



**Lamp measurement report – 1 Feb 09 for Line Lite  
International BV**

**Line Lite International BV MR16 Sharp 3.8W NaturalW  
40deg frosted**





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### Summary measurement data

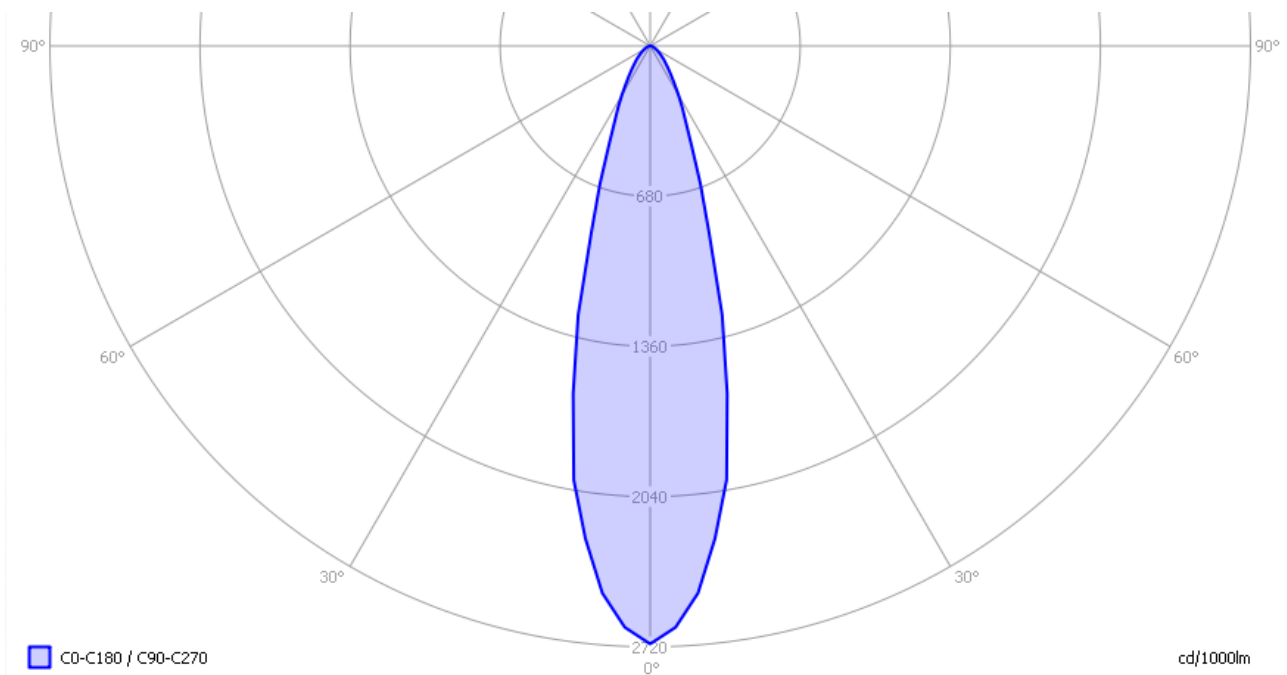
parameter	meas. result	remark
Color temperature	5858 K	Bright white
Luminous intensity $I_v$	494 Cd	
Beam angle	29 deg	
Power P	3.6 W	
Power Factor	0.68	For every 1 kWh net power consumed, there has been 1.1 kVAhr for reactive power.
Luminous flux	179 lm	
Luminous efficacy	50 lm/W	
CRI_Ra	67	Color Rendering Index.
Coordinates chromaticity diagram	x=0.3250 and y=0.3342	
Fitting	GU5.3/MR16	
D x H external dimensions	49 x 50 mm	External dimensions of the light bulb.
Diameter luminous area	33 mm	Dimensions of the luminous area (used in Eulumdat file). This is the diameter of the frosted lens at the front of the light bulb.
General remarks		<p>The ambient temperature during the whole set of measurements was 23.5-27 deg C.</p> <p>Warm up effect: little effect (3 % variation) on illuminance and consumed power. The color temperature increases 7 %.</p> <p>Voltage dependency: consumed power and illuminance drop sharply below 12 V.</p>



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### Eulumdat light diagram

An interesting graph is the light diagram, indicating the intensity in the C0-C180 and the C90-C270 plane. This light diagram below comes from the program Qlumedit, that extracts these diagrams from an Eulumdat file.



*The light diagram giving the radiation pattern.*

It indicates the luminous intensity around the light bulb. This light diagram is symmetrical around the z-axis.

