

School lighting

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Basic criterias for classroom lighting

- Safety
- Comfort
- Energy efficiency
- Architectural approach

European standards

- SR EN 12464:1/2021
- SR EN 1838/2014 – 2023?
- SR EN 15193:1 and 2 from 2018

Stages:

- Drafting the specifications
- Preparation of the tender
- Tender
- Reception of the works
- Maintenance of lighting systems

Specification

Safety criteria:

- Emergency lighting for marking exits, circulation and against panic



Tender Comfort criteria:

Table 44 — Educational premises - Educational buildings

Ref. no.	Type of task/activity area	\bar{E}_m lx		U_o	Ra	RUGL	$\bar{E}_{m,z}$ lx	$\bar{E}_{m,wall}$ lx	$\bar{E}_{m,ceiling}$ lx	Specific requirements
		required ^a	modified ^b							
44.1	Classroom - General activities	500	1 000	0,6 0	80	19	150	150	100	Lighting should be controllable, see 6.2.4, for different activities and scene settings. For classrooms used by young children, an \bar{E}_m required of 300 lx may be used by dimming (see 5.3.3). Ambient light should be considered, see Annex B, room brightness, see 6.7.
44.2	Auditorium, lecture halls	500	750	0,6 0	80	19	150	150	50	Lighting should be controllable, see 6.2.4, to accommodate various A/V needs, room brightness, see 6.7.
44.3	Attending lecture in seating areas in auditoriums and lecture halls	200	300	0,6 0	80	19	75	75	50	Reduction by dimming. DSE-work, see 5.9.
44.4	Black, green and white boards	500	750	0,70	80	19	-	-	-	Vertical illuminances. Specular reflections shall be prevented. Presenter/teacher shall be illuminated with suitable vertical illuminance.

Specification

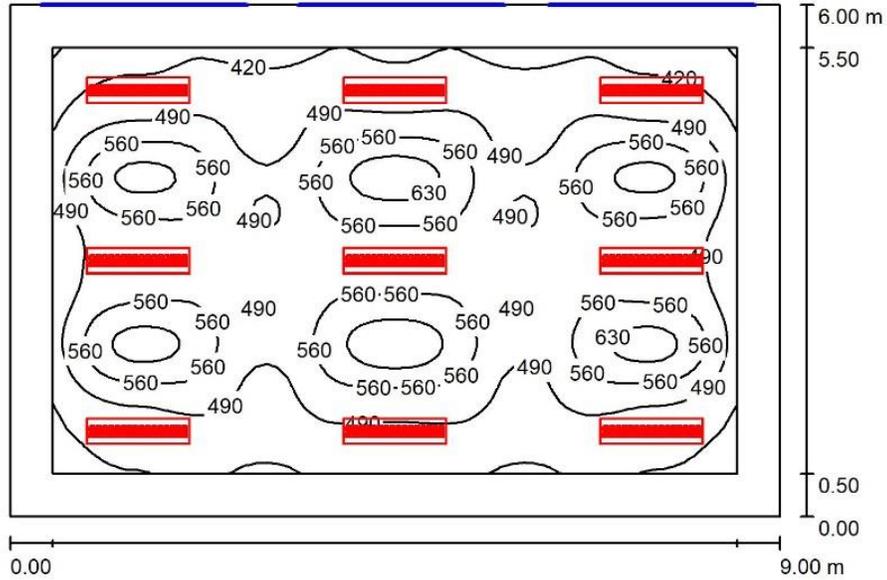
Energy efficiency criteria:

- Luminous efficacy $> 130 \text{ lm/W}$
- Specific power $p < 1,1 \text{ W/mp/100lx}$
- LENI $< 7-8 \text{ kWh/mp/an}$

Typical classroom Existing situation:

- Dimensions: 9 m x 6 m x 3.3 m height
- Equipped with 6 or 9 (rarely) luminaires with 2 fluorescent lamps of 36W
- $P_{ap} = 84 \text{ W}$, $P_{sist} = 6 \times 84 = 504 \text{ W}$
- Average illuminance $E_m = \text{approx. } 270 \text{ lx}$

Sala de clasa / Rezultate pe o singură pagină



Înălțimea spațiului: 3.300 m, Înălțime de montare: 3.295 m, Factor de menținere: 0.83

