Cours E314
Principe d'éclairagisme

ÉCOLE POLYTECHNIQUE MONTRÉAL

Module 18

WELL BUILDING STANDARDS

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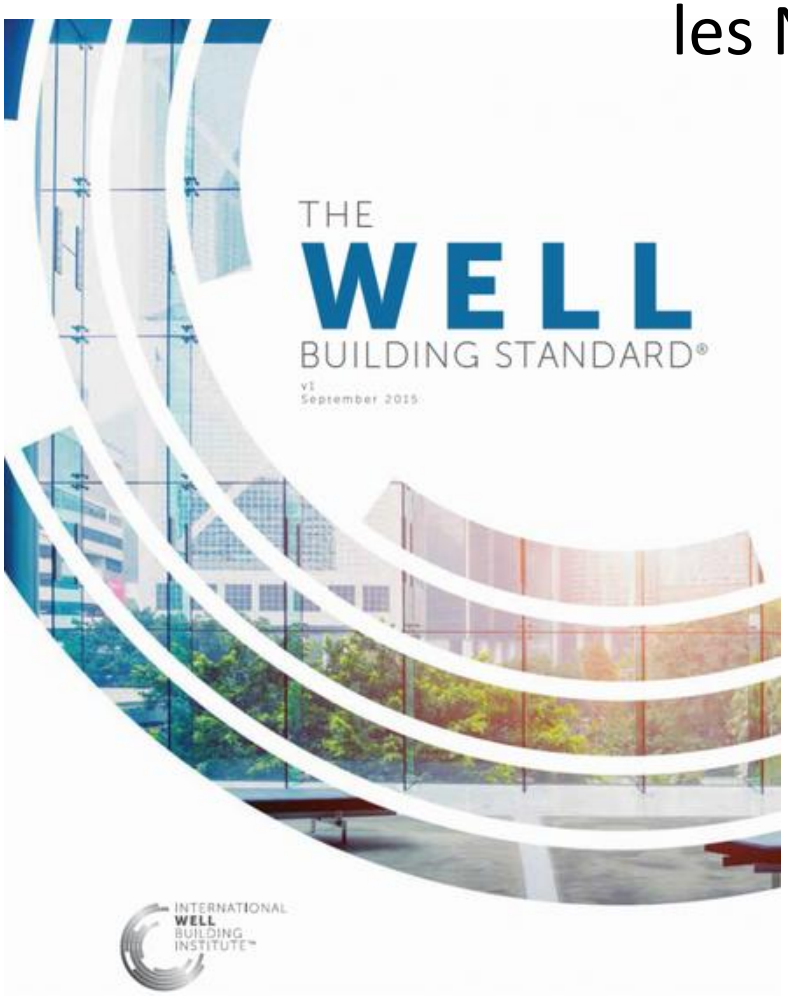
Comment calculer le calcul de l'éclairage pour les NORMES DU BÂTIMENT DE PUITS



INTERNATIONAL
WELL
BUILDING
INSTITUTE

WELL BUILDING STANDARDS

Voici une association responsable d'accrédité les aspects du confort humain dans un bâtiment.

1. Qualité de l'air (par exemple, gaz organiques et inorganiques et particules)
2. Qualité de l'eau (par exemple, produits chimiques dissous et solides en suspension)
3. Attributs de lumière (par exemple qualité de couleur, intensité et distribution de puissance spectrale)
4. Considérations thermiques (p. Ex., Température ambiante et radiante, vitesse de l'air et humidité)
5. 5. Eléments acoustiques (par exemple, niveaux de décibels et réverbération)

WELL BUILDING STANDARDS

Pour obtenir l'accréditation, vous devez répondre à des préconditions et aller chercher des points d'optimisation.

STANDARD VERSION	LEVEL OF ACHIEVEMENT	PRECONDITIONS THAT MUST BE ACHIEVED	OPTIMIZATIONS THAT MUST BE ACHIEVED
WELL Building Standard®	Silver Certification	All applicable	None
	Gold Certification	All applicable	40% of applicable
	Platinum Certification	All applicable	80% of applicable
WELL Pilot Standards	Silver Certification	All applicable	20% of applicable
	Gold Certification	All applicable	40% of applicable
	Platinum Certification	All applicable	80% of applicable

PROJECT TYPES	PRECONDITIONS	OPTIMIZATIONS	TOTAL
New and Existing Buildings	41	59	100
New and Existing Interiors	36	62	98
Core and Shell	26	28	54

INTENT

The WELL Building Standard® for Light provides illumination guidelines that are aimed to minimize disruption to the body's circadian system, enhance productivity, support good sleep quality and provide appropriate visual acuity where needed.

