower leg = 90°+7°

3 taller user with angle between thigh and lower leg = 90°

Figure I.5 — Stool seat height

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