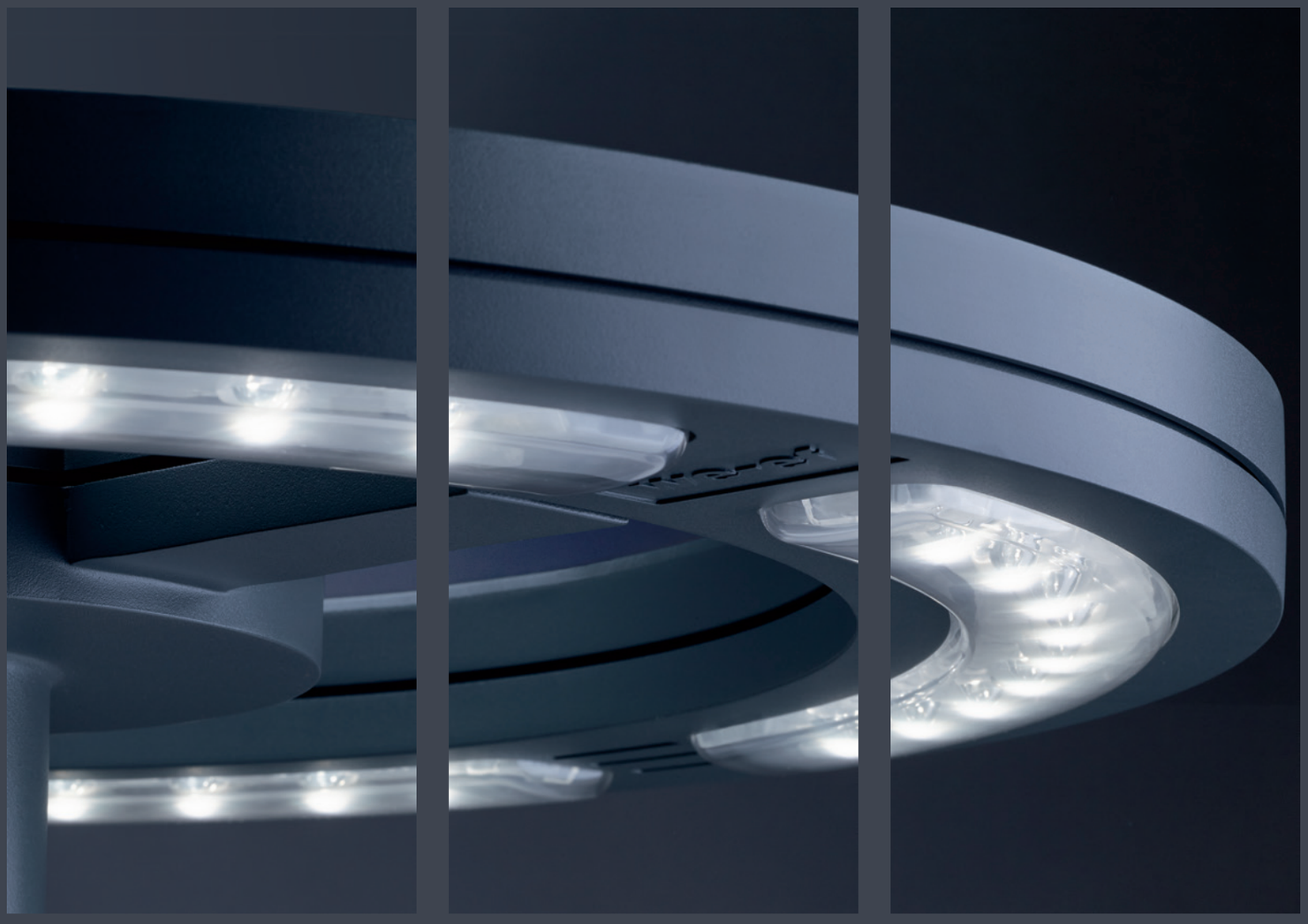
we-ef

WE-EF LEUCHTEN
General Catalogue
European Edition
2016 – 2018



Technical information

IOS® INNOVATIVE OPTICAL SYSTEM

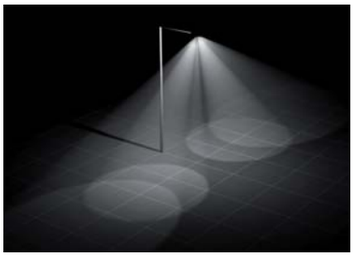
Supported by an in-house lighting laboratory that develops high-performance innovative optical systems IOS®, WE-EF combines the latest advances in LED technology with specially-designed lenses. When applied to streetlighting, IOS® optimises luminaire spacing while ensuring the best lighting result.

OLC® Technology

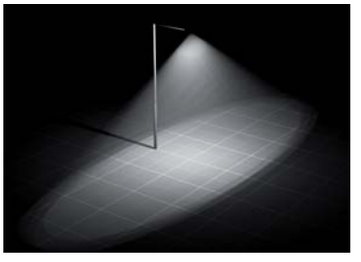
WE-EF has taken the unique and critical features of LEDs (e.g., long lifetime) as the basis for OLC® One LED Concept. The current trend in LED streetlighting has the LEDs with either a symmetric or elliptical distribution in order to achieve uniformity. The interaction and overlapping of the beams from the individually-oriented LEDs provides the overall light level and, to some extent, uniform distribution. This standard solution is known as the multi-spot technique. However, WE-EF has moved away from this thinking and adopted, via OLC® technology, the multi-layer principle. Each LED, in combination with the special 'butterfly' lens, illuminates the same area. The sum of all the layers provides a uniform output.