LIGHT FEATURE LEVEL MATRIX

	Core and Shell	New and Existing Interiors	New and Existing Buildings
53 VISUAL LIGHTING DESIGN			
1: Visual Acuity for Focus	-	P	P
2: Brightness Management Strategies	-	P	P
54 CIRCADIAN LIGHTING DESIGN			
1: Melanopic Light Intensity for Work Areas	-	P	P
55 ELECTRIC LIGHT GLARE CONTROL			
1: Luminaire Shielding	-	P	P
2: Glare Minimization	P	P	P
56 SOLAR GLARE CONTROL			
1: View Window Shading	O	P	P
2: Daylight Management	O	P	P
57 LOW-GLARE WORKSTATION DESIGN			
1: Glare Avoidance	-	O	O
58 COLOR QUALITY			
1: Color Rendering Index	-	O	O
59 SURFACE DESIGN			
1: Working and Learning Area Surface Reflectivity	-	O	O
60 AUTOMATED SHADING AND DIMMING CONTROLS			
1: Automated Sunlight Control	-	O	O
2: Responsive Light Control	-	O	O
61 RIGHT TO LIGHT			
1: Lease Depth	O	O	O
2: Window Access	-	O	O
62 DAYLIGHT MODELING			
1: Healthy Sunlight Exposure	O	O	O
63 DAYLIGHTING FENESTRATION			
1: Window Sizes for Working and Learning Spaces	O	O	O
2: Window Transmittance in Working and Learning Areas	O	O	O
3: Uniform Color Transmittance	O	O	O

53- Calcul de l'éclairage standard

54-calcul de l'éclairage avec test Sphere du facteur mélanique / photopique et test de la puissance radiante totale (contenu spectral) à 5 nm

55- Peut être validé avec la distribution du luminaire (fichier IES)

56-Éclairage non électrique lié

57- Ne pas diriger l'appareil sur l'écran de l'ordinateur

58- CRI> 80 avec R9> 50 Le rapport LM79 complet fournira à l'info ou à Sphère les valeurs CCT et CRI avec toutes les valeurs R

59-Éclairage non électrique lié / réflectance de surface

60-Éclairage non électrique lié

61-Éclairage non électrique lié

62-Éclairage non électrique lié

63-Éclairage non électrique lié

Comment obtenir précondition # 54 éclairage circadien

54

CIRCADIAN LIGHTING DESIGN

Light is one of the main drivers of the circadian system, which starts in the brain and regulates physiological rhythms throughout the body's tissues and organs, affecting hormone levels and the sleep-wake cycle. Circadian rhythms are kept in sync by various cues, including light which the body responds to in a way facilitated by intrinsically photosensitive retinal ganglion cells (ipRGCs): the eyes' non-image-forming photoreceptors. Through ipRGCs, lights of high frequency and intensity promote alertness, while the lack of this stimulus signals the body to reduce energy expenditure and prepare for rest. The biological effects of light on humans can be measured in Equivalent Melanopic Lux (EML), a proposed alternate metric that is weighted to the ipRGCs instead of to the cones, which is the case with traditional lux. During Performance Verification, EML is measured on the vertical plane at eye level of the occupant. Tables L1 and L2 in Appendix C show how to calculate the LML of individual lamps and larger spaces.

Cardiovascular
Digestive
Endocrine
Immune
Muscular
Nervous

Core and Shell	New and Existing Interiors	New and Existing Buildings
-	P	P

Intent: To support circadian health by setting a minimum threshold for daytime light intensity.

