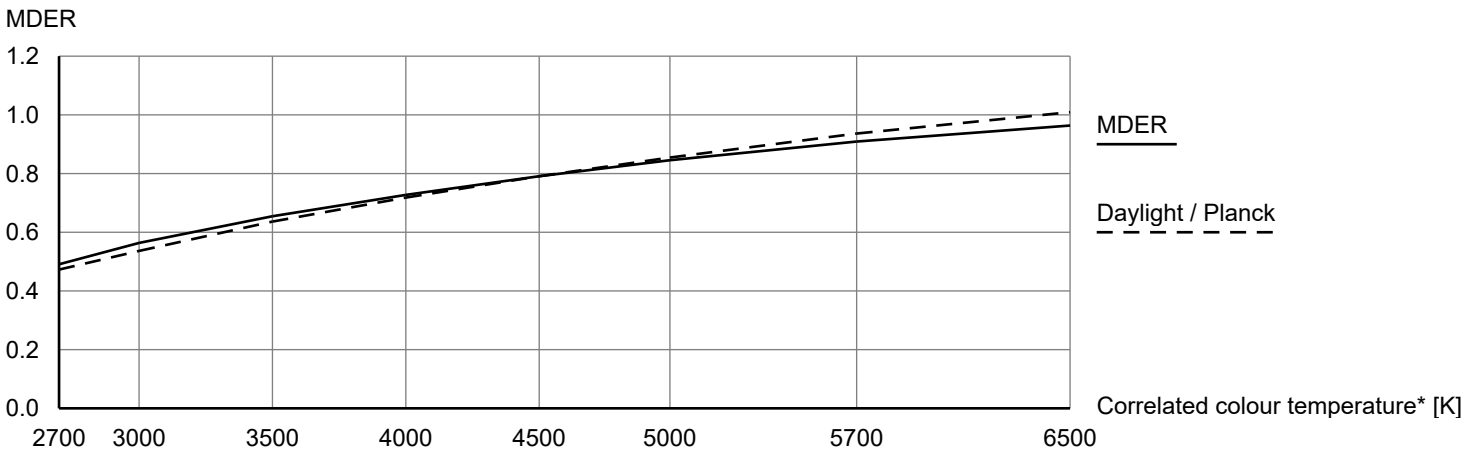
Melanopic LED action factors

To convert photopic (visual) evaluation parameters into melanopic (biological) evaluation parameters (according to CIE S 026 / E: 2018, DIN SPEC 5031-100).

CRI	Correlated colour temperature*	Luminaire luminous flux	MNER	MDER	MEER
>90	2700 K	3800 lm	1.04	0.48	0.53
	3000 K	3800 lm	1.05	0.55	0.61
	3500 K	3800 lm	1.04	0.65	0.71
	4000 K	3800 lm	1.02	0.72	0.80
	4500 K	3800 lm	1.00	0.78	0.86
	5000 K	3800 lm	0.99	0.83	0.92
	5700 K	3800 lm	0.97	0.90	0.99
	6500 K	3800 lm	0.96	0.96	1.06

CRI: Colour Rendering Index min.
Correlated colour temperature*: Values according to ANSI
Luminaire luminous flux: Luminaire rated luminous flux
MNER: Melanopic Natural Efficacy Ratio
≙ mv, mel, nat (conversion factor relative to the natural reference illuminant, similar to color rendering calculation, at the same correlated color temperature (CCT))
MDER: Melanopic Daylight Efficacy Ratio, CIE S 026/E:2018
≙ mv, mel, D65 (DIN SPEC 5031-100, conversion factor relative to the D65 illuminant, for the calculation of the melanopic daylight equivalent illuminance)
MEER: Melanopic Equal-energy Efficacy Ratio, CIE S 026/E:2018
≙ R (equivalent Melanopic Lux Metric, Melanopic Ratio)
suitable for calculations for certification according to WELL Building Standard v2 (L03)
Daylight / Planck: Daylight illuminants are used as natural reference illuminant from 5000K on upwards and planckian radiator illuminants are used for lower CCTs.



Note for the lighting designer:
See supplement on how to calculate melanopic lighting effects or contact our lighting solution planners.
Supplement: https://www.thornlighting.com/PDB/Teaser/EN/TLG_Melanopic-Datasheet-Supplement.pdf

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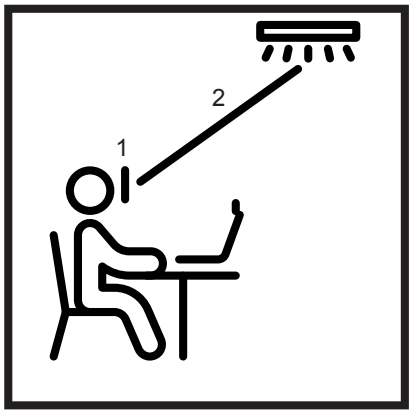
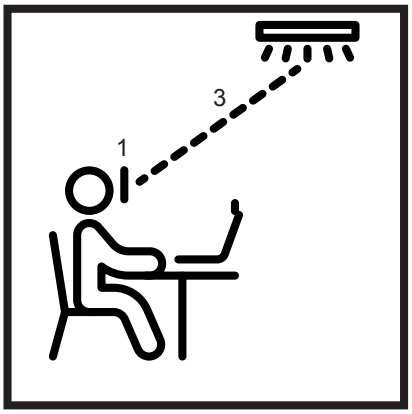
Notes regarding the conversion of visual evaluation variables into biological evaluation variables

The conversion factors specified in the “Melanopic Data Sheet” can be used to convert the results of a photopic light calculation or measurement into melanopic evaluation variables.



Photopic (visual) evaluation



Melanopic (biological) evaluation

1 Reception area of the vertical illuminance at the eye of the observer, relevant for melanopic evaluation

2 Light from light source **photopically evaluated** with standard measuring and planning tools

3 Light from light source **melanopically evaluated** with formula (photopic value multiplied by factor from Zumtobel data sheet = melanopic value)

Notes regarding melanopic light planning

The specified “melanopic action factors” enable the light planner to perform calculations to determine biological effectiveness (in accordance with CIE S 026/E:2018, DIN SPEC 5031-100, DIN SPEC 67600 and WELL Building Standard). With regard to the aspects of “Human Centric Lighting” and “Human Centred Design”, these extended planning parameters are attributed increasing importance for optimised light quality and well-being.

The luminaire and its spectrum contribute to the biological effect, but a holistic approach is required: *Integrative, holistic planning includes the application and effects of light in the planning process from the outset and, amongst other things, helps to implement energy-efficient solutions for biologically effective light through suitable use of daylight.**

A holistic planning should take the following aspects into account: *,**, ***
- Luminous intensity (illuminance)
- Changes in the spectrum during transmission
- Changes in the spectrum during reflection
- Changes in the spectrum through absorption
- Area and room angle (geometric arrangement of the light)
- Light direction (geometric arrangement of the light)
- Daytime adapted light
- Season adapted light
- Duration of light exposure
- Spectral and spatial distribution of light over time
- Rapid light changes
- Luminous intensity (illuminance) at other times
- Correction factor for age with melanopic effects of light
- Correction factor for age-dependent reduction of transmission by the eyes
- Correction factor for age-dependent pupil constriction

Another source for planning all aspects of “Human Centric Lighting” is the licht.wissen 21 Guide to Human Centric Lighting (HCL), available free of charge at licht.de.

*DIN SPEC 67600, **DIN SPEC 5031-100, *** No claim to completeness