The multi-layer principle has five advantages:

- If one LED fails and the light level drops, uniformity is retained.
- As well as dimming, it is possible to simply switch off individual or groups of LEDs to reduce the light level.
- The system ensures through modular engineering that groups of LEDs can be simply and quickly exchanged. The same linear board system means that when more efficient LEDs become available, they can simply be retrofitted. The photometric performance remains the same.
- OLC® technology has been developed with the future in mind.
- Light is strictly controlled, and any light pollution is kept to an absolute minimum through the exact aiming of the LEDs in combination with the unique 'butterfly' lens.



Standard Solution: Multi Spot

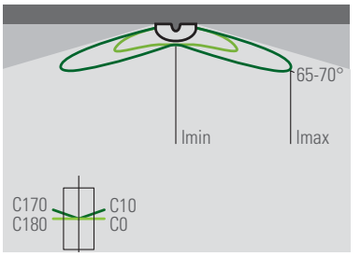


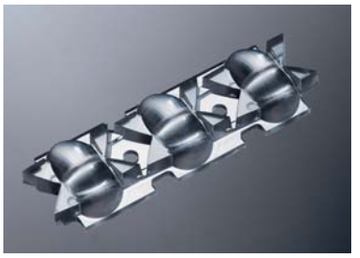
WE-EF Solution: Multi Layer

The OLC® technology (multi-layer principle) is the ideal method for achieving a uniform and energy saving lighting solution, particularly for streetlighting, providing highest safety in ensuring that the failure of individual LEDs does not lead to an adverse affect in the lighting. It balances the needs for safety with visual comfort and energy savings.

[P65] Lens – The advantages of this lens are:

- Optimised for illuminance-based design work (maximum spacing). The 65–70 references the nominal angle of peak intensity from nadir (downward vertical).
- Pedestrian and bicycle lane distribution.
- No light above the horizontal (ILE Class E1/E0). Ideal for pedestrian and bicycle lanes according to the criteria for illuminance EN DIN 13201, Class S2 – S4.

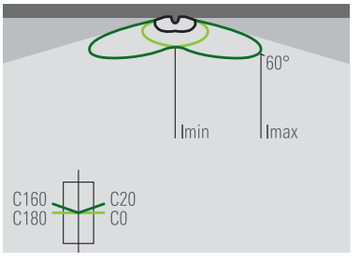




[P65]

[S60] and **[S65] Lenses** – The advantages of these lenses are:

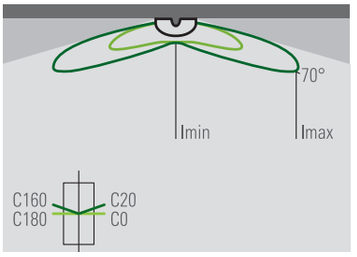
- Optimised for luminance-based design work (high visual comfort). The '60' references the nominal angle of peak intensity from nadir (downward vertical).
- Streetlighting distribution.
- No light above the horizontal (ILE CLASS E1/E0). Ideal for streetlighting according to the criteria for luminance EN DIN 13201, Class ME3-ME6. For a one-sided arrangement, guaranteed spacing = 5-5.5 x MH Ul ≥ 0.4, Ti <15 per cent.



[S60]

[S70] Lens – The advantages of this lens are:

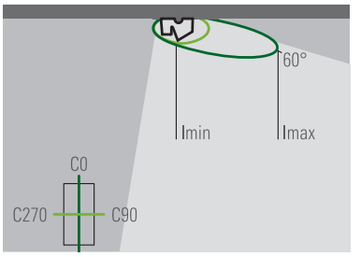
- Optimised for illuminance-based design work (maximum spacing). The '70' references the nominal angle of peak intensity from nadir (downward vertical).
- Streetlighting distribution.
- No light above the horizontal (ILE CLASS E1/E0). Ideal for streetlighting according to the criteria for illuminance EN DIN 13201, Class S1-S6. For a one-sided arrangement, guaranteed spacing = 7-9 MH Uniformity Uo ≥ 0.2-0.4, with good visual comfort (the norm does not provide specific values for glare limitation).



[S70]

[A60] and **[R65] Lenses** – The advantages of these lenses are:

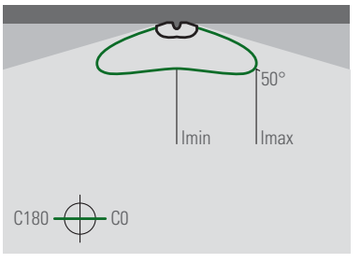
- A comparable performance to conventional asymmetric 'forward throw' HID reflectors.
- Nominal angle of peak intensity through C0 60-65°.
- Rearward spill limited to an angle of 10°.
- No light above the horizontal (ILE CLASS E1/E0). Ideal for lighting public spaces where visual comfort (glare) is a critical factor.



[A60]

[C50] and **[R] Lenses** – The advantages of these lenses are:

- Optimised for illuminance-based design work (maximum spacing) with good visual comfort.
- Symmetric and rectangular distribution
- For [C50] maximum angle of peak intensity through C0 50°. For [R] maximum angle peak intensity through C0 65°, C90 45°. The [R] distribution has a forward to side ratio of 1:2. No light above the horizontal (ILE Class E1/E0). Ideal for lighting public spaces where both uniformity and visual comfort are critical factors.



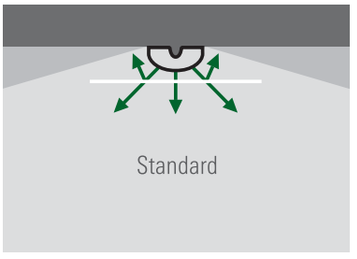
[C50]

IOS® INNOVATIVE OPTICAL SYSTEM

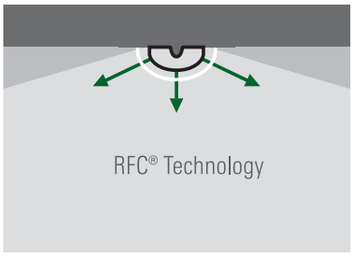
RFC® Technology

RFC® technology is designed to complement the streetlighting versions and it is an important method of further enhancing system performance.

