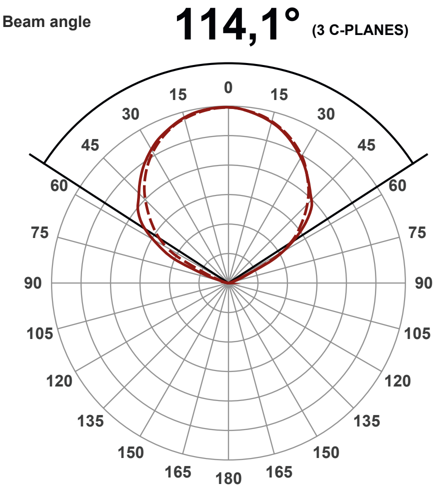
B.E.G. LUXOMATIC®

How to read the light lab test results

B.E.G. LUXOMATIC® lights are energy-efficient products of high quality. In our light laboratory our experts verify that the quality of the products meets our demands. The lights are automatically rotated, and so measurement takes place from all sides and angles. The test report is available as pdf file for each product. An explanation of the values is given here:

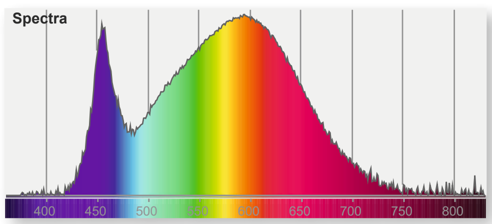
Light distribution

The angular light distribution shows the amount of light from the non-rotational symmetrical part of the light source. This field distribution is used to calculate the beam angle.



Complete integrated spherical spectrum

The individual spectra, measured in a spatial distribution, are presented as an integral part of the spectral diagram (in this case also known as a "fully integrated sphere spectrum"). The colour spectrum contained in the light from the lamps is therefore presented as an overview. This makes the differences between individual lamps very clear. LEDs often do not cover the red spectrum and have strong peaks in the blue spectrum. The colour spectrum of filament bulbs, however, increases almost continuously from blue to red.



Luminous flux

The complete integrated spherical spectrum is used to calculate the luminous flux in lumens. The peak intensity output is indicated in candela and represents the highest level of the light output during measurement.

Output: 2508 lm
Peak: 1006 cd

Power consumption

The power is measured by sampling a voltage and a current at a rate of 50,000 samples per second to ensure high resolution and high precision for power consumption measurement. The power factor (PF) indicates the quality of power consumption, where 1.0 being the best (it is generally achieved with a pure resistive load such as a tungsten lamp) and 0.0 being the worst. For a satisfactory level, the PF value should be located between 0.5 – 1.0.

Power: 26,6 W
PF: 0,89

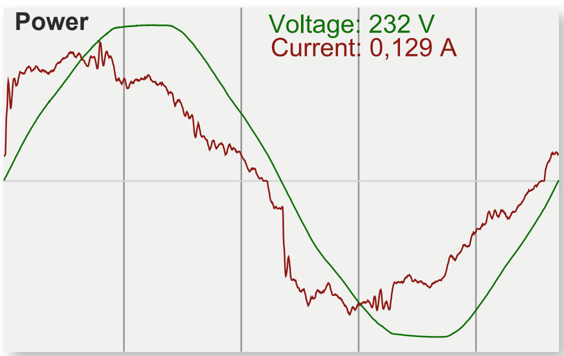
Power details

The real-time data of the voltage and current is shown in the power details window: the green line illustrates voltage (it should have a sine curve). The upper part of the sine curve can sometimes have a flat top, which is explained by the power grid distortions. The current is presented with a red line, it is displaying how the current is consumed by the light source.

The power factor is an indication of how well the current is consumed through a voltage period. The power factor is calculated according to the following principle: the value of the actually consumed power is divided by the product of the voltage and the current.

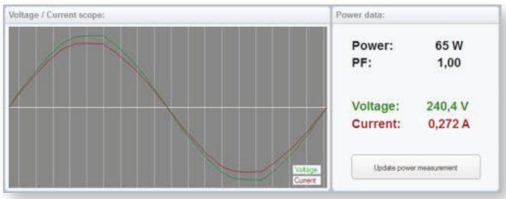
PF = Power / (Voltage x Current)
With respect to example 3:
5.2 / (238.6 x 0.035) = 5.2 / 8.35 = 0.62

The lower the power factor, the greater the apparent power and thus the interferences tranferred into the power grid.



Example 1

shows a standard 60 W tungsten bulb with an ideal PF of 1.0 and a current curve that is identical to the voltage.

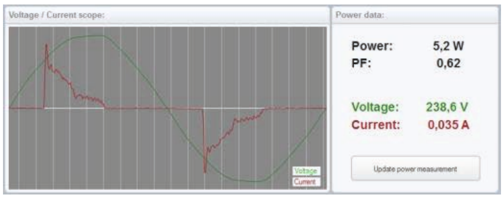


Example 2

shows an LED bulb that has a passive capacitive power supply, which results in a high phase shift between current and voltage, thus resulting in a very low power factor of 0.19.