PART 1: MELANOPIC LIGHT INTENSITY FOR WORK AREAS

Light models or light calculations demonstrate that at least one of the following requirements is met:

a. At 75% or more of workstations, at least 200 equivalent melanopic lux is present, measured on the vertical plane facing forward, 1.2 m [4 ft] above finished floor (to simulate the view of the occupant). This light level may incorporate daylight, and is present for at least the hours between 9.00 AM and 1.00 PM for every day of the year.

b.[174] For all workstations, electric lights provide maintained illuminance on the vertical plane facing forward (to simulate the view of the occupant) of 150 equivalent melanopic lux or greater.

1. Vous devez obtenir le ratio mélanopique

A partir d'un test de shpere, vous pouvez obtenir la table de distribution de puissance spectrale de la source lumineuse à chaque 5nm et la comparer aux courbes mélanopiques et visuelles pour obtenir le ratio.

2. Vous devez effectuer un calcul vertical standard et appliquer un facteur mélanopique

Appliquer le facteur mélanopique pour chaque grille de calcaire à chaque personne travaillant à 4 'du sol et regarder si 75% des employés rencontrent les valeurs

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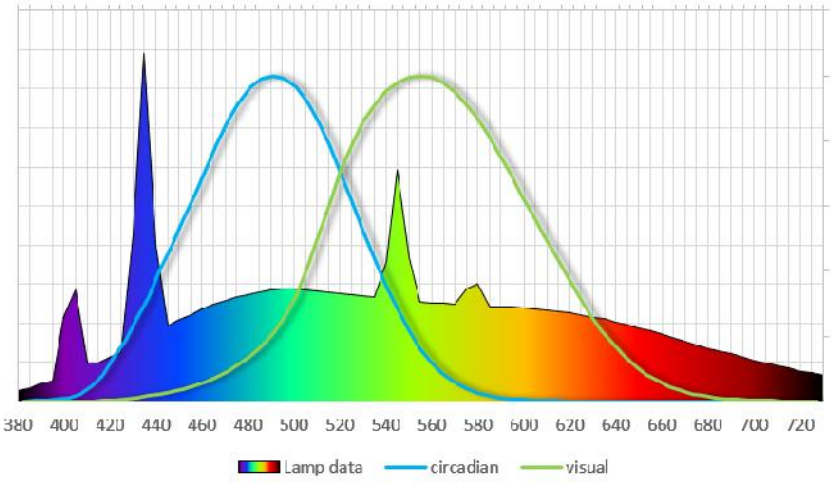
ISO/IEC 17025
NVLAP
NVLAP LAB CODE: 200899-0

Spectral Power Distribution Table (2/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
480	0.01205	505	0.02654	530	0.03414	555	0.04433
481	0.01242	506	0.02699	531	0.03446	556	0.04484
482	0.01283	507	0.02735	532	0.03484	557	0.04539
483	0.01328	508	0.02779	533	0.03520	558	0.04592
484	0.01367	509	0.02814	534	0.03548	559	0.04640
485	0.01418	510	0.02844	535	0.03578	560	0.04698
486	0.01473	511	0.02892	536	0.03612	561	0.04769
487	0.01520	512	0.02931	537	0.03637	562	0.04821
488	0.01584	513	0.02957	538	0.03678	563	0.04881
489	0.01649	514	0.03000	539	0.03718	564	0.04934
490	0.01713	515	0.03029	540	0.03756	565	0.04971
491	0.01779	516	0.03047	541	0.03809	566	0.05037
492	0.01848	517	0.03082	542	0.03853	567	0.05086
493	0.01911	518	0.03092	543	0.03890	568	0.05134
494	0.01981	519	0.03118	544	0.03938	569	0.05198
495	0.02055	520	0.03144	545	0.03975	570	0.05248
496	0.02120	521	0.03160	546	0.04006	571	0.05310
497	0.02187	522	0.03192	547	0.04061	572	0.05368
498	0.02252	523	0.03219	548	0.04103	573	0.05422
499	0.02321	524	0.03251	549	0.04146	574	0.05498
500	0.02377	525	0.03269	550	0.04194	575	0.05552
501	0.02452	526	0.03302	551	0.04255	576	0.05613
502	0.02499	527	0.03331	552	0.04296	577	0.05686
503	0.02563	528	0.03357	553	0.04349	578	0.05719
504	0.02607	529	0.03379	554	0.04387	579	0.05765



Comment obtenir la précondition # 55 Contrôle électrique de l'éblouissement

55

ELECTRIC LIGHT GLARE CONTROL

Non-diffuse, bright indoor lights create uneven levels of brightness in the visual field. The resulting glare, defined as "excessive brightness of the light-source, excessive brightness-contrasts and excessive quantity of light", can cause visual discomfort (discomfort glare), fatigue, visual impairment and even injury (disability glare), and can be attributed to either direct or reflected glare. In the case of glare caused by electric light sources, lamps should be shielded based on their luminance. This quantity, often given in cd/m2, can be measured directly or calculated from lighting specification sheets with sufficient detail. Light fixtures of greater luminous intensity require a greater shielding angle to reduce the likelihood of creating direct glare for occupants.