- The conventional flat-glass panel or cover is replaced by a UV-stabilised panel which has a contoured surface, contoured in a way that imitates the shape of the 'butterfly' lens; the goal is to minimise the loss of light that normally occurs due to internal reflection. The RFC® technology is available for the WE-EF lens systems [P65] [S60] [S65] [S70] [A60] [R65] [C50] [R].
- In the case of the [S60] lens, the benefits include the transmission factor at the critical 60° (downwards vertical), which is improved by ~20 per cent. With the [S70] lens, at the critical 70°, the transmission factor is improved by ~30 per cent. As much as 5 per cent will be added to the light output ratio (LOR) of both luminaires.
- In the case of the [S60] lens, this means there is a modest improvement in spacing due to it being a luminance-optimised luminaire. In the case of the [S70] lens, which is optimised for illuminance design work, important increases have been achieved in spacing. This adds to the economic and environmental case favouring the OLC® One LED Concept technology with the special 'butterfly' lens.



Standard distribution



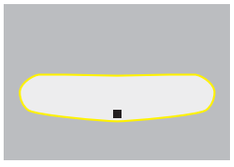
RFC® distribution

The contour of the cover follows the shape of the lens, thereby minimising the internal reflection within the luminaire caused by the light hitting the cover.

IOS® INNOVATIVE OPTICAL SYSTEM

LED beam distribution

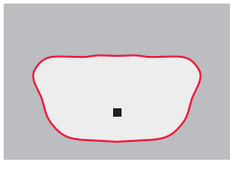
The modular construction of WE-EF LED luminaires makes optimised distribution possible for different lighting solutions.



[P65] Pedestrian / bicycle lane distribution. Illuminance optimised lens, based on Class S2-S4 from EN 13201.

Spacing 5 – 7 x mounting height.

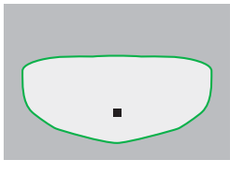
Typical mounting height 3 – 5 m.



[S60] Streetlighting distribution, luminance-optimised lens, based on Class ME3-ME6 from EN 13201.

Spacing 5 to 5.5 times the mounting height; Ti<15 per cent.

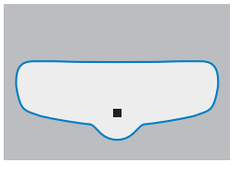
Typical mounting height 3 m to 6 m.



[S65] Streetlighting distribution including intersections and public spaces, luminance-optimised lens, based on Class ME3-ME6 from EN 13201.

Spacing 5 to 5.5 times the mounting height; Ti<15 per cent.

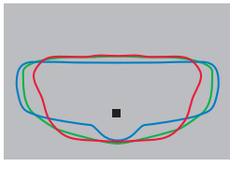
Typical mounting height 6 m to 10 m.



[S70] Streetlighting distribution, illuminance-optimised lens, based on Class S1-S6 from EN 13201.

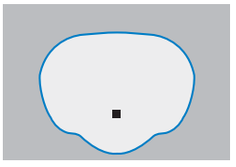
Spacing 7 to 9 times the mounting height; Ti<15 per cent.

Typical mounting height 3 m to 6 m.



[S60] [S65] [S70]

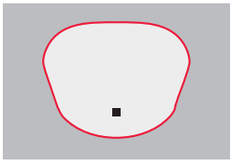
light distributions in comparison.



[R65] Rectangular forward throw distribution for lighting public spaces and car parks.

Maximum angle of peak intensity (side and forward) approximately under 65°. Rearward spill limited to an angle of 10°.

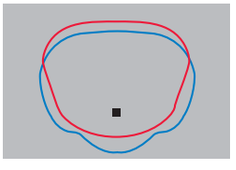
Typical mounting height 4 m to 8 m.



[A60] Asymmetric forward throw distribution for lighting public spaces.

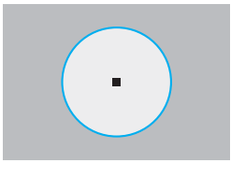
Maximum angle of peak intensity 60°-65°. Rearward spill limited to an angle of 10°.

Typical mounting height 4 m to 8 m.



[A60] [R65]

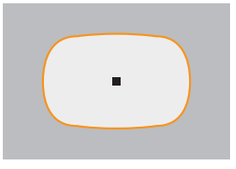
light distributions in comparison



[C50] Symmetric distribution for lighting public spaces and car parks.

Maximum angle of peak intensity approximately 50°. Glare index G1 from EN 13201.

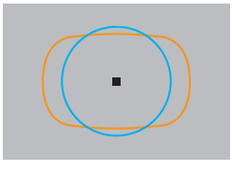
Typical mounting height 4 – 6 m.



[R] Rectangular distribution for lighting public spaces and car parks.

Maximum angle of peak intensity approximately 45° and 65°. Glare index G1 from EN 13201.

Typical mounting height 4 – 6 m.



[C50] [R]

light distributions in comparison

LED ENGINEERING

The development of high quality and efficient LED lenses is one of WE-EF's core competencies. WE-EF possesses the expertise for design, engineering and production.

WE-EF is able to apply its expertise gained from a long experience in the development and operation of LEDs. For example, at the SONY Center in Berlin, 12 years ago, WE-EF was involved with one of the first major LED projects. It was an invaluable advantage, both in understanding today's possible LED technology and in converting this knowledge into innovative lighting solutions.