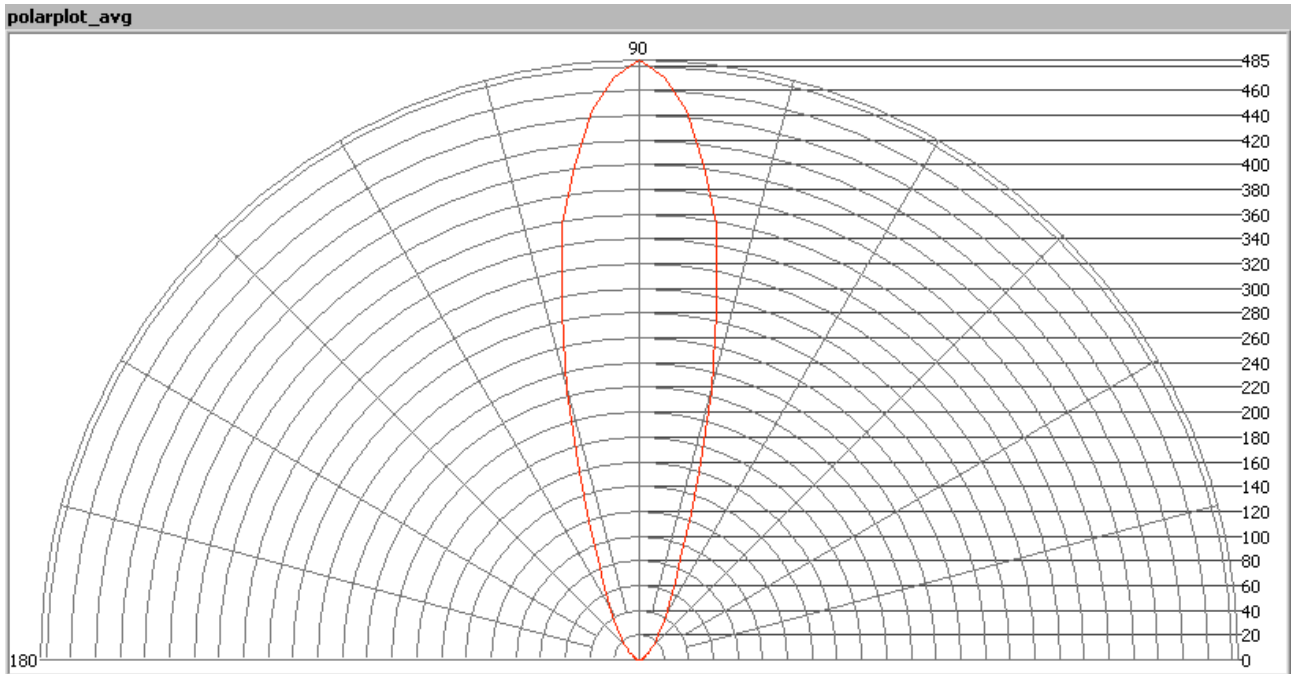
The unit is Cd/1000lm, meaning the intensity in Cd assuming there would be 1000 lumen in the measured light bulb. This enables comparing different types of light bulbs.

### Illuminance $E_v$ at 1 m distance, or luminous intensity $I_v$

Herewith the plot of the *averaged* luminous intensity  $I_v$  as a function of the inclination angle with the light bulb.



