

REQUIREMENTS FOR CHAIRS AND TABLES FOR EDUCATIONAL INSTITUTIONS

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Abstract: *Several requirements are requested for the furniture in the educational institutions that are resulting from legislative of the Czech republic and technical standards. Are the requirements for a safety, and ergonomic and a mechanical character of the products. As for the above mentioned requirements is necessary to equip furnish the lecture rooms and the classrooms by the furniture with the required characters. Above all the correct ergonomic of the school's furniture is basic condition for successful prevention of some the defects of the kinetic system of the children of preschool and school age. Referring to the choice and equip of the lecture rooms and classrooms with the furniture is necessary to request the proof of the basic requirements according to valid technical standards, especially according to European standards EN 1729-1 and EN 1729-2. The context of the basic characters and requirements for the chairs and tables at schools and pre-schools are stated in the article.*

Key words: *chairs and tables, educational institutions, ergonomy, basic requirements*

Introduction

The furniture for educational institutions to which belongs also pre-school establishments must fulfill several conditions and requirements that result from the Intimation No. 410/2005 of Digest about hygiene requirements for space and operation of establishment for education and upbringing of the children and the youngsters. This Intimation was amended by the Intimation No. 343/2009 of Digest. This inscription results from the Law No. 258/2000 of Digest about the protection of public health. In the § 11 determined chairs and tables for children and pupils must accomplish technical standards adjusting furniture size indicators. It concerns European standards introduced in to the Czech national standards system that are ČSN EN 1729-1 Furniture - Chairs and tables for educational institutions - Part 1: Functional dimensions and ČSN EN1729-2 Furniture - Chairs and tables for educational institutions - Part 2: Safety requirements and test methods which are, however, only in English language. At the moment, however, are still surviving the older Czech national standards of the year 1978 called ČSN 91 0841 Tables for educational institutions. Pupil's tables. Functional sizes and

technical requirements whose regulations are not corresponding to the above mentioned European standards and whose abolishment is in the suggestion.

There areas are under standards:

- Dimensions (ergonomy)
- Safety requirements
- Mechanical properties
- Requirements for instruction´s use.

1. Dimension (ergonomy)

The Intimation No . 410/2005 of Digest had in Annex No. 2 before the amendment of the year 2009 Table of the required basic dimensions that are not totally corresponding to the requirements of ČSN EN 1729-1, now the standards are fully valid after the amendment. The tables and chairs for educational institutions are divided into seven size marks which are operated by the stature range and popliteal range and the furniture must be indicated by size mark or colour codes.

Figure 1

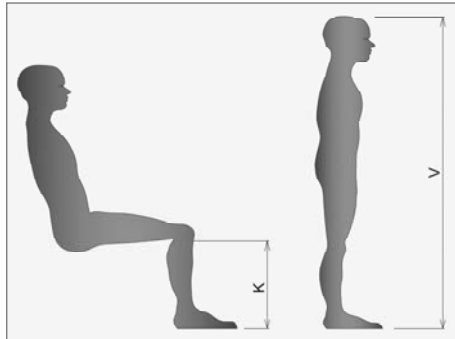


Table 1. Size marks. Dimension in mm

Size mark	0	1	2	3	4	5	6	7
Colour code	white	orange	purple	yellow	red	green	blue	brown
K Popliteal range (without shoes)	200- -250	250- -280	280- -315	315- -355	355- -405	405- -435	435- -485	485+
V Stature range (without shoes)	800- -950	930- -1160	1080- -1210	1190- -1420	1330- -1590	1460- -1765	1590- -1880	1740- -2070

Functional dimensions for chairs with slopes between -5° and $+5^\circ$ and associated tables: Figure 2