Definitions

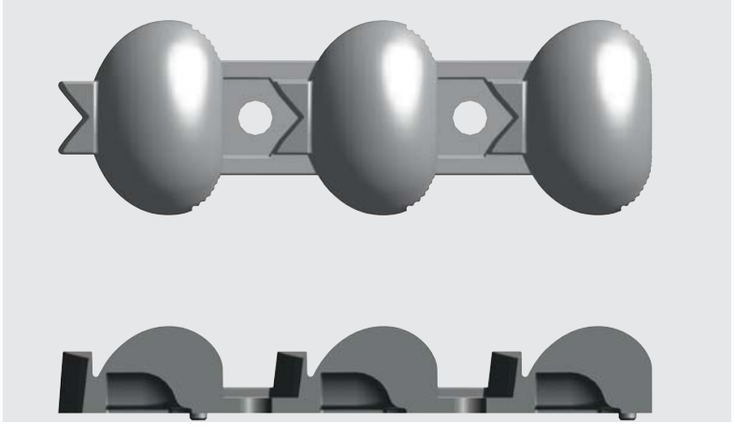
The terms and definitions used in this section are based on the document entitled 'Guidelines for project design safety in LED lighting' (Leitfaden Planungssicherheit in der LED-Beleuchtung) as published by the German Electrical and Electronic Manufacturers' Association (ZVEI) in November 2015.

Rated input power P (W): the effective input of a luminaire, comprising the power consumption of all components integrated in the luminaire.

Rated luminous flux Φ_v (lm): the total radiant flux of a luminaire in its visible range, also known as the initial luminous flux.

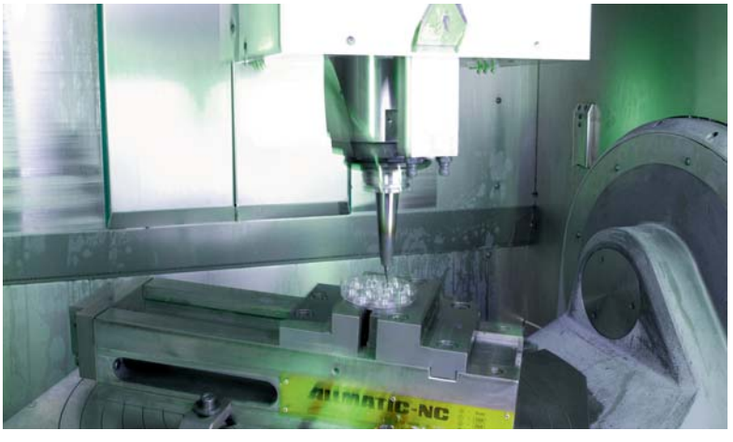
Luminaire efficacy η_v (lm/W): the quotient of the rated luminous flux and the rated input power.

Rated ambient operating temperature T_a (°C): the maximum ambient temperature at which a luminaire can be operated whilst still maintaining all safety-relevant parameters. In this catalogue, Ta = 25°C. However, please note that the majority of the

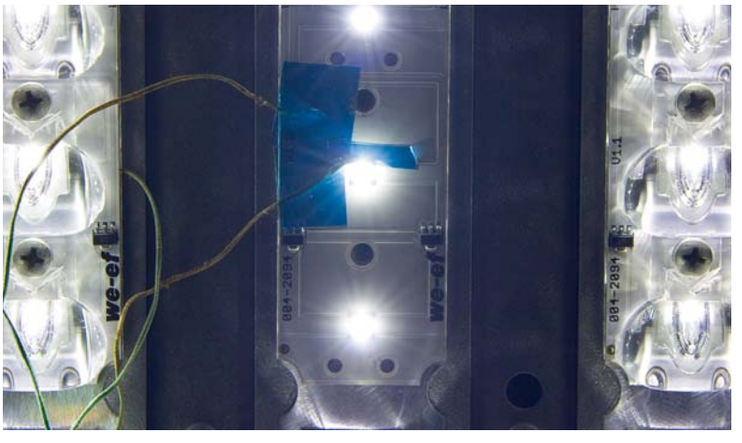


CAD design, optical simulations, prototypes, verification and injection moulding tooling are all used in WE-EF's development and production facilities.

WE-EF LED boards fitted with high-quality LEDs, which have narrowly-defined binning tolerances, guarantee high-visual comfort.



For every LED lens type a prototype is prepared in WE-EF's tooling shop, which is then measured and optimised.



The junction temperature T_J of the LEDs in operation is important for defining lumen depreciation and lifetime.

luminaires listed have a significantly higher rated temperature T_a.
Contact WE-EF to request data for a particular luminaire.

Rated ambient performance temperature T_q (°C): the maximum ambient temperature at which a luminaire reaches the specified values for luminous flux and service life, for example. All of the data in this catalogue is based on a rated ambient temperature of T_q = 25°C.

Rated service life L_xB_y (h): the number of hours after which
a) a group of LED luminaires have dropped to a luminous flux of x (%)
b) a number y (%) of LED luminaires have dropped below the specified luminous flux

Example:
Requirement $L_{70}B_{10}$ – 60,000 h means that after 60,000 hours the group of LED luminaires in question must still provide 70% of the initial luminous flux, whereby 10% of the LED luminaires in question are permitted to provide less than 70% of the initial luminous flux.

Using either a 1-10V or DALI interface with electronic converter, the light output and energy usage of the individual luminaires can be controlled.

In all WE-EF luminaires the LED boards can be individually exchanged without special tools.

All components of the luminaire are engineered for reliability and longevity.