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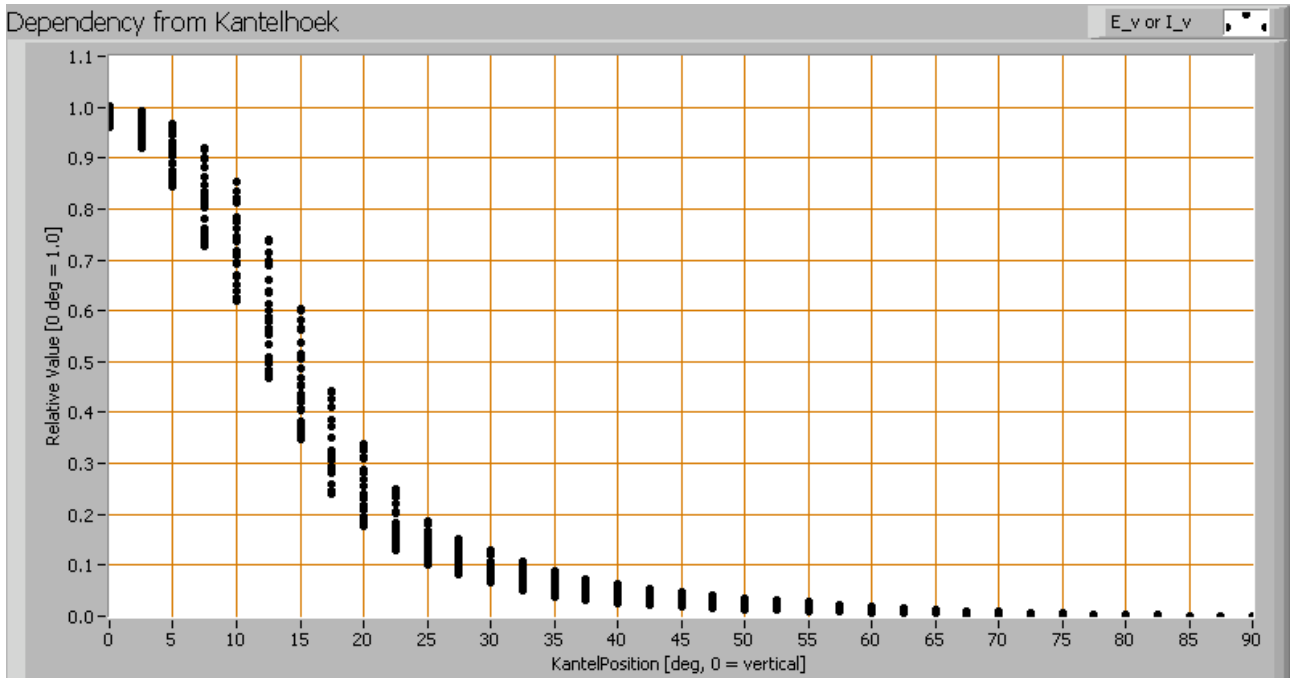
*The radiation pattern of the light bulb.*

This radiation pattern is the same as the one given earlier. This is because in this light bulb's case, the radiation pattern is symmetric around the z-axis, meaning that the averaged pattern given here is the same as the extraction of the Eulumdat file.

These averaged values are used (later) to compute the lumen output.



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*Intensity data of every measured turn angle at each inclination angle.*

This plot shows per inclination angle the intensity measurement results for each turn angle at that inclination angle. So at 20 degrees inclination angle, all the measurement results of illuminance for all measured turn angles are in the range of 17-34 % of the illuminance value at 0 degrees inclination angle.

When using the average values per inclination angle, the beam angle can be computed, being 29 degrees.

### Luminous flux

With the averaged illuminance data at 1 m distance, taken from the graph showing the averaged radiation pattern, it is possible to compute the luminous flux.

The result of this computation for this light spot is a luminous flux of 179 lm.

### Luminous efficacy

The luminous flux being 179 lm, and the power of the lightbulb being 3.6 W, yields a luminous efficacy of 50 lm/W.

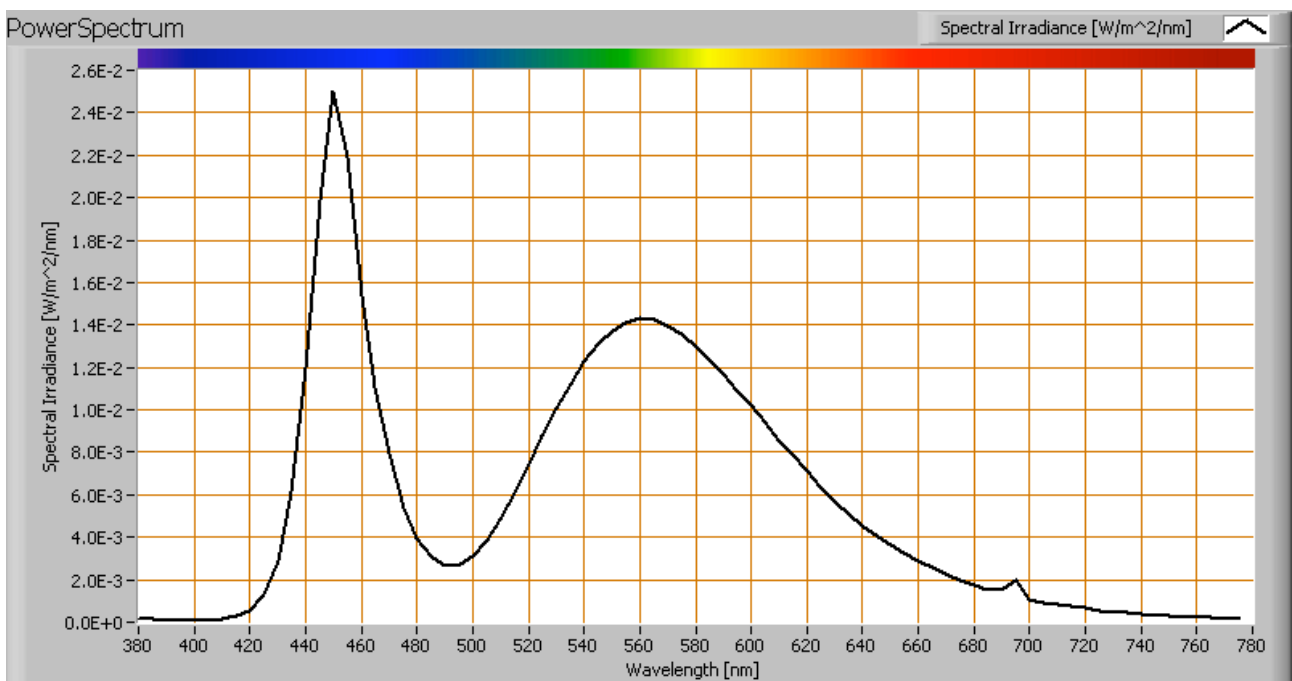
A power factor of 0.68 means that for every 1 kWh net power consumed, a reactive component of 1.1 kVAr was needed.