Intent: To minimize direct and overhead glare by setting limits on the luminous intensity of luminaires.

Muscular
Nervous
Skeletal

	Core and Shell	New and Existing Interiors	New and Existing Buildings
PART 1: LUMINAIRE SHIELDING	-	P	P

The following shielding angles (α = 90 - cutoff angle) must be observed for lamps in regularly occupied spaces with luminance values in the ranges specified:

a. No shielding required for less than 20,000 cd/m² (including reflected sources).
b.[79] α: 15° for 20,000 to 50,000 cd/m².
c.[79] α: 20° for 50,000 to 500,000 cd/m².
d.[79] α: 30° for 500,000 cd/m² and above.

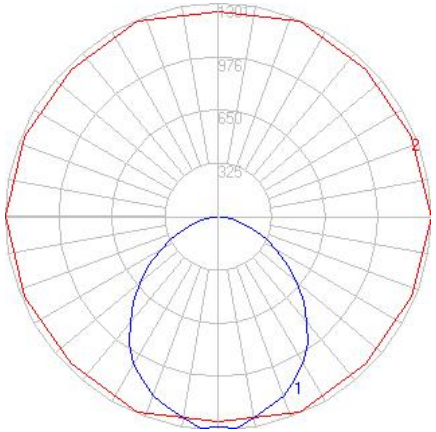
PART 2: GLARE MINIMIZATION	P	P	P

At workstations, desks, and other seating areas, the following requirement is met:

a.[174] Luminaires more than 53° above the center of view (degrees above horizontal) have luminances less than 8,000 cd/m².

2. Vous devez vérifier les valeurs du fichier ies

Assurez-vous que les valeurs de luminance supérieures à 43 ° et inférieures à 90 ° sont inférieures à 8000 cd / m²



IES INDOOR REPORT
PHOTOMETRIC FILENAME : RM4DOD-1L35K-4-M-L3.IES

CANDELA TABULATION

	0.0	22.5	45.0	67.5	90.0
0	1287.26	1287.26	1287.26	1287.26	1287.26
5	1300.80	1281.48	1275.04	1291.92	1251.92
10	1244.38	1264.77	1253.31	1250.68	1259.80
15	1204.42	1213.96	1191.10	1194.55	1195.45
20	1169.63	1143.56	1147.94	1123.26	1112.05
25	1101.13	1090.58	1077.88	1056.07	1057.00
30	1033.78	1025.03	992.85	965.78	961.07
35	949.70	931.77	899.70	857.96	841.85
40	838.37	828.90	785.77	741.40	725.12
45	738.80	720.01	674.60	632.90	611.66
50	630.88	612.12	561.90	519.29	502.77
55	522.99	498.09	456.26	411.20	404.37
60	413.07	395.32	355.75	323.59	309.51
65	318.73	302.20	268.58	240.64	232.96
70	222.15	211.73	190.07	166.38	157.08
75	144.34	133.37	116.66	104.16	98.86
80	77.53	71.04	61.56	52.82	50.24
85	26.77	24.48	20.44	18.26	16.96
90	5.75	4.71	3.57	2.80	2.77

IES INDOOR REPORT
PHOTOMETRIC FILENAME : RM4DOD-1L35K-4-M-L3.IES

LUMINANCE DATA (cd/sq.m)

Angle In Degrees	Average 0-Deg	Average 45-Deg	Average 90-Deg
45	7726	4225	3360
55	6535	2958	2245
65	5140	1864	1348
75	3428	900	617
85	1279	184	119

Comment obtenir l'optimisation # 58 Couleur

58

COLOR QUALITY

Color quality is a function of the spectral output of a light source, the spectral absorbance/reflectance of an object, and the sensitivity of the eye's cone photoreceptors to different wavelengths of light, which we perceive as color. Color quality impacts visual appeal and can either contribute to or detract from occupant comfort. Poor color quality can reduce visual acuity and the accurate rendering of illuminated objects. For instance, foods, human skin tones and plants may appear dull or unsaturated under lights that have low color quality metrics. Color rendering index (CRI) is a common way to measure color quality, capturing R1-R8 metrics. R9, while not always reported, is also included as part of this feature, as R9 values further take into consideration how we perceive the saturation of warmer hues.

