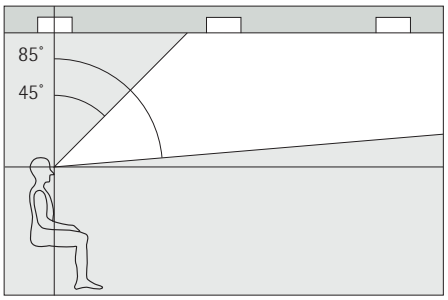
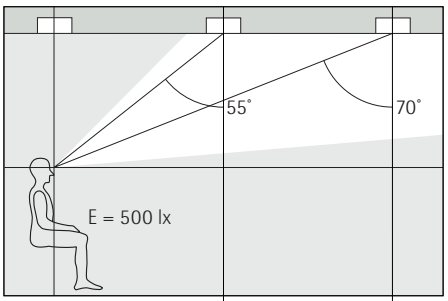
Minimum cut-off angle of luminaires with different light sources, in relation to the glare limitation category.

Lamp type	Glare limitation category			
	A	B	C	D
	Very low	High	Average	Low
Fluorescent lamp	20°	10°	0°	0°
Compact fluorescent lamp	20°	15°	5°	0°
High-pressure lamp, matt	30°	20°	10°	5°
High-pressure lamp, clear Incandescent lamp, clear	30°	30°	15°	10°



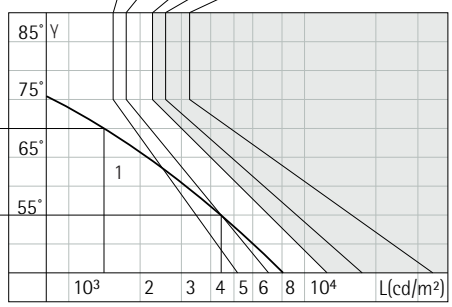
To evaluate direct glare the luminance of the luminaires within the range 45° to 85° is considered.



Example of how to apply glare limitation to an illuminance level of 500 lx and category A. From the geometry of the space the viewing angle for the first luminaire is 55°, for the second luminaire 70°. The corresponding luminances can be read off luminance curve 1 in the diagram.

The luminance curve does not exceed the limiting curve, the luminaire therefore meets the requirements laid down for glare limitation.

Category	Mean illuminance (lx)				
A	1000	750	500	–	300
1	2000	1500	1000	750	500

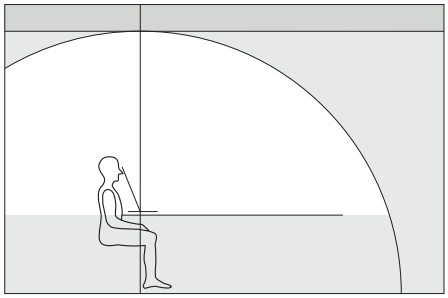


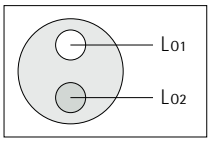
Luminance limiting curves (for luminaires without luminous side panels). They identify values for average luminance L of the luminaire at angles γ between 45° and 85°, which are not to be exceeded by the luminaire in question for the given mean illuminance and for the required glare limitation category.

lighting conditions to the luminance contrast of the same visual task under the given lighting conditions.

The contrast rendition factor (CRF) is based on a reflection standard comprising one light (high reflectance) and one dark (low reflectance) ceramic disc with standardised reflectance for various directions and angles of illumination. For completely diffuse lighting the reference contrast is known.

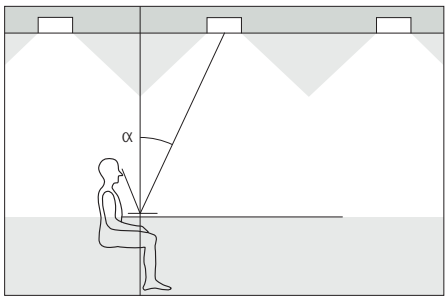
The CRF can be measured in an actual lighting installation on the basis of the given reflection standard or calculated on the basis of the reflectance data. The CRF is then classified into one of three CRF categories.

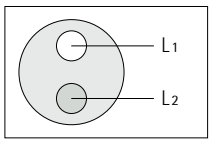




$$C_0 = \frac{L_{01} - L_{02}}{L_{01}}$$

$$C_0 = 0{,}91$$





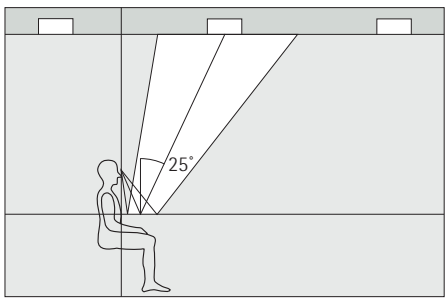
$$C = \frac{L_1 - L_2}{L_1}$$

$$CRF = \frac{C}{C_0} = \frac{C}{0{,}91} = \frac{L_1 - L_2}{0{,}91 \cdot L_1}$$

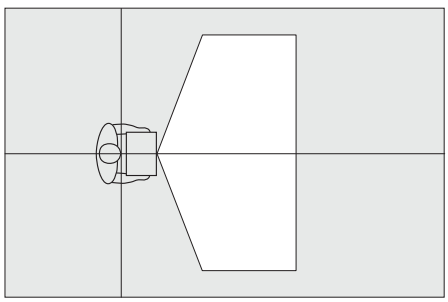
Evaluating the contrast rendition factor (CRF): in the case of a completely diffuse reference lighting situation (idealised representation of a light hemi-sphere, above left) the reference value for standard reflectanceaccording to Bruel + Kjaer is C_0 (above right).

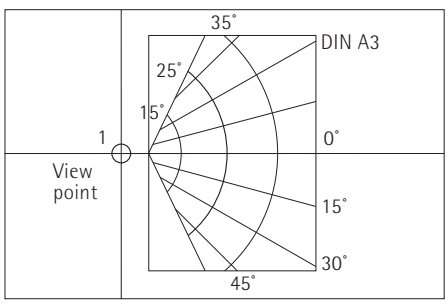
In the case of an actual lighting situation (below left) the contrast value for standard reflectance with a viewing angle α is C (below right).

Contrast rendition factor CRF is a criterion for contrast perception at viewing angle α. CRF <1 indicates that the lighting has lost part of its contrast rendering quality due to reflections. CRF >1 indicates that the lighting situation exceeds the quality of the reference lighting with regard to contrast rendition.



By projecting the field of vision onto the ceiling surface it is possible to define the area in which the luminaires may have a negative influence on contrast rendering. For the basic planning of a lighting installation the CRF value is generally only calculated for the primary viewing angle of 25°.





Grid for calculating the contrast rendition factor, taking as a basis an A3 format area of view at viewing position (1), 50 mm in front of and 400 mm above the front edge of the area under consideration.

Recommendations for average and minimum CRF values depending on the type of visual task and CRF rating.

Visual task	Contrast rendering	CRF cat.	CRF av. value	CRF min. value
Predominantly glossy	High	1	1.0 ≤ CRF	≥ 0.95
Matt with a soft sheen	Average	2	0.85 ≤ CRF < 1.0	≥ 0.7
Matt	Low	3	0.7 ≤ CRF < 0.85	≥ 0.5