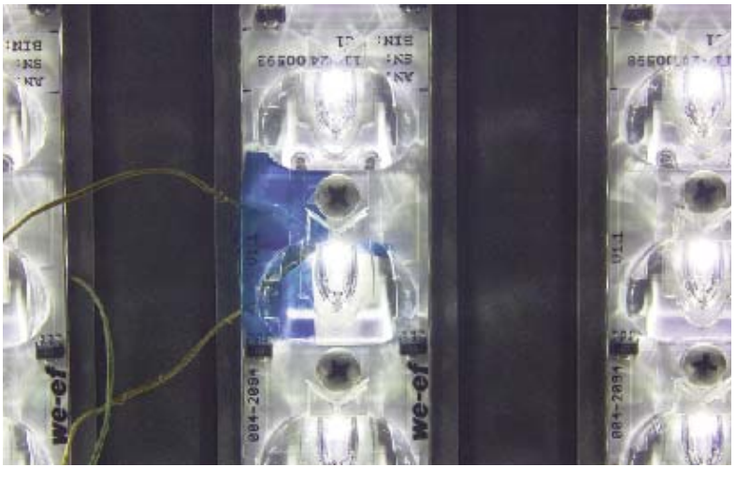
LED ENGINEERING

Thermal management

Long service life and maximum efficiency can only be achieved with perfectly coordinated thermal management. WE-EF products discharge the heat generated by the LEDs through the enclosure that contains a built-in heat sink. As part of a first development step, thermal conditions are simulated with the relevant computer programs and optimised at a theoretical level. Once this optimisation process is complete, prototypes are produced for each luminaire, which are then subjected to intensive testing until they provide results that meet the requirements. WE-EF guarantees optimised heat discharge with maximum service life and minimal reduction in luminous flux.

The luminaire housing is made from die-cast aluminium with integrated heat sink. This, in addition to the excellent heat-conducting properties of aluminium, helps to optimise thermal management.

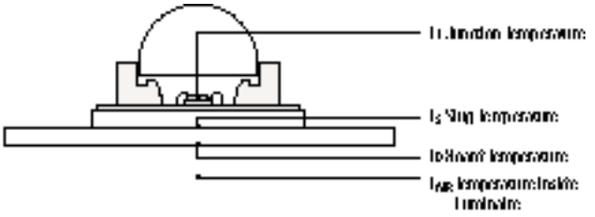
Thermal simulation results are verified using prototypes and actual products before a new luminaire is introduced to the market.



Extensive stress testing is carried out under extreme operating conditions. Products tested in this manner perform exceptionally well under normal field conditions.

LED Lighting Emitting Diodes

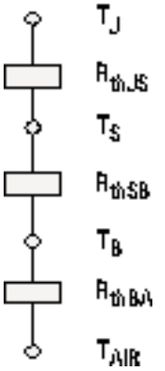
As a luminaire manufacturer, WE-EF aims to shape the thermal conditions in the luminaire so as to ensure that the LEDs are operated at the optimum working point and overloads can be avoided. The product data sheets of the LED manufacturers, which are based on the results of tests and mathematical calculations, form the foundation for ensuring that these tasks can be performed successfully. An assessment of whether an LED in a luminaire is operated in an optimum manner and the effects on service life and reduction in luminous flux is much more complex than for conventional lamps, and therefore requires more attention.



Thermal resistance R_{th}

One of the main focus areas of LED developments in recent years was and is the reduction in thermal resistance $R_{th} = R_{thJS} + R_{thSB} + R_{thBA}$ (resistance between the LED's junction temperature and the temperature on the inside of the luminaire). The smaller the resistance, the smaller the LED's thermal load. This leads to higher luminous flux and reduced ageing, and hence to a longer service life. A luminaire manufacturer can influence thermal resistance by

- developing optimised cooling elements for specific applications,
- guaranteeing clean and level contact surfaces between the LED circuit board and the heat sink, and
- selecting materials with very high thermal conductivity for the LED circuit boards, for example aluminium or ceramics. Circuit boards made of plastics are not suitable in this context.