Intent: To enhance spatial aesthetics and color differentiation through the use of lamps with quality color rendering abilities.

Core and Shell	New and Existing Interiors	New and Existing Buildings
-	O	O

PART 1: COLOR RENDERING INDEX

To accurately portray colors in the space and enhance occupant comfort, all electric lights (except decorative fixtures, emergency lights and other special-purpose lighting) meet the following conditions:

a. Color Rendering Index Ra (CRI, average of R1 through R8) of 80 or higher.

b. Color Rendering Index R9 of 50 or higher.

1. Vous devez confirmer à partir d'un test de sphère de laboratoire

Vous devez rencontrer un CRI> 80 avec un R9> 50

Le rapport complet LM79 fournira à l'info ou à Sphère les valeurs CCT et CRI avec toutes les valeurs R

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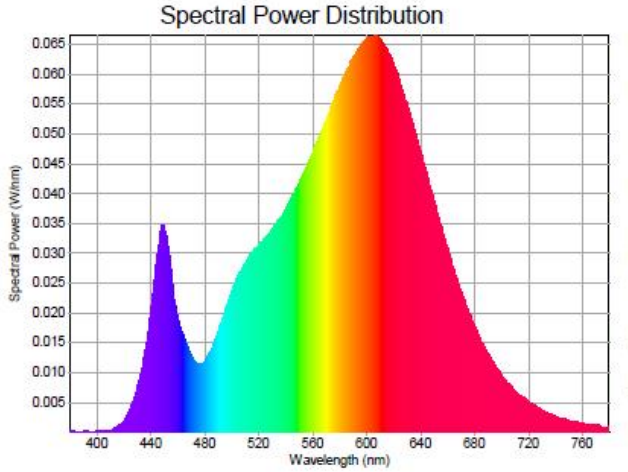
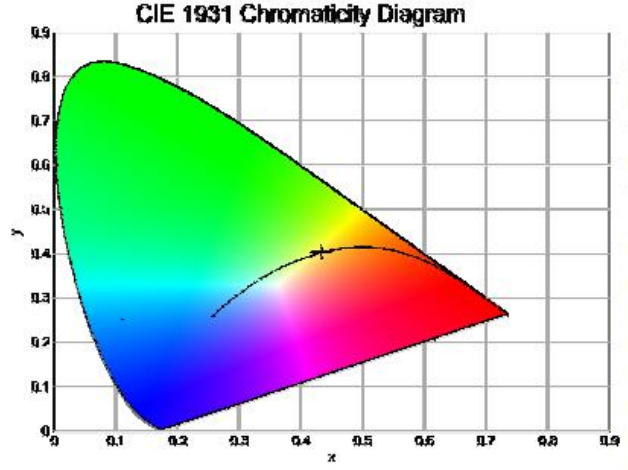


Peak Wavelength	607 nm
Luminous Flux	3310 lm
Input Power	28.19 W
Lumens/Watt	117.4
Full Width/Half Maximum	130.23
Center Wavelength	592 nm
Centroid Wavelength	400 nm
Dominant Wavelength	491 nm
Excitation Purity	0.0336
Colorimeric Purity	0.0270



x	0.4339	CCT	3057 K
y	0.4047	CRI	83
u	0.2483	L*	25.67
v	0.3474	a*	-1.45
u'	0.2483	b*	-2.79
v'	0.5212	Duv	0.0007
R1	80.9	R9	7.8
R2	90.2	R10	77.9
R3	97.0	R11	81.1
R4	81.6	R12	72.7
R5	81.3	R13	82.9
R6	88.1	R14	98.7
R7	83.8		
R8	60.1		