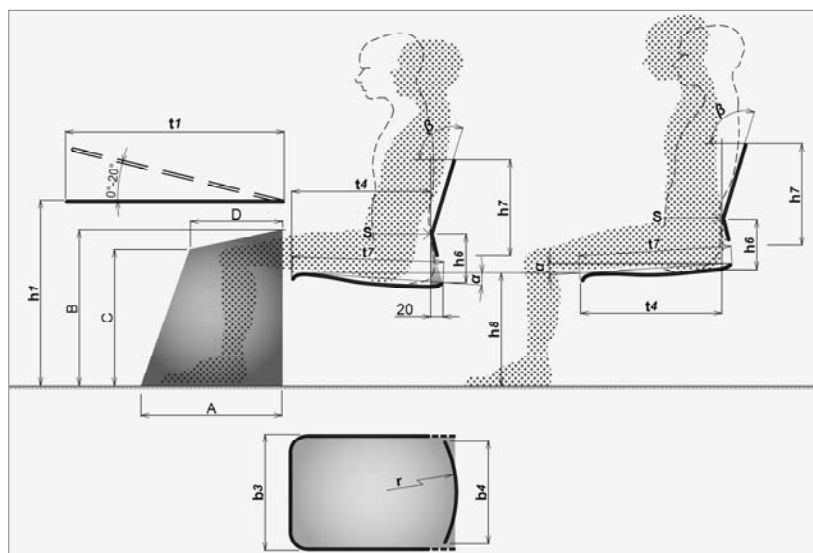


Table 2. Dimension in mm.

Size mark	0	1	2	3	4	5	6	7	
h_8 height of seat ± 10 mm	210	260	310	350	380	430	460	510	
t_4 depth of seat ± 10 mm (0-2) ± 20 mm (3-7)	225	250	270	300	340	380	420	460	
b_3 min. seat width	210	240	280	320	340	360	380	400	
t_7 depth seat surface (min)	actual t_4 minus 20 mm			actual t_4 minus 30 mm					
h_6 height of point S -10 to +20 mm	140	150	160	180	190	200	210	220	
h_7 backrest height min.	100								
b_4 min. width of backrest	-	210	250	270	270	300	330	360	
r min. horizontal radius of backrest	-	300	300	300	300	300	300	300	
β inclination of backrest	-	95° to 110°							
α inclination of the seat max.	+5° to -5°								
h_1 height, top ± 10	400	460	530	590	640	710	765	820	
t_1 min. depth of top	-	500 ¹	500 ¹	500 ¹	500	500	500	500	
Min. length of top, per person	-	600 ²				600			
Min. horizontal distance between front leg / structure per person,	-	500 ³			500				
Min. leg room	A	400			500				
	B	325	380	440	495	545	610	665	725
	C	275	325	375	420	465	520	565	620
	D	300			400				

¹ Can be reduced to 400 mm (only when required by educational conditions); ² Can be to 550 mm, (only when required by educational conditions); ³ Can be reduced to 450 mm (only when required by educational conditions). Functional dimension for high chairs with double-slope seats and associated tab.