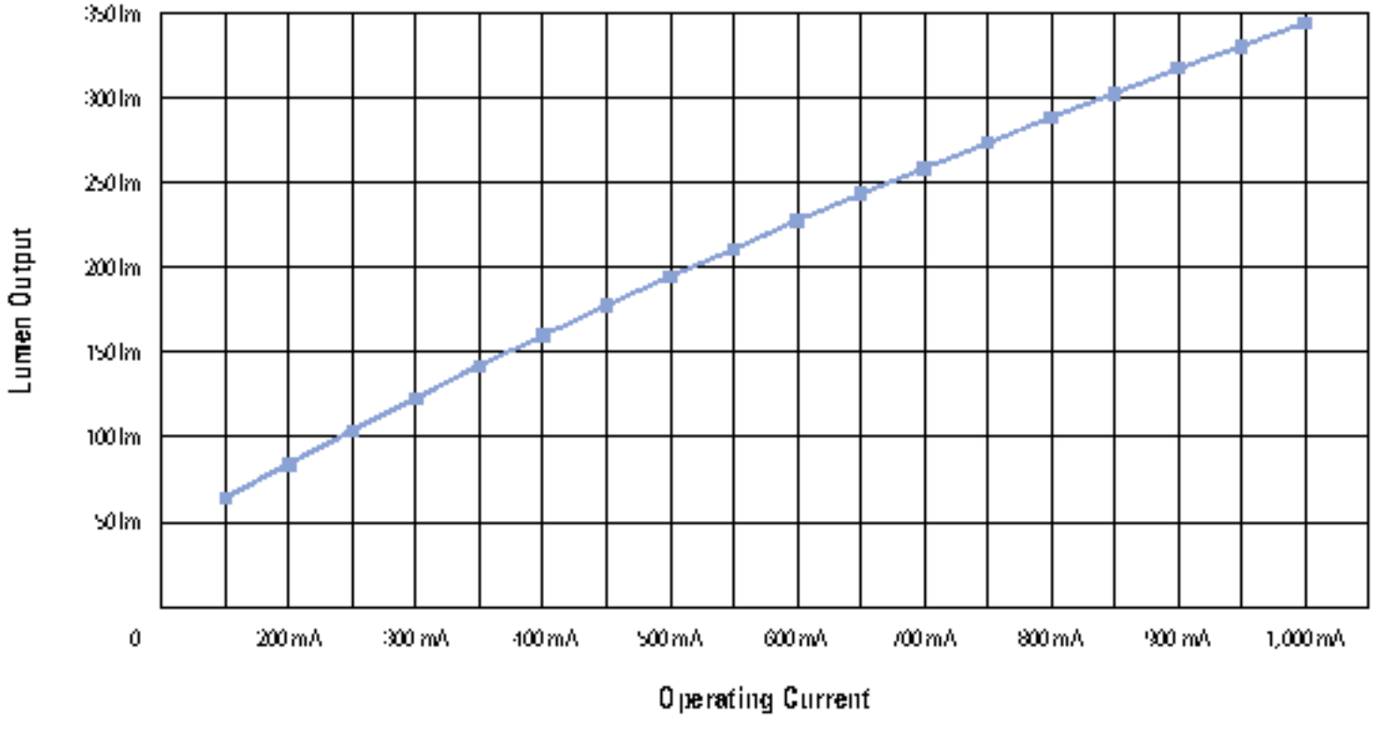


LED ENGINEERING

Operating current I_f

LEDs can be operated with a variety of currents. While at present currents range between 350 mA, 500 mA, 700 mA and 1,050 mA, there is also a development trend towards 1,400 mA and up to 4,000 mA. The higher the operating current, the higher the luminous flux. Unfortunately, LEDs also feature a declining operating current/luminous flux characteristic line. In other words, increases in operating current are accompanied by disproportionately low increases in luminous flux, and luminaire efficacy (lumen/watt) also decreases. The ideal situation is a proportional linear relationship between operating current and luminous flux.

The non-linearity between operating current and luminous flux increases as the temperature of the junction temperature (T_J) increases.



Service life and junction temperature T_J

The service life information provided by LED manufacturers is based on measurements pursuant to LM-80-08 (minimum testing 6,000 h). By combining these measurement values with mathematical calculation models according to TM-21, it is possible to make statements about the behaviour of LEDs during a significantly larger time frame. Today, it is possible to expect a rated service life according to TM-21 of up to 6 times the measured time period. This calculation can be used as a basis to extrapolate a service life curve and draw conclusions regarding the expected service life.

(It is now up to the luminaire manufacturer to transfer these results to the luminaires, which in turn requires them to conduct extensive testing on their luminaires.)*

The service life indications that are derived from this process are based on certain assumptions, which must be clearly documented. Information on the following is required:

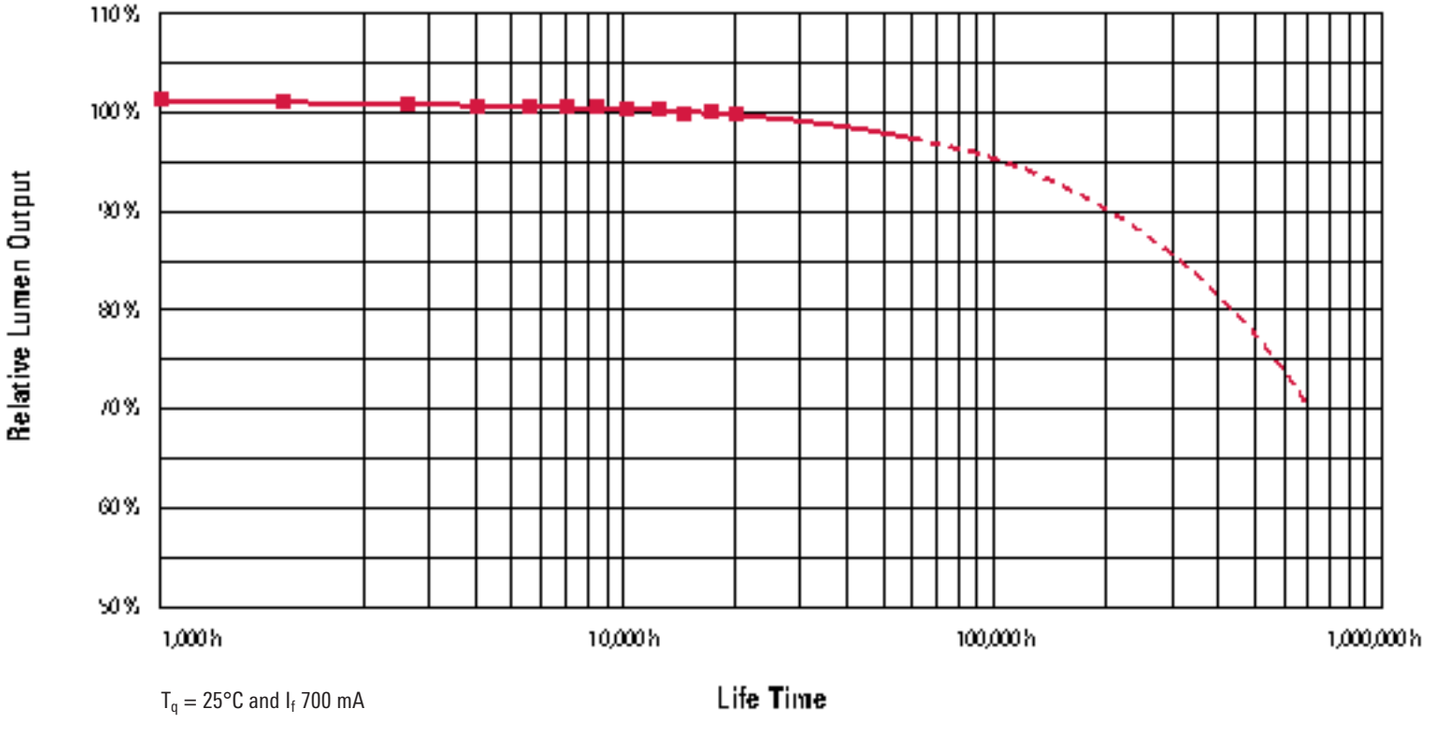
- Maximum rated ambient performance temperature (T_q);
- Operating current (I_f);
- Service life L_xB_y

If for example the average rated ambient performance temperature T_q is 30°C (basis T_q = 25°C) for an application, then the so-called junction temperature T_J will also increase by the difference (30°C – 25°C).

