

Enlightening facts about light

Casting light on light

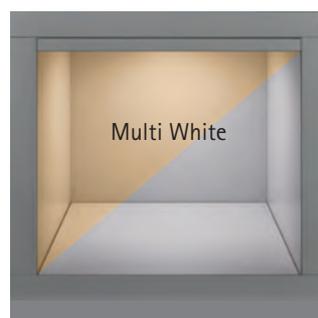
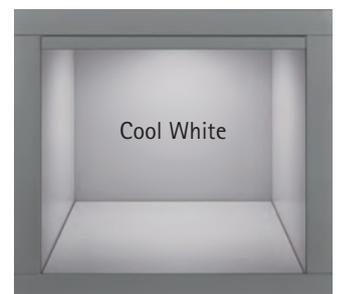
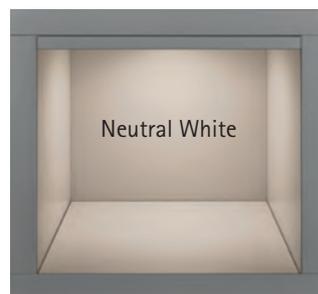
Lux, lumen and Kelvin; warm, cool and neutral white – although the terminology of lighting technology is all around us, it is not always transparent. We would like to bring light into the dark with a few explanations.

► Light colour and colour temperature

White light consists of the entire colour spectrum; that is to say, it is the sum of all light colours. If the proportion of red in the light dominates, light appears warm; with more blue, it appears cooler. This colour impression of a light source is called the light colour. Colour temperature is measured in Kelvin (K). It only provides information on the visual colour impression and does not say anything about the thermal value of the light. The values are referenced to the tempering colours of a black test body heated to a specific temperature.

► Classification

- XW Ix** Extra Warm White
2500 – 2800 K
Display lighting, e.g. in bakeries
- WW Ix** Warm White
2900 – 3300 K
Cosy, relaxing
- NW Ix** Neutral White
4000 – 4500 K
Functional
- CW Ix** Cool White
5000 – 6500 K
Like daylight, technical, stimulating
- MW Ix** MultiWhite 2500 – 6500 K
White, adjustable from
cosy to daylight



These categories and terms are not standardised and do not refer to the actual colour of the light, but to colour temperature ranges.

► Colour rendition

The colour rendition of light determines whether colours appear dull or bright in the light. It is an important factor for good visual results and pleasant viewing experiences.

Light that contains all spectral colours – such as daylight – makes the colours of objects look natural. Colour rendering is neutral, and therefore particularly favourable for judging colours.

In light with an unbalanced colour spectrum, the colours of objects tend to look unnatural.

The quality of the colour rendering of a light source is assessed by the colour rendering index (CRI). It is derived from common test colours and indicates how naturally colours are rendered. Depending on the visual task, the appropriate colour rendition should be chosen. To ensure a relaxed and positive visual experience, the colour rendering index should not be less than 80.

This aspect can be safely ignored in spaces where precise colour rendition is not crucial, such as living rooms and bedrooms. Here, lights can be selected according to the mood to be evoked.

Only an indirect relationship exists between light colour temperature and colour rendition. The best available method applies the principle of "luminescence conversion" and is used both for LED and fluorescent lamps. With this method, the original blue LED light is transformed into white light by a thin layer of phosphor material. Currently, CRI values of over 90 can be achieved with this method. As this approach offers great value for money when it comes to top-quality lighting solutions, it is the method preferred by HALEMEIER.



CRI ~ 90
(HALEMEIER)



CRI ~ 70



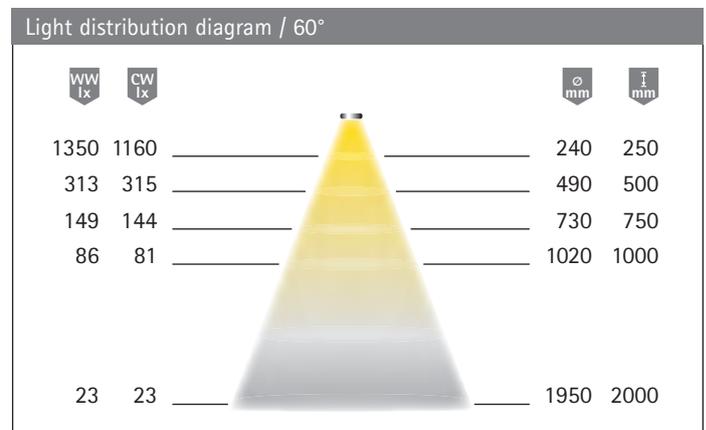
CRI ~ 50

► **Luminous flux**

Luminous flux is defined as the quantity of energy of the light emitted by a source. The unit of luminous flux is lumen (lm).

