SYLVANIA

Glare and UGR

Nigel Box Defines

Light your world

Contents

Glare 03

Unified Glare Rating (UGR) 04

Tabular Method 05

How to find the UGR values of a product 06

Glare

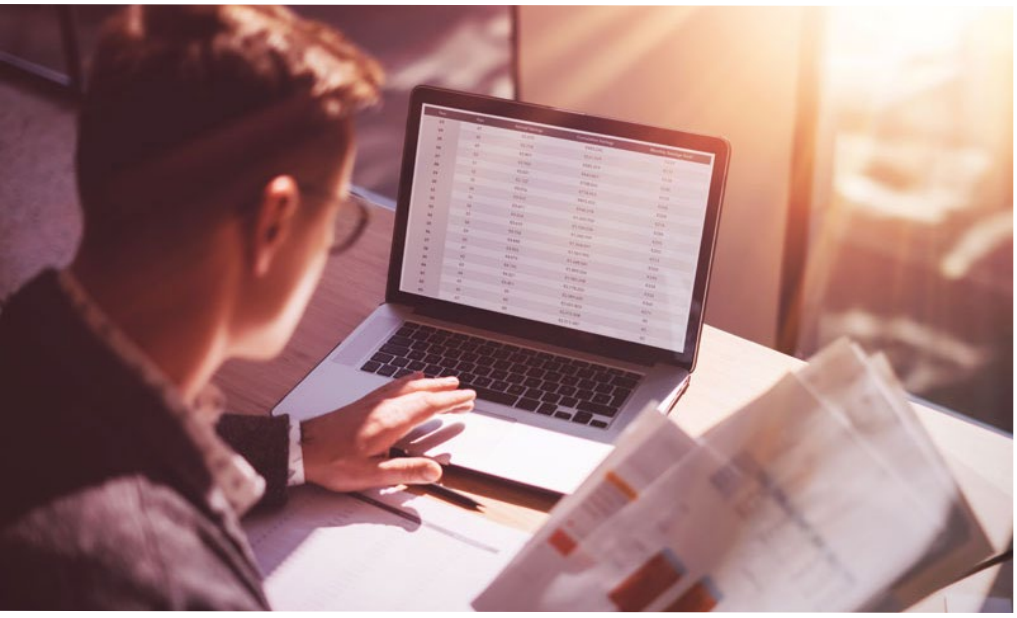
Glare is a visual sensation caused by excessive and uncontrolled brightness.

It can be disabling or simply uncomfortable.

It is subjective, and sensitivity to glare can vary widely. Older people are usually more sensitive to glare due to the aging characteristics of the eye.

There are two commonly considered types of glare:

- Discomfort Glare - the sensation of annoyance or even pain induced by overly bright sources, but not actually stopping you seeing.
- Disability Glare - the reduction in visibility caused by intense light sources in the field of view. It causes a loss of visibility from stray light being scattered within the eye.



This presentation deals exclusively with glare produced by artificial light sources in interior (indoor) installations.

One common metric that is used to quantify Discomfort Glare is the UGR

UGR = Unified Glare Rating

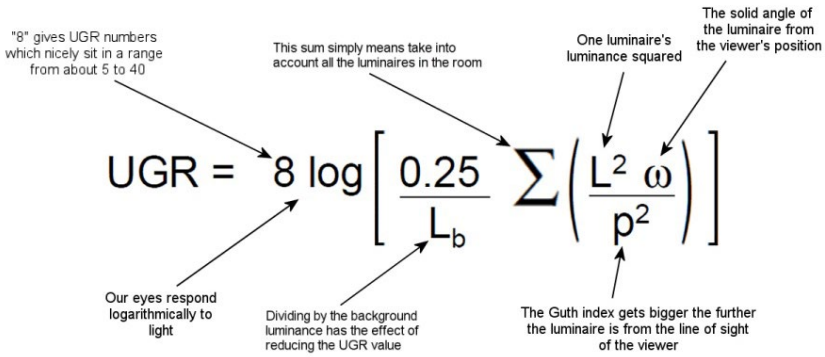
Unified Glare Rating (UGR)

UGR is calculated using a precise formula. Essentially, this formula measures the luminance of a luminaire divided by the background of visible luminance from the room. The UGR ranges from 5 to 40.

The lower the number, the better.

For example, a low UGR of 10 means the glare is so discreet it will go unnoticed, while a UGR of 30 will definitely cause distraction.

UGR = Unified Glare Rating



UGR is applicable to lighting installations, not luminaires.