The junction temperature T_J is different for each luminaire, depending on system performance and operating current. This temperature is a maximum of 85°C on average for all of the luminaires shown in this catalogue, which are fitted with the maximum number of LEDs and are operated with 700 mA at an average rated ambient performance temperature of 25°C.

LEDs also undergo an ageing process similar to conventional lamps, i.e. the initially available rated luminous flux decreases the longer the LED is in operation. The lower the LED's thermal load, the lower the reduction in luminous flux. The diagram below illustrates the dependency of an LED's luminous flux on the service life and the average rated ambient performance temperature at an operating current of 700 mA. The diagram below can be used to calculate the luminous flux that can be expected after a certain operating period.

* WE-EF data is based on continual testing for at least 10,000 h



T_q = 25°C and I_f 700 mA

Maintenance factor MF

When using conventional lamps, the luminaire manufacturer is only responsible for supplying information pertaining to the luminaire maintenance factor (LMF). With the introduction of LED this method of approach changed. All three values which provide the maintenance factor (MF), are to be provided by the luminaire manfacturer, as LEDs are now a fixed part of the luminaire.

In addition, in LED luminaires, the three factors in terms of how they are derived has changed, which is detailed as follows.

MF = LLMF x LSF x LMF

MF Maintenance Factor
LLMF Lamp Lumen Maintenance Factor
LSF Lamp Survival Factor
LMF Luminaire Maintenance Factor

Lamp lumen maintenance factor LLMF

It is also possible to calculate the luminous flux that can be expected after a defined rated service life by multiplying the respective rated luminous flux with a lamp lumen maintenance factor that takes into account the ageing of the LEDs; this is easier than trying to read the information from the diagram.

Example Luminaire: VFL540 [S70], 4000 K
Part ID: 108-0910
Nominal luminous flux: 8,854 lm
Rated luminous flux: 8,164 lm

Using the information in the table, we obtain a lamp lumen maintenance factor of LLMF = 0.925 for an average rated ambient performance temperature of 25°C, an operating current of 700 mA and a rated service life of 60,000 h. We obtain the following theoretical minimum rated luminous flux after 60,000 h. 8,164 x 0.925 = 7,552 lm.

T_q = 25°C				
I_f [mA]	T_J *** [°C]	TM-21 [1,000 h]	LLMF at 60,000 h	Theoretically Expected Lifetime [1,000 h] L95
350*	45	>60	0.975	170
500*	55	>60	0.950	150
700*	69	>60	0.925	120
1,050**	80	>60	0.950	90
1,400**	90	>60	0.925	80

* based on 30,000 h continual testing with XP-G2 LED and than extrapolated
** based on 6,000 h continual testing with XP-L LED and than extrapolated
*** measured, average junction temperature T_J in nominated luminaire series

Lamp survival factor LSF

According to the information provided by the LED manufacturer, due to SIC technology, the total failure rate of LEDs is very small. It is approximately 750ppm (after 60,000 h, if = 700mA/1,050mA/1,400mA).

LSF = 1

Luminaire maintenance factor LMF

LED Luminaires operate differentely to HID street & area lighting luminaires. Therefore, the factors applied in line with CIE 154:2003 for WE-EF street & area lighting luminaires have been adjusted.

The reasons for, are as follows:

a) reduced insect build-up because of less thermal heat across the outer cover and less UW damage due to lamp source

b) reduced obscuring/ageing of the outer lens due to reduced convection.

Recommended maintenance factor MF after 60.000 h

I_f [mA]	T_J *** [°C]	LLMF	LSF	LMF (4 Years, IP6x)			MF (N)	MF (M)
				N	M	H		
350*	45	0.975	1	0.96	0.92		0.94	0.90
500*	55	0.950	1	0.96	0.92		0.92	0.88
700*	69	0.925	1	0.96	0.92		0.89	0.85
1,050**	80	0.950	1	0.96	0.92		0.92	0.88
1,400**	90	0.925	1	0.96	0.92		0.89	0.85

* based on XP-G2 LED
** based on XP-L LED
*** measured, average junction temperature T_J in nominated luminaire series