► **Luminous intensity**

Luminous intensity (illuminance) is probably the term most frequently used in connection with lighting and defines the incidence of luminous flux on a defined surface, measured in lux (lx).



Illuminance	Room function or type of activity		
1000 lux	Colour inspection, colour checks, goods inspection Precision assembly of small components (electronics, etc.) Jewellery making, retouching, etc.	Functional lighting	High illumination level
750 lux	Technical drawing Drawing and error checking Inspecting wood veneers Grinding, glass polishing, precision assembly		
500 lux	Office spaces, data processing centres, conference rooms Exhibition stands, control platforms Points of sale in retail outlets		
300 lux	Office workstations near windows Lathing, drilling, milling, general assembly tasks Shops, dispatch departments	Accent lighting	Medium illumination level
200 lux	Archives, storage rooms with reading activity Assembly of large components Public areas in buildings Changing rooms, washrooms and toilets		
100 lux	Storerooms Vehicle and pedestrian traffic areas in buildings Foyers, stairwells and escalators		



▶ **ENEC**
European mark of conformity: Certificate of conformity with European standards for electrical products, issued by national certification bodies.



▶ **Safety class 2 – Devices without earth conductor connection**
Equipment in which protection against electrical shock does not rely solely on basic insulation. Safety class 2 devices come with extra safety features, such as double insulation or reinforced insulation. The protective earth conductor cannot be incorrectly wired.



▶ **VDE-GS mark**
German mark for appliances classified as technical equipment according to the Appliance Safety Act GSG.



▶ **Safety class 3 – Devices using safety extra low voltages**
Equipment in which protection against electric shock is based on the use of safety extra low voltage and in which no voltage higher than the safety extra low voltage is generated – AC < 50 V rms and DC < 75 V.



▶ **EMV**
Approval mark of VDE, confirming compliance with statutory electromagnetic compatibility regulations.



▶ **CE**
The CE mark certifies among other things compliance with the Low Voltage Directive and the EMC Directive.



▶ **F mark**
In the past, lights suitable for direct mounting on normally flammable surfaces carried the F-mark. Today, all lights must meet the respective requirements, so that the mark has become obsolete, and only deviations need to be indicated accordingly.

IP codes

▶ **Protection against foreign bodies / water**



▶ **MM mark**
Lights and transformers suitable for installation in or on furniture made from materials with unknown flammability properties.

IP 20

Protection against medium-sized foreign bodies / no protection against water

IP 21

Protection against medium-sized foreign bodies / protection against dripping water

IP 40

Protection against granular foreign bodies / no protection against water

IP 44

Protection against granular foreign bodies / protection against splashing water from all directions

IP 65

No ingress of dust / protection against water jets



▶ **Temperature-protected electronic transformer**
Transformer with temperature protection. The value in the triangle shows the maximum housing temperature in the event of a defect.



▶ **Short-circuit-proof safety transformer**
Transformer protected against short circuits.



Use only in dry rooms



▶ **Independent electronic transformer**
Transformer for use outside lights, without additional cover.

▶ **The following marks confirm compliance with North American standards**

$t_{a_{max}}$

▶ **Maximum permissible ambient temperature**
The temperature level up to which no overheating of components occurs.



QPS test mark for Canada and USA

t_c°

▶ **Temperature reference point**
Denotes the temperature reference point on the housing. Exceedance leads to a reduced service life.



Test mark of the UL Institute



Test mark of the ETL Institute

SELV

▶ **Safety Extra Low Voltage**



▶ **Safety class 1 – Devices with earth conductor connection**
Equipment in which protection against electrical shock does not rely solely on basic insulation. Additional protection is given by connecting conductive components capable of assuming hazardous voltages if the basic insulation fails to the protective earth conduct or the building wiring.