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Light bulb voltage	12 V
Light bulb current	439 mA
Power P	3.6 W
Apparent power S	5.3 VA
Power factor	0.68

### Color temperature and Spectral power distribution



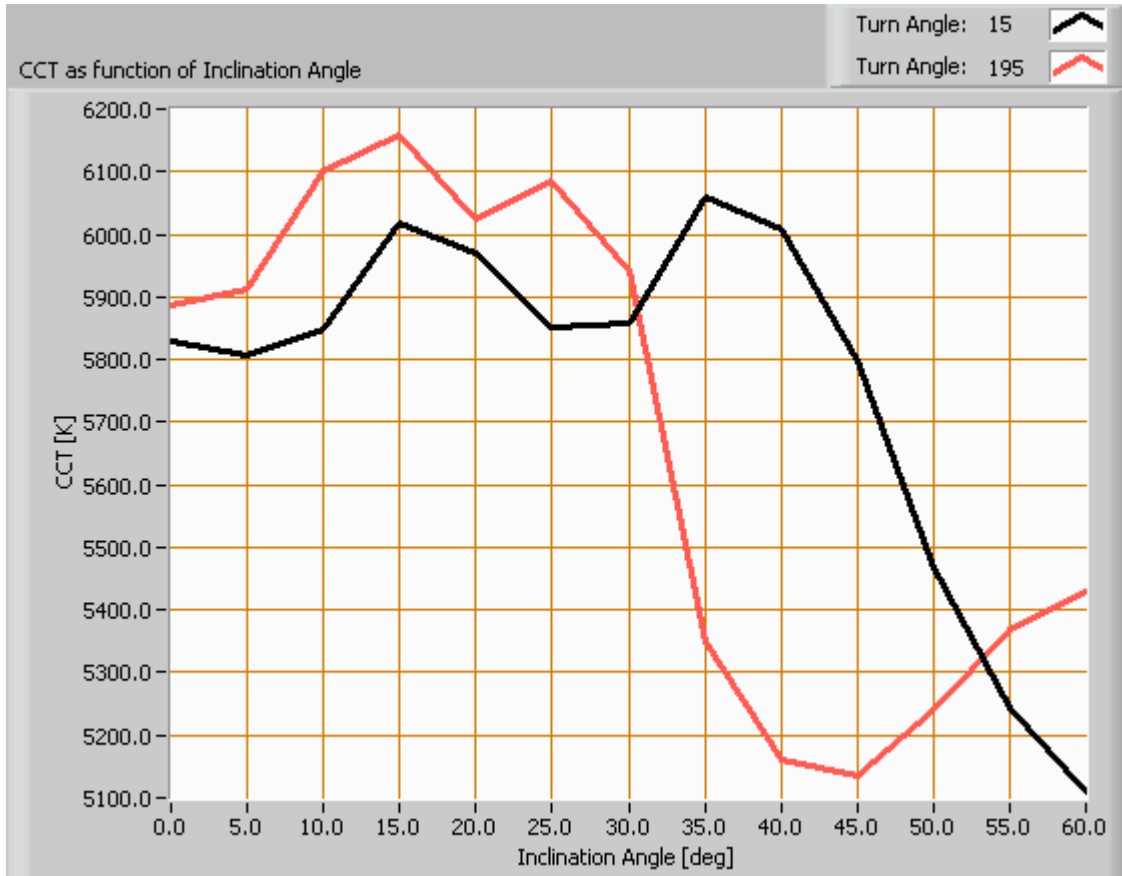
*The spectral power distribution of this light bulb.*

The measured color temperature is about 5850 K which is bright white.