Figure 3

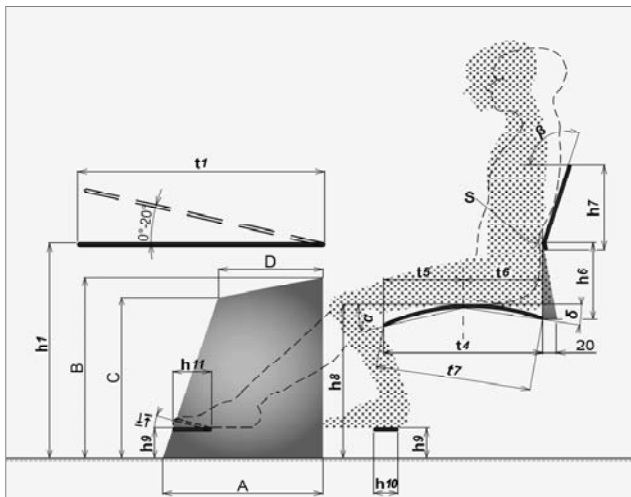


Table 3. Dimension in mm

Size mark	0	1	2	3	4	5	6	7
α max. inclination of the front part of the seat	+15°							
δ inclination of the rest part of the seat	-5° až +5°							
h_8 height of seat ± 10	210+ (220x)	260+ (240x)	310+ (270x)	350+ (300x)	380+ (340x)	430+ (380x)	460+ (420x)	510+ (460x)
t_4 depth of seat ± 10 mm (0-2) ± 20 mm (3-7)	tg 2 α) ⁴							
t_4 depth of seat ± 10 mm (0-2) ± 20 mm (3-7)	225	250	270	300	340	380	420	460
b_3 min. seat width	210	240	280	320	340	360	380	400
t_7 depth seat surface (min)	actual t_4 minus 20			actual t_4 minus 30				
h_6 height of point S -10 až +20 mm	140	150	160	180	190	200	210	220
h_7 backrest height min.	100							
b_4 inclination of backrest	210	240	280	320	340	360	380	400
r min. horizontal radius of backrest	-	300						
β inclination of backrest	-	95° to 110°						
h_9 height of footrest ⁵	-	$h_8 - 260$	$h_8 - 310$	$h_8 - 350$	$h_8 - 380$	$h_8 - 430$	$h_8 - 460$	$h_8 - 510$

Minimum length of footrest	-	240	280	300				
h_{10} minimum depth of footrest of chairs	-	50						
h_{11} minimum depth of footrest of tables	-	100			200			
h_1 height, top ± 10	$h_8 + 190$	$h_8 + 200$	$h_8 + 220$	$h_8 + 240$	$h_8 + 260$	$h_8 + 280$	$h_8 + 300$	$h_8 + 310$
t_1 min. depth of top	-	500 ⁶			500			
Min. horizontal distance between front leg // structure per person	-	500 ⁶			500			

⁴ Example of the calculation of the height, size mark 4 with front seat angle $+10^\circ$:

$h_8 = 380 + (340 \times \text{tg}2\alpha)$; $h_8 = 380 + (340 \times \text{tg}20^\circ)$; $h_8 = 380 + (340 \times 0,364)$; Result: $h_8 = 504 \text{ mm}$.

And the height of the table top $h_1 = h_8 + 260 \text{ mm}$; $h_1 = 504 + 260$; Result: $h_1 = 764 \text{ mm}$.

⁵ The footrest can be placed in the lower leg zone and the footrest may be inclined. The height is

measured at the mid point of the depth whether inclined or not.

⁶ Can be reduced to 400 mm (only when required by educational conditions).

Minimum legroom for tables for use with chairs double slope seat:

Table 4. Dimension in mm.

Size mark		0	1	2	3	4	5	6	7
Min. leg room for high chairs See fig.2	A	400				500			
	B	$h_1 - 75$	$h_1 - 80$	$h_1 - 90$	$h_1 - 95$	$h_1 - 95$	$h_1 - 100$	$h_1 - 95$	$h_1 - 95$
	C	$h_1 - 125$	$h_1 - 135$	$h_1 - 155$	$h_1 - 170$	$h_1 - 175$	$h_1 - 190$	$h_1 - 125$	$h_1 - 200$
	D	300				400			

2. Safety requirements

Several safety requirements for tables and chairs in the educational institutions are established in order to minimize the risk of injury or clothing damage.

- All edges of the seat, backrest and armrest which are in contact with the user and pupils during sitting in the chair must be rounded at least with 2 mm radius⁷;
- All other edges and corners with which the users while using them can come into contact must be smooth, rounded or chamfered and shall not have burrs;
- The distance between accessible moving parts powered by mechanisms (for example mainspring gas lifts) will be always smaller than 8 mm or bigger than 25 mm;
- Except for folding tables and chairs will not be any accessible gaps smaller than 8 mm or bigger than 25 mm which are created during normal and common movements and using;
- Adjustment controls won't take place in a dangerous way or accidentally;
- No parts can be detachable without using the tools;
- Open ends of tubular components will be covered by capped;
- Chairs will demonstrate the overturn according to the tests ČSN EN 1729-2;







- Tables shall not be overturned during the testing according to ČSN EN 1730 and ČSN EN 1728;
- Working surface of tables must have a matte finish;
- The sides of the chairs or seats must not be raised to form a ridge higher than 15 mm above any other lower point of the seat surface in a transverse direction;
- The lower and the upper edge of the backrest must be rounded;
- Tables and chairs must not demonstrate any constructional defect which would influence the tests in an unfavourable way according to ČSN EN 1729-2;
- Adjustable furniture for pupils which include two or more size marks must correspond to proportioned requirements of every size mark listed on the product.