The formula requires the prior knowledge of the position and brightness of each potential glare source. It is quite accurate, but relatively difficult to work with. It is best calculated with computer software.

Recommended UGR limits

Working area	Maximum allowed UGR
Drawing/design offices	16
Offices	19
Industrial work, fine	22
Industrial work, medium	25
Industrial work, course	28

Glare calculations are complex and involve **summing all the light** from all sources at a particular angle entering the eye at a particular location.

Strictly speaking, there is no such thing as a 'UGR19-compliant' luminaire. There are luminaires whose performance supports a UGR-compliant design or installation, but compliance can only be determined once the ergonomics and geometry relative to the occupants of a space have been assessed. If a manufacturer claims UGR19 compliance, then it can only be for a set of pre-determined conditions.

Thus, a **luminaire UGR is a simplification** which enables us to determine if it is likely to cause discomfort in specific *types of work or office environment*.

Tabular Method

This is a procedure which is followed in order to determine the UGR value of a lighting installation in a standard room.

The lighting designer should bear in mind that the 'standard room' rarely represents real-world situations.

In this method, the floor has a standardised reflectance of 20%, walls: 30% to 50% and ceiling up to 70%.

White walls or ceilings with a higher reflectance (75 to 90%), such as frequently occur in indoor spaces, are not taken into consideration in this approach.

The observer is positioned either across or along the luminaire axis. It does not permit an angle of vision diagonal to the luminaire axis. Also, it is based exclusively on rectangular room geometries.

It must be applied for each individual type of luminaire, if more than one luminaire type is present in the room. (Each type of luminaire has its own UGR table.)

Reflectances:											
Ceiling/cavity		0,70	0,70	0,50	0,50	0,30	0,70	0,70	0,50	0,50	0,30
Wall		0,50	0,30	0,50	0,30	0,30	0,50	0,30	0,50	0,30	0,30
Working plane		0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Room dimensions		Viewed crosswise					Viewed endwise				
X =2*H*	*Y*=2*H*	8,9	10,5	9,3	10,8	11,1	10,6	12,2	11,0	12,5	12,9
	3*H*	10,4	11,9	10,8	12,2	12,6	12,4	13,8	12,8	14,2	14,5
	4*H*	10,9	12,3	11,3	12,6	13,0	13,1	14,4	13,5	14,8	15,2
	6*H*	11,5	12,7	11,9	13,1	13,5	13,6	14,8	14,0	15,2	15,6
	8*H*	11,7	12,9	12,1	13,3	13,7	13,7	14,9	14,2	15,3	15,7
	12*H*	12,0	13,2	12,4	13,5	14,0	13,8	14,9	14,2	15,3	15,7
4*H*	2*H*	9,6	11,0	10,0	11,3	11,7	11,0	12,4	11,4	12,7	13,1
	3*H*	11,3	12,5	11,7	12,9	13,3	13,0	14,1	13,4	14,5	14,9
	4*H*	12,0	13,0	12,4	13,4	13,9	13,9	14,9	14,3	15,3	15,7
	6*H*	12,6	13,5	13,1	14,0	14,4	14,5	15,4	15,0	15,8	16,3
	8*H*	13,0	13,8	13,5	14,2	14,7	14,7	15,5	15,2	16,0	16,4
	12*H*	13,4	14,1	13,8	14,6	15,0	14,8	15,6	15,3	16,0	16,5
8*H*	4*H*	12,4	13,2	12,8	13,6	14,1	14,0	14,9	14,5	15,3	15,8
	6*H*	13,2	13,8	13,6	14,3	14,8	14,8	15,4	15,2	15,9	16,4
	8*H*	13,6	14,2	14,1	14,7	15,2	15,0	15,6	15,5	16,1	16,6
	12*H*	14,1	14,6	14,6	15,1	15,7	15,2	15,7	15,7	16,2	16,8
12*H*	4*H*	12,4	13,2	12,9	13,6	14,1	14,0	14,8	14,5	15,2	15,7
	6*H*	13,2	13,8	13,7	14,3	14,8	14,8	15,4	15,3	15,9	16,4
	8*H*	13,8	14,3	14,3	14,8	15,3	15,1	15,6	15,6	16,1	16,7

Note on Interdistance or space:height ratio (SHR)

0.25 is usually used in Europe (and by most luminaire manufacturers).