This color temperature is measured straight underneath the light bulb. Below a graph showing the color temperature for different inclination angles.



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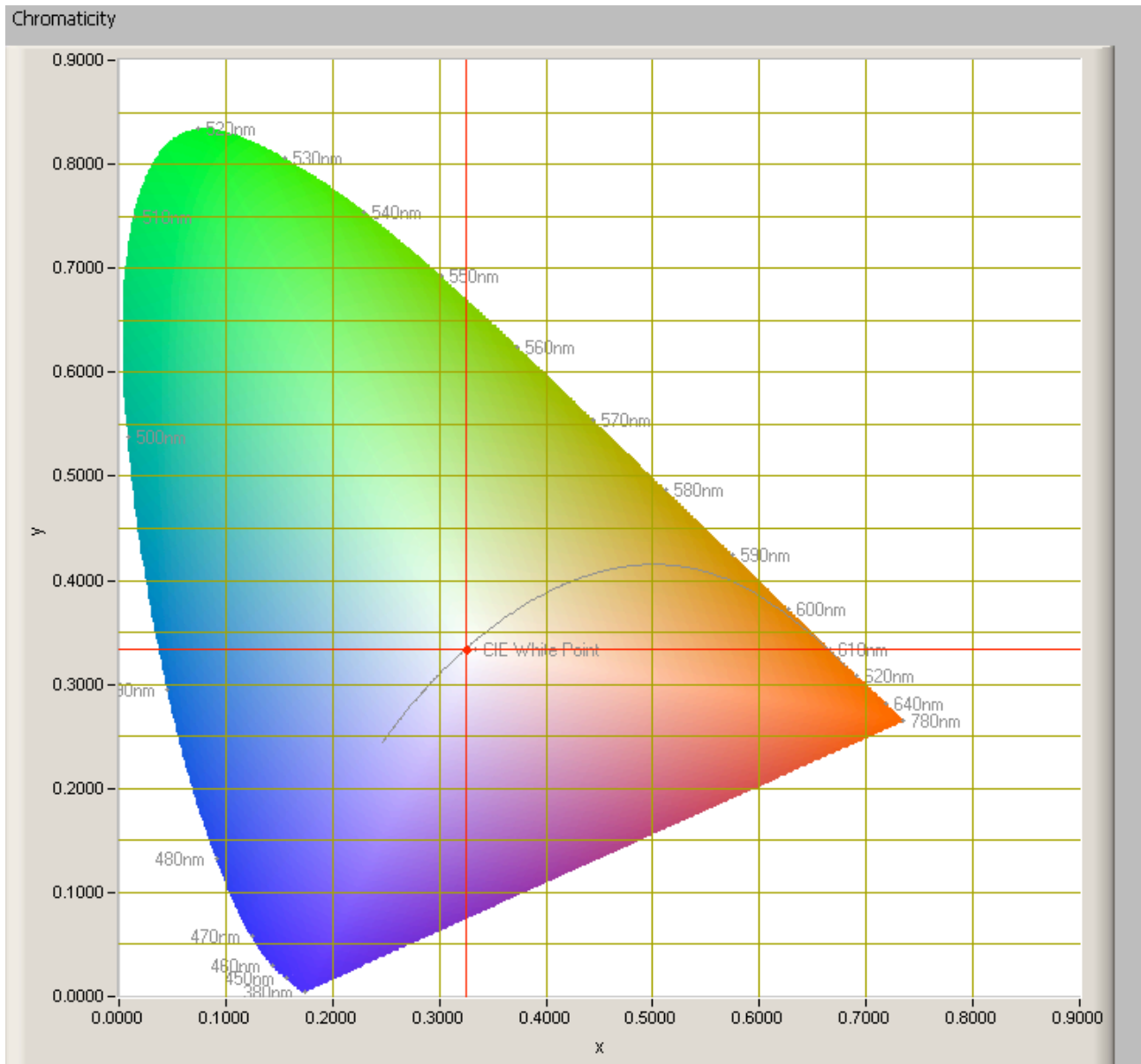
*Color temperature as a function of inclination angle.*

The maximum value of inclination angle is 60 degrees. Beyond that value there is virtually no intensity anymore. The color temperature remains relatively (4 %) constant for inclination angles from 0 - 30 degrees. Then it decreases about 14 %.