Valoare în Lux, Scară 1:78

Suprafață	ρ [%]	E_m [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	510	343	680	0.672
Floor	20	424	228	562	0.536
Ceiling	70	70	46	82	0.662
Pereți (4)	50	141	52	298	/

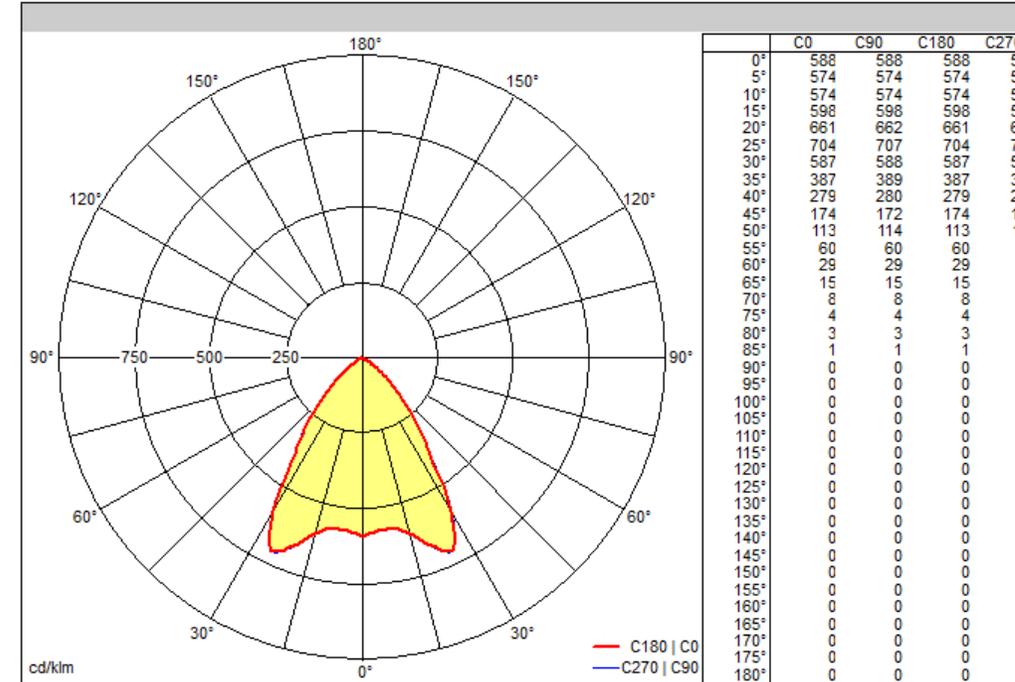
Workplane:	UGR	Pe lungime-	Transversal	la axa corpului de iluminat
Înălțime: 0.850 m	Perete stânga	10	10	
Raster: 64 x 64 Puncte	Perete inferior	10	10	
Zonă de margine: 0.500 m	(CIE, SHR = 1.00.)			

Raport iluminare (conform LG7): Pereți / Plan util: 0.255, Tavan / Plan de lucru: 0.137.

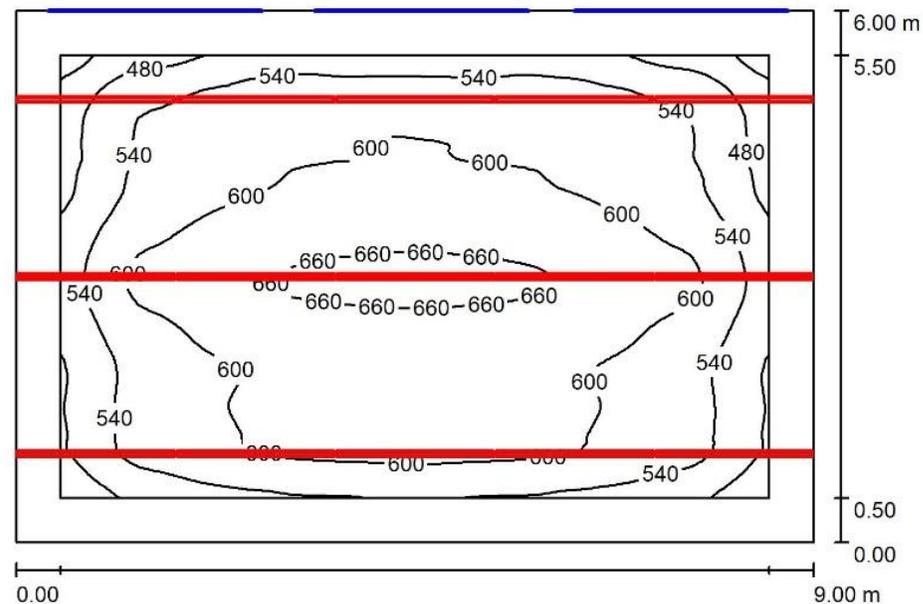
Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	Φ (Corp de iluminat) [lm]	Φ (Lămpi) [lm]	P [W]
1	9		3750	3750	25.2
Total:			33750	33750	226.8