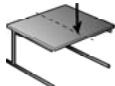


As for the safety the furniture must be also considered according to ČSN 91 0100 Furniture - Safety requirements which determines, except for the other, the furniture must not have holes and gaps that can be the cause of finger injuries and moving parts of the furniture must not be reason of injuries during its use in an adjusted level both when adjusting and while common application.

3. Mechanical features

In order to be able to be the chairs and tables for educational institutions considered as safe must be tested several times according to ČSN EN 1729-1. We take into account size division during the determination of specified load forces. The most important tests are the ones of stability from the view of safety. Some products have problems to fulfil the stability requirements backwards. The above mentioned standards determine functional dimensions for the height of adjustable chairs and tables and for the tables determined to be used for standing except for the mentioned obligatory requirements for the tables and chairs used in the educational institutions. The types with two height levels as maximum are suitable to use for height of adjustable tables and chairs. The maximum of two height levels is preventing from the possibility of incorrect adjustment for corresponding height group of users both while adjusting and while common application in an adjusted level.

Table 5 Overview of tests

Stability in all directions		Seat front edge durability	
Seat and back static load		Sideway static load	
Seat and back durability		Forward static load	

Seat impact		Back impact	
Static load of foot rail		Drop test	
Stability, horizontal impact		Stability, vertical load	
Horizontal static load		Vertical static load	
Vertical durability		Horizontal durability	

Mechanical testing of chairs and tables for educational institutions are more challenging than the furniture for domestic use, such as testing seat and back chairs durability is required for home use 25 000 cycles and chairs for educational institutions 100 000 cycles.

4. Requirements for instructions to use

The instructions for use must be submitted in the official language of the country where the furniture is sold. It can be given either as a leaflet or as a label affixed on the furniture. The instruction must include the following:

- size mark, to distinguish the size mark according to the ČSN EN 1729-1 with the references to this standard
- Maintenance instruction including the details about surface modification features;
- The instruction for the multi-size furniture must be suitable for the specific group of the pupils;
- The instructions for users (pupils) how to adjust multi-size furniture and set in a correct way.

In the instructions it is recommended to use drawings or pictures which makes their comprehensibility better and for height adjustable tables and chairs is recommended permanent placing of instructions for operating on the product. The moving chairs must be designed in such a way to prevent from the intentional push-off and

fall of their user while sitting down and standing up. The colour scheme of work surface must not have improper brightness and contrast to prevent the sight stress.

5. Epilogue

When the classrooms are equipped with the furniture it is necessary to require from supplier of the furniture to declare the correct size marks already in the title the required features with the reference to the ČSN EN 1729-1 and to the ČSN EN 1729-2. It is also necessary to demand the instructions for the use with all the above mentioned requirements. It is the only way to ensure nowadays the equipment of space for education with the furniture that can be the benefits for the healthy development of the children both of school and of the pre-school age. The above mentioned requirements are valid for the furniture designated for the educational space, the requirements for the furniture of the teachers are similar to those of office furniture.

Figures and references:

Figures:

1. Stature range and popliteal range
2. Functional dimensions for chairs
3. Functional dimension for high chairs

The author of all the figures including the pictures in the tables is Mr. Zdeněk Holouš, the figures and pictures are only illustrative.

Literature

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POŽADAVKY NA SEDACÍ A STOLOVÝ NÁBYTEK PRO VZDĚLÁVACÍ INSTITUCE

Abstrakt: Na nábytek pro vzdělávací instituce je kladena řada požadavků vyplývajících z legislativy ČR a technických norem: na jejich bezpečnost, ergonomii a mechanické vlastnosti. Vzhledem k uvedeným požadavkům je nutné vybavit učebny nábytkem stanovených vlastností. Především správná ergonomie školního nábytku je základní podmínkou úspěšné prevence poruch pohybového aparátu u dětí předškolního i školního věku. Při výběru a vybavování nábytkem učeben je nutné požadovat doložení základních požadavků podle platných technických norem, především dle ČSN EN 1729 – 1 až 2. V článku jsou uvedeny souvislosti základních vlastností a požadavků pro sedací a stolový nábytek pro školní a předškolních zařízení.

Klíčová slova: židle a stoly, vzdělávací instituce, ergonomie, základní požadavky