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### Chromaticity diagram



*The chromaticity space and the position of the lamp's color coordinates in it.*

The light coming from this lamp is on the Planckian Locus (the black path in the graph).

Its coordinates are  $x=0.3250$  and  $y=0.3342$ .

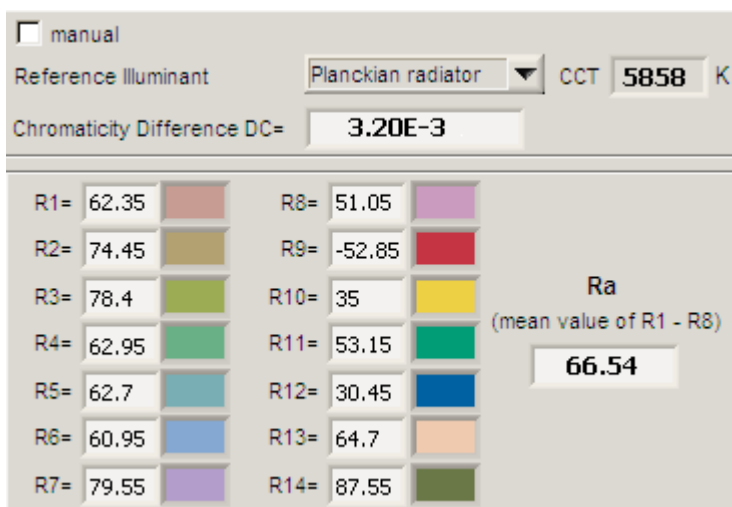


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### Color Rendering Index (CRI) or also Ra

Herewith the image showing the CRI as well as how well different colors are represented (rendered). The higher the number, the better the resemblance with the color when a black body radiator would have been used (the sun, or an incandescent lamp).

Each color has an index  $R_x$ , and the first 8 indexes ( $R_1 .. R_8$ ) are averaged to compute the  $R_a$  which is equivalent to the CRI.



*CRI of the light of this lightbulb.*

The value of 67 is lower than 80 which is considered a minimum value for indoor usage.

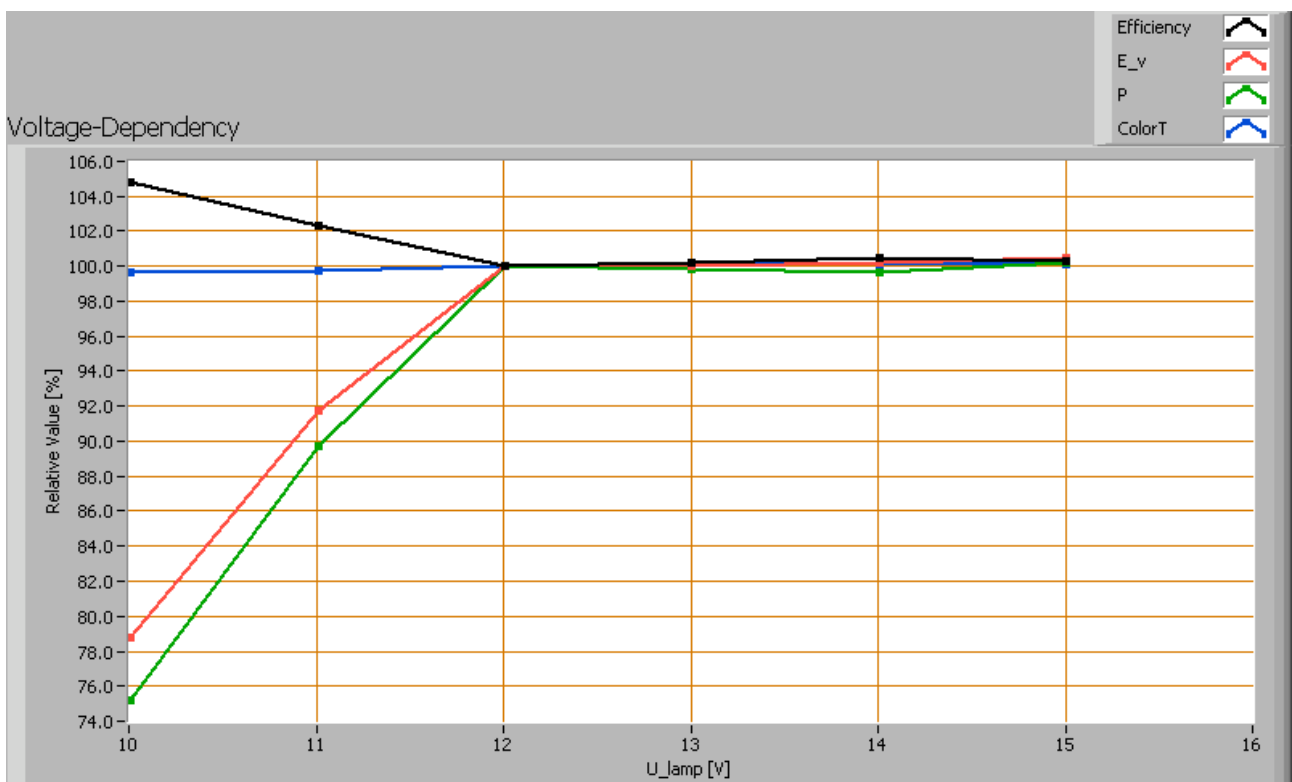
Note: the chromaticity difference is 0.0032 indicates the distance to the Planckian Locus. Its value is lower than 0.0054, which means that the calculated CRI result is meaningful.