Putere specifică: $4.20 \text{ W/m}^2 = 0.82 \text{ W/m}^2/100 \text{ lx}$ (Suprafață: 54.00 m^2)



Sala de clasa v2 / Rezultate pe o singură pagină



Înălțimea spațiului: 3.300 m, Înălțime de montare: 2.800 m, Factor de menținere: 0.83

Valoare în Lux, Scară 1:78

Suprafață	ρ [%]	E_m [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	579	394	674	0.680
Floor	20	466	283	582	0.608
Ceiling	70	96	69	111	0.716
Pereți (4)	50	242	66	3389	/

Workplane:	Înălțime:	0.850 m	UGR	Pe lungime-	Transversal	la axa corpului de iluminat
Raster:	64 x 64 Puncte		Perete stânga	23	23	
Zonă de margine:	0.500 m		Perete inferior	22	23	

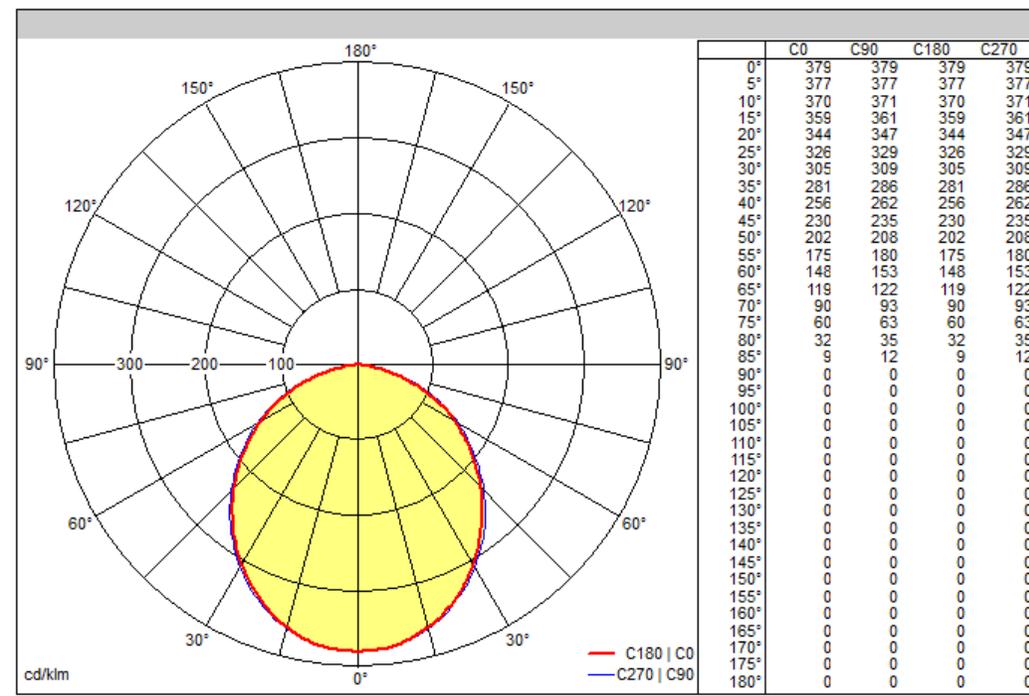
(CIE, SHR = 1.00.)

Raport iluminare (conform LG7): Pereți / Plan util: 0.417, Tavan / Plan de lucru: 0.166.