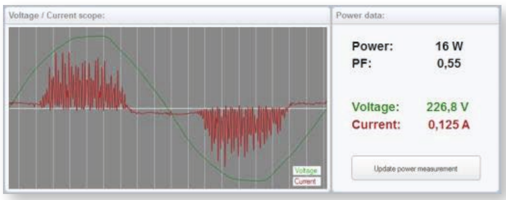
Example 3

shows an LED bulb of a medium quality switch-mode driver with a high capacity peak load, thus a medium quality power factor of 0.62.



Example 4

shows an LED bulb having a switch-mode driver with a particularly bad filtering. It results in a high noise level of the current. This level of noise would probably not be able to pass the EMC noise level requirements.



Luminous efficacy

The efficiency in lumens per watt is calculated by dividing the luminous flux in lumens to the power consumption. The result is displayed in the efficiency bar with a corresponding colour. Red represents a bad value (e.g. halogen bulbs having 15 lm/W) and green represents a high energy efficiency (e.g. LED floodlight having 100 lm/W).

Light efficiency:

94 Lumen/Watt

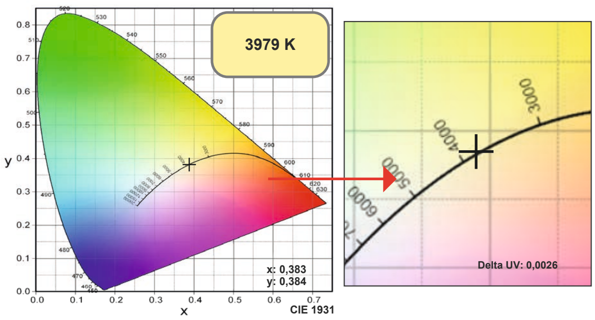
Colour temperature

The photometric colour temperature indicates the colour of the white light and is displayed in kelvin. Values of approximately 6500K are called "cool white", values of about 3000K as warm white. The Kelvin scale was initially derived from the temperature of the tungsten filament. Therefore the high temperature of the filament is considered as cold light and vice versa. If the colour temperature is not displayed, it means that either the radiated light does not meet the criteria for white light or that light levels are too low to be measured.

Color temperature:

3848 K

On the second page, the radiated colour is shown with x and y coordinates in the CIE1931 diagram. The diagram illustrates all colours visible to the human eye. It is based on an experiment conducted in 1931 with a number of participants aiming at figuring out the eye's perception of colour.



The black line in the diagram is called the black body curve. It illustrates all colours that are defined as white colours from cold to warm. The point corresponding to the measured colour is shown with a black cross. It can be used to check the whiteness of a colour, by checking how close it is to the black body curve: the closer it is to the black body curve the more accurate is the white colour.

Colour rendering

The B.E.G. light laboratory uses three different colour quality scales for evaluating the colour quality of white light: CRI, TM30 and CQS. All three scales offer reference values representing the optimum colour rendering.

CRI

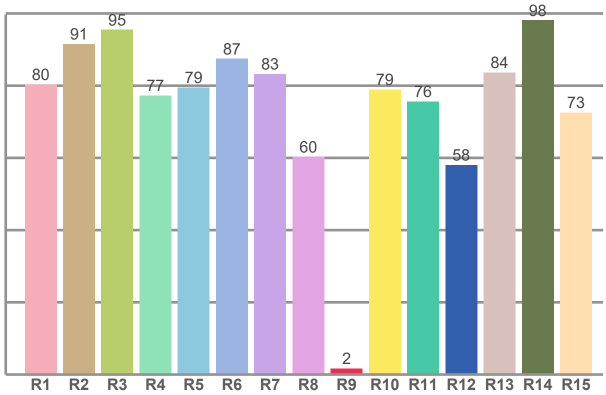
The Colour Rendering Index (CRI), also known as the Ra, has been developed to give a scale for qualifying the colour spectrum of a lamp compared to daylight. The CRI defines the quality of white light with respect to colour rendering. The higher the value, the better even small colour differences can be recognised. A value of 100 is the best value comparable to sunlight. The lower the value, the lesser colour differences are obvious. In offices, values of >80 are demanded, in the industrial field >65. Below a value of 40 it is very difficult to differentiate colours.

Light quality:

CRI: 84,1

The CRI is calculated with the help of the standard test colours, which examine the chromatic adaptation of light. The standard set consists of 15 test colours, but only the first 8 of them (known as R1-R8) are used to calculate the CRI, whereas the remaining R9-R15 are typically not used.