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### Voltage dependency

The dependency of a number of lamp parameters on the lamp voltage is determined. For this, the lamp voltage has been varied and its effect on the following lamp parameters measured: illuminance  $E_v$  [lx], color temperature CT or correlated color temperature CCT [K], the lamp power  $P$  [W] and the luminous efficacy [lm/W].



Lamp voltage dependencies of certain light bulb parameters, where the value at 12 V is taken as 100 %.

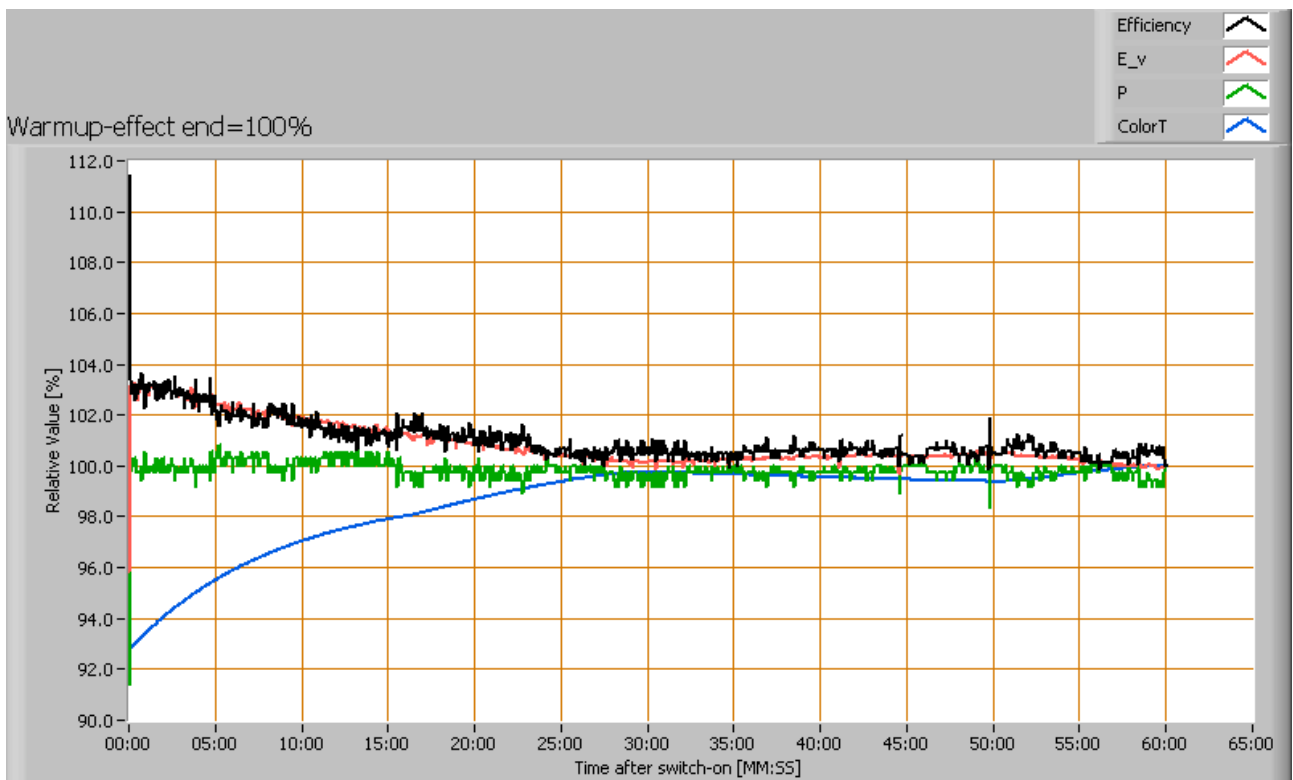
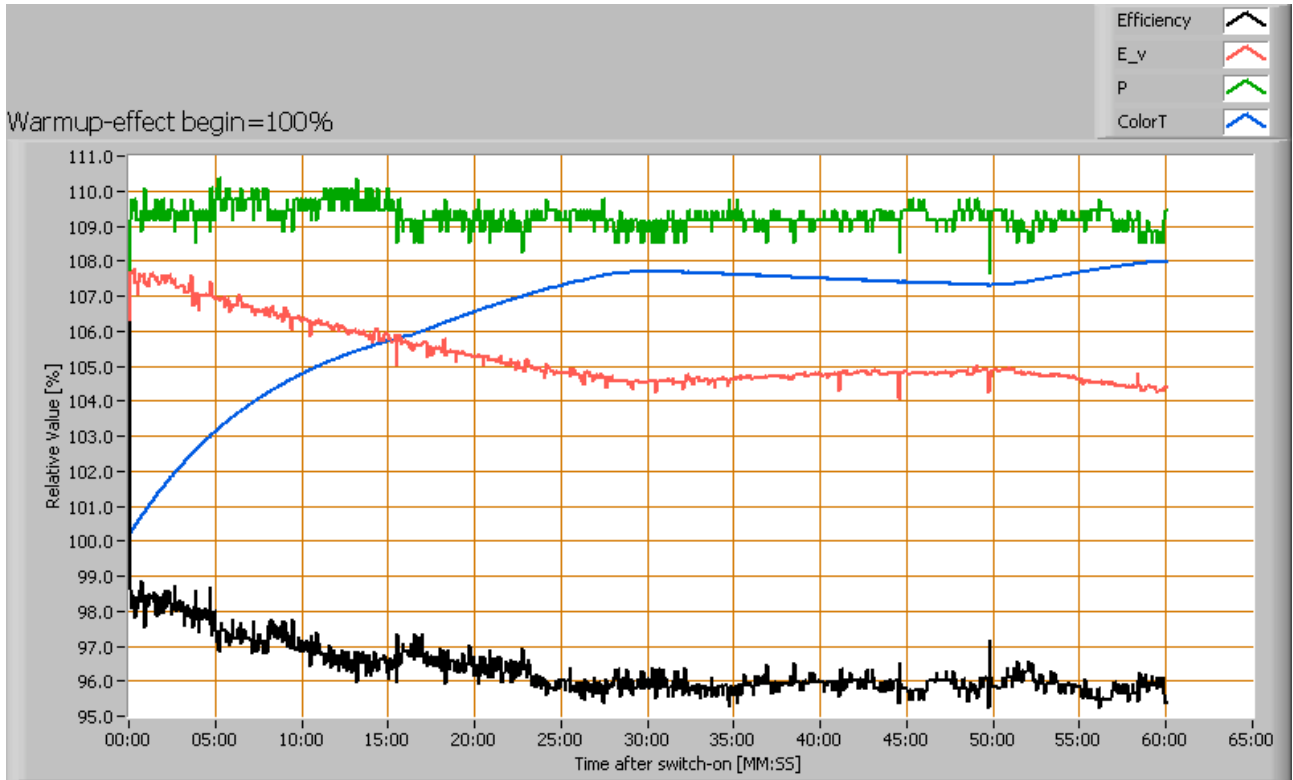
The consumed power and the illuminance drop sharply below 12 V. When the voltage around 12 V varies with + and - 0.25 V (equivalent to 5 V at 230 V lampvoltage), then the illuminance does not vary.

### Warm up effects

After switch on of a cold lamp, the effect of heating up of the lamp is measured on illuminance  $E_v$  [lx], color temperature CT or correlated color temperature CCT [K], the lamp power  $P$  [W] and the luminous efficacy [lm/W].



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*Effect of warming up on different light bulb parameters. At top the 100 % level is put at begin, and at bottom at the end.*

The graph with the 100 % level set at the end gives the results easiest to interpret in this case (as there seems to be a small spike at the beginning for both power consumption and illuminance, that most likely is not seen as it is so short after switch on). The illuminance and consumed power vary little, less than 3 %. The color temperature does increase with 7 % over a warmup time of 30 minutes.

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