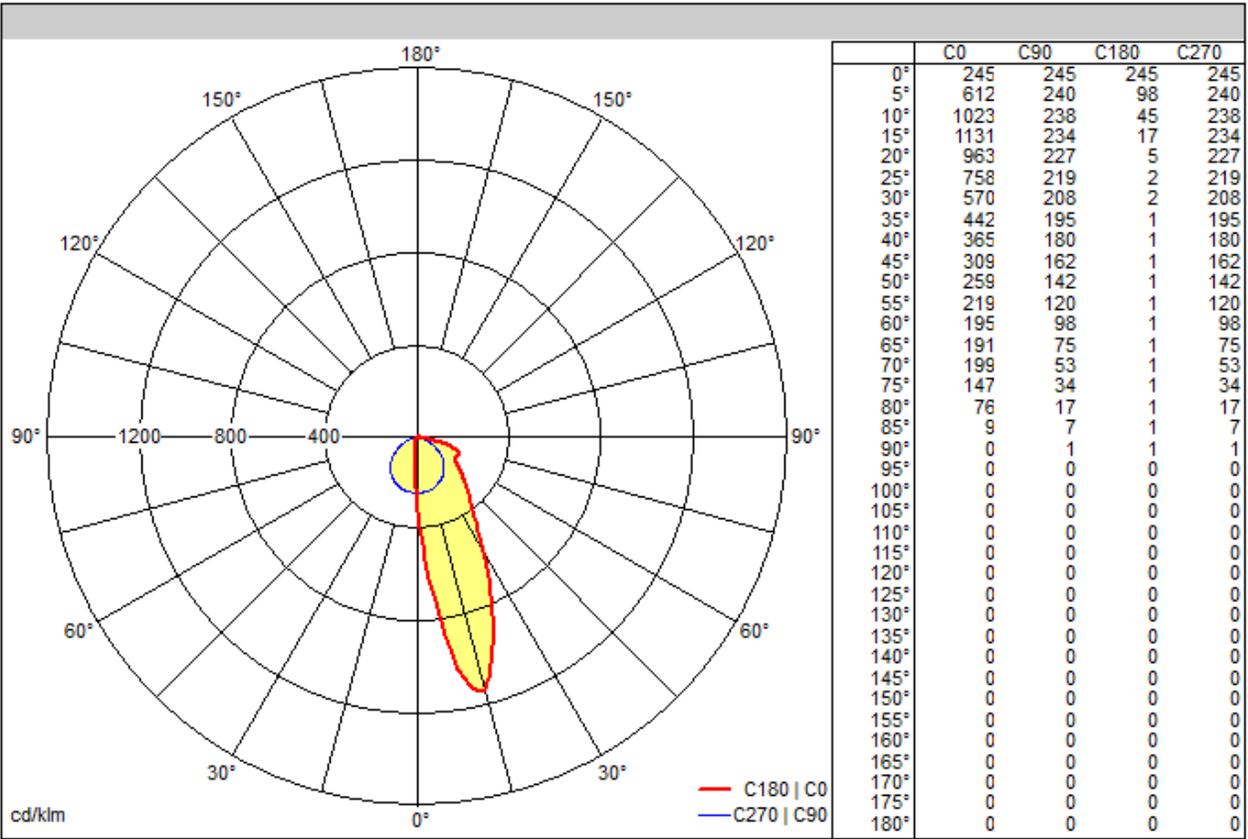
Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	Φ (Corp de iluminat) [lm]	Φ (Lămpi) [lm]	P [W]
1	15		2880	2880	27.2
Total:			43200	43200	408.0

Putere specifică: $7.56 \text{ W/m}^2 = 1.30 \text{ W/m}^2/100 \text{ lx}$ (Suprafață: 54.00 m^2)



Blackboard lighting: dedicated wallwasher



Light output ratio

Accepting lighting works:

- Use of the luxmeter



Maintenance of lighting systems:

- Replacement of fault luminaires
- Improving control systems
- Checking the operating time of emergency lighting
- Once a year luminaires should be wiped from dust

Luminous flux and color control for classrooms:

- Drivers with DALI or DALI2 protocol are needed to control the luminous flux
- In conjunction with motion sensors (hallways, toilets) and presence sensors (classrooms)
- Only lighting devices marked 'tunable white' allow colour temperature to be changed between 2700K and 6500K

Integrative lighting systems (color temperature change):

- Impact on circadian rhythm



Sunrise	Morning	Noon	Afternoon	Sunset
<2000k	3500-4500K	5500-6500K	3500-4500K	<2000K