1:1 was used in the UK, but is not so common now

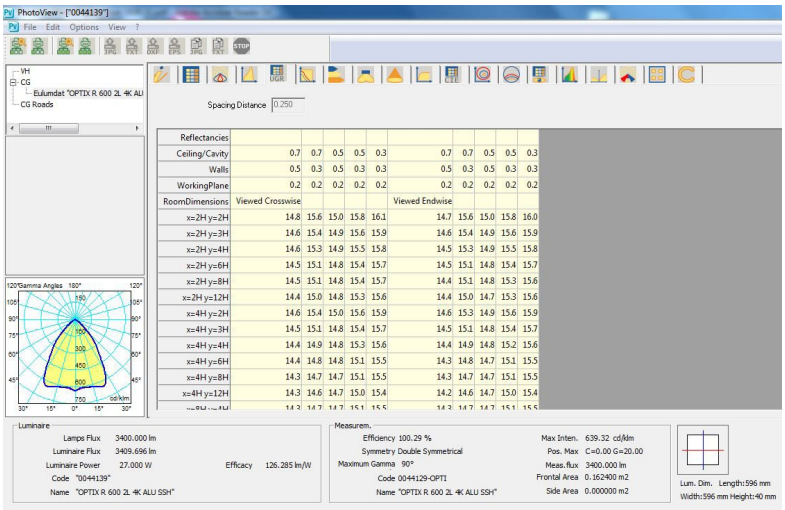
How to find the UGR values of a product

Download a free photometric file viewer
(such as Photoview – part of Oxytech's LITESTAR 4D Open)

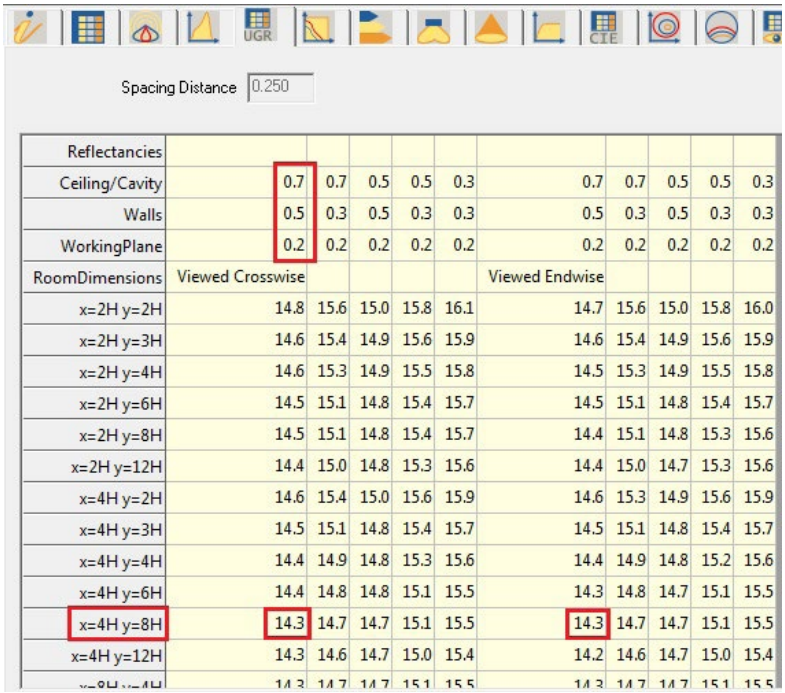
Obtain the photometric file of the luminaire (LDT, IES, etc.)

Open the photometric file with the viewer

Click on the UGR tab



Navigate to **4H** x **8H** Room Dimensions, and the **UGR value** will be **in the first column** (under a standard room reflectance of **0.7/0.5/0.2**).



Spacing Distance 0.250

Reflectancies										
Ceiling/Cavity	0.7	0.7	0.5	0.5	0.3	0.7	0.7	0.5	0.5	0.3
Walls	0.5	0.3	0.5	0.3	0.3	0.5	0.3	0.5	0.3	0.3
WorkingPlane	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
RoomDimensions	Viewed Crosswise					Viewed Endwise				
x=2H y=2H	14.8	15.6	15.0	15.8	16.1	14.7	15.6	15.0	15.8	16.0
x=2H y=3H	14.6	15.4	14.9	15.6	15.9	14.6	15.4	14.9	15.6	15.9
x=2H y=4H	14.6	15.3	14.9	15.5	15.8	14.5	15.3	14.9	15.5	15.8
x=2H y=6H	14.5	15.1	14.8	15.4	15.7	14.5	15.1	14.8	15.4	15.7
x=2H y=8H	14.5	15.1	14.8	15.4	15.7	14.4	15.1	14.8	15.3	15.6
x=2H y=12H	14.4	15.0	14.8	15.3	15.6	14.4	15.0	14.7	15.3	15.6
x=4H y=2H	14.6	15.4	15.0	15.6	15.9	14.6	15.3	14.9	15.6	15.9
x=4H y=3H	14.5	15.1	14.8	15.4	15.7	14.5	15.1	14.8	15.4	15.7
x=4H y=4H	14.4	14.9	14.8	15.3	15.6	14.4	14.9	14.8	15.2	15.6
x=4H y=6H	14.4	14.8	14.8	15.1	15.5	14.3	14.8	14.7	15.1	15.5
x=4H y=8H	14.3	14.7	14.7	15.1	15.5	14.3	14.7	14.7	15.1	15.5
x=4H y=12H	14.3	14.6	14.7	15.0	15.4	14.2	14.6	14.7	15.0	15.4