CRI: 81,8 (R1-R8)



However, sometimes LED lights do not have a red light component (which is considered in the R9 measurement), i.e. the red light of R9 is rather low compared to the rest of the values. In some cases R9 can even be negative due to particularly low levels of the red light. That is why it is becoming more common to include the R9 measurement as well. The R9 value is indicated seperately in the table on the bottom of the page. The CRI can only be used for white light.

CRI R9
1,6

B.E.G.

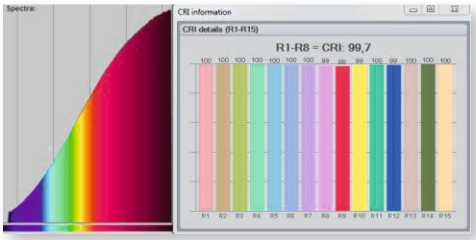
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
80,30	91,47	95,45	77,20	79,42	87,42	83,18	60,28	1,64	78,90	75,60	57,98	83,63	98,08	72,51

If the CRI is not indicated this means that either the radiated light does not meet the criteria for white light or that light levels are too low to be measured.

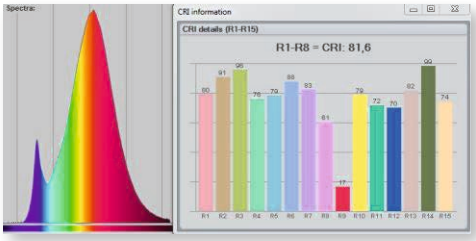
Example 1

shows a standard tungsten lamp. Its continuous spectrum has the closest resemblance to the sun, therefore the CRI values are the highest.



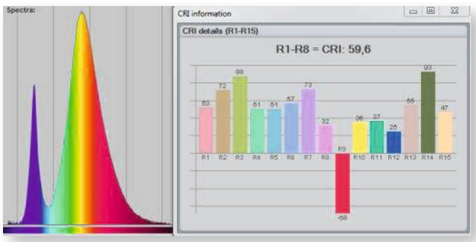
Example 2

shows a Philips LED bulb with a low red R9 value.



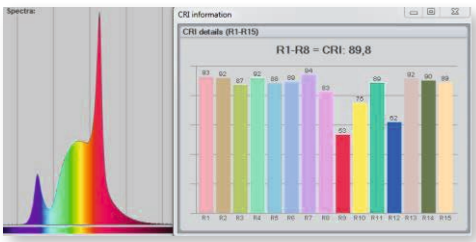
Example 3

shows a standard LED bulb with a negative red R9 value due to the lack of red light in the spectrum.



Example 4

shows an LED bulb with an additional red colour boost, so that the LED's R9 value is increased.



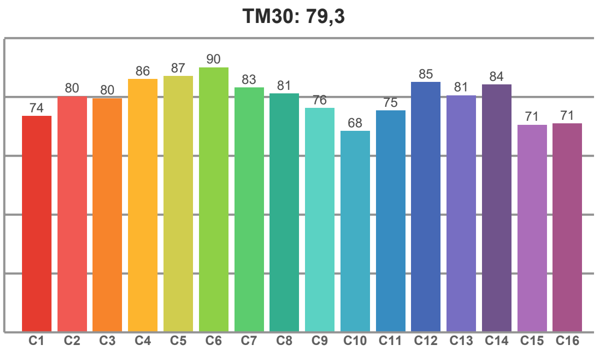
TM30

In 2015, the North-American IES (Illuminating Engineering Society) has developed a new measurement method as a new colour rendering index. This new index is more adapted to the modern lamp technology (e.g. LEDs) as the CRI. This new index is called TM30 or Rf and is also used to evaluate the colour rendering, similar to the CRI. However, there are more and better test colours: there are 99 colours and the value range is from 0 to 100.

It is not possible to compare CRI- and TM30 indications. In most cases, the TM 30 value will be lesser than the CRI value.

TM30 C values, 16 binned values out of total of 99 C values

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
73,55	80,27	79,56	86,08	87,14	90,09	83,16	81,22	76,24	68,45	75,43	85,10	80,55	84,19	70,56	71,02



In addition to evaluating the similarity of the tested light source and the reference, which is Rf, TM30 also considers the colour gamut, the index being abbreviated Rg. The measured value can be greater than 100. This is the case when the tested light source shows a higher saturation (as a mean value) than the reference.

Both values are indicated in the table at the bottom of page 2.

TM30 Rf	TM30 Rg
79,3	90,7

CQS

Referring to the colour quality scale (CQS), this index uses saturated colours. This offers the possibility to evaluate the rendering of saturated colours. The method assumes that the tested light source renders unsaturated colours as good as saturated colours. The value of a spectrally measured light source is between 0 and 100.

In this method, the overemphasis of one colour does not lead to a value being more worse. The CQS defines the value as a geometric mean and not as an arithmetic mean as the CRI does. This results in a stronger devaluation of single colours which are poorly rendered.