This luminaire is **UGR < 15**

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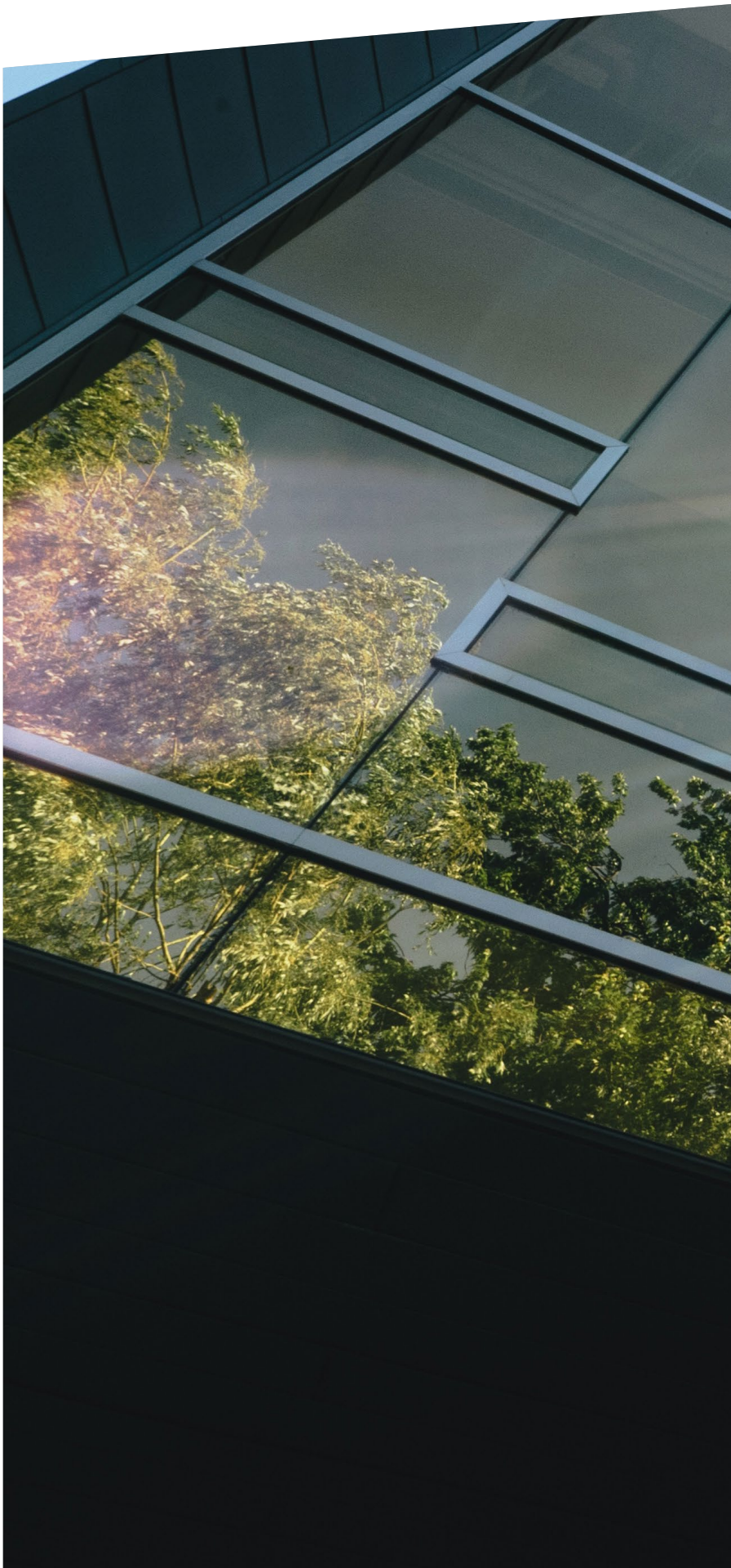

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