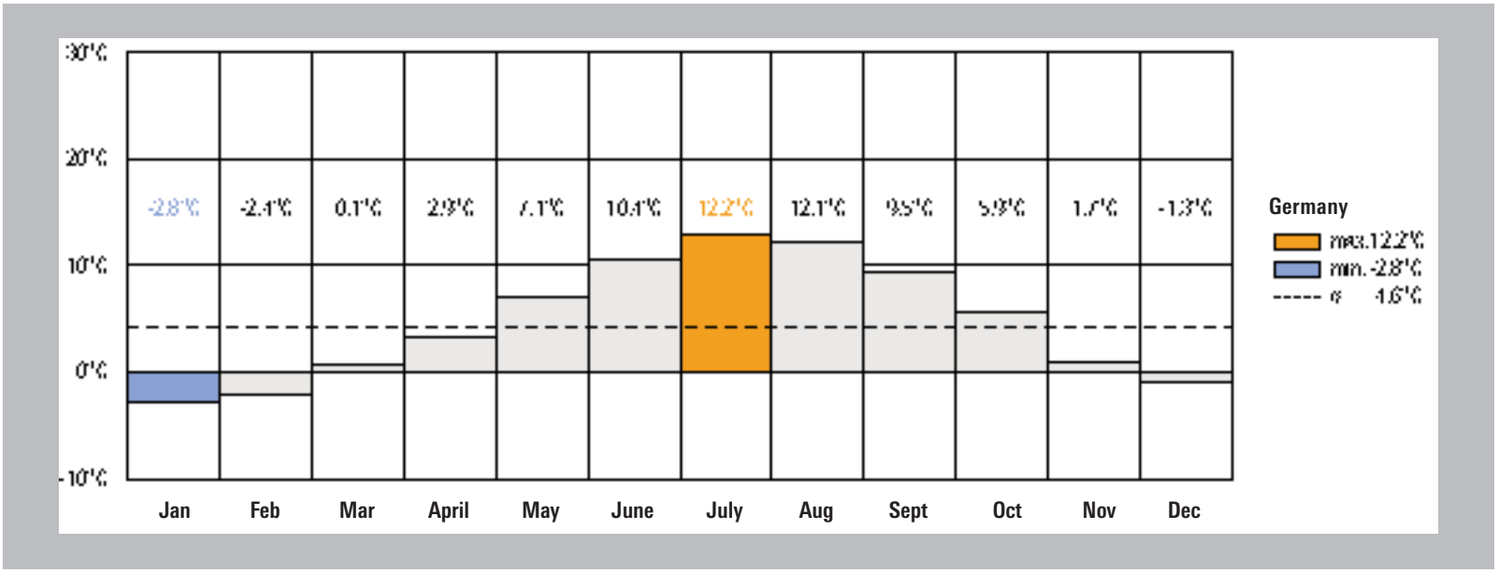
N = area with low pollution
M = area with moderate pollution
H = area with high pollution

Rated ambient performance temperature T_q

The Isolux curves shown in this catalogue refer to an average rated ambient performance temperature of 25°C. However, conditions at a particular location will often deviate from this standard and can have a fairly significant influence on the technical lighting quality and service life of a system. If the average rated ambient performance temperature falls below 25°C, then the luminous flux and service life increase, and vice versa if the temperature increases above this level.

To obtain a more precise calculation, we recommend that the average rated ambient performance temperature that applies when the luminaire is in operation (i.e. night-time hours) during the hottest month of the year at its respective location is used as a measurement basis. The national weather services publish this type of data. The diagram and table show the average ambient temperature for several selected European countries. You can use e.g. www.laenderdaten.info to obtain more comprehensive and detailed global data for selected cities and regions in Germany and Europe.

	Germany	Belgium	Finland	France	Ireland	Italy	Croatia	Netherlands	Norway	Austria	Portugal	Russian Federation	Sweden	Switzerland	Slovakia	Spain	Czech Republic	Ukraine	Hungary	U. K.
max. °C in July	12.2	12.7	10.8	15.0	11.7	20.7	19.2	12.4	8.5	10.8	17.7	10.3	11.0	13.5	9.7	18.3	12.3	15.5	14.6	11.9
min. °C in January	-2.8	0.1	-14.4	2.1	3.1	6.2	1.3	-0.6	-6.0	-7.4	9.2	-23.2	-10.8	-0.8	-9.4	8.0	-5.4	-7.7	-5.0	2.8
average temperature °C	4.6	6.1	-1.8	8.6	6.9	13.1	10.3	5.5	0.9	2.1	13.2	-6.5	0.4	5.9	1.0	12.7	4.2	4.3	5.0	7.0



Luminous flux – nominal vs. rated luminous flux

The luminous flux values listed in this catalogue refer to so-called nominal luminous lux levels. They have been obtained from the data sheets of the LED manufacturers and relate to the set operating currents 350 mA, 500 mA, 700 mA, 1,050 mA or1,400 mA at a junction temperature of 85°C. These values are derived from the laboratories of the LED manufacturers, from free-burning LEDs, with so-called pulsed currents. However, the junction temperature increases differently once the LEDs are in operation inside a luminaire. This temperature is set at a maximum 95°C (based on a average rated ambient performance temperature T_q = 25°C) for the WE-EF luminaires shown in this catalogue. This heating up of the LED leads to a change in luminous flux, hence a decrease in the luminous flux which must be recorded when the luminaire is measured in the lighting laboratory. All of the technical lighting data published by WE-EF takes this context into account. It means that technical lighting computer calculations using original WE-EF technical lighting data, such as is available worldwide via DIALUX, also render these correlations correctly. Current information regarding the luminous flux that can be achieved during the operation of the luminaire can be obtained from www.we-ef.com.

PRODUCT INFORMATION

5CE Superior Corrosion Protection

Outstanding and long lasting anticorrosion properties can only be achieved by a comprehensive, integrated approach. The result of many years of research and development, hands-on testing and experience, WE-EF's unique 5CE system encompasses 5 Critical Elements:

1. Substrate
2. Conversion Coating
3. Powder
4. PCS Hardware
5. Process control

Powder Applications

PCS Hardware

1. Substrate

A marine grade, low copper content aluminium alloy is used for all above ground luminaires. Typical alloy composition:

Cu	≤	0.1 %	Zn	≤	0.1 %
Mg	≤	0.1 %	Ph	≤	0.1 %
Si	=	10.0-13.5 %	Sn	≤	0.05 %
Fe	≤	1.0	Ti	≤	0.2 %
Mn	≤	0.5 %	Al	=	Balance
Ni	≤	0.1 %			

2. Conversion Coating

The multi-step pre-treatment and conversion coating process includes degreasing, deoxidizing, etching and depending on product, zirconium conversion coating. It is considered the most effective conversion coat available for aluminium substrates.

Zirconium conversion coating process:

- Acid degreasing / etching
- Clear water rinse
- Counterflow clear water rinse
- Demineralised water rinse
- Zirconium (+polymer) conversion coating (3-10 mg/m²)
- Hot air drying

Strict controls are constantly maintained over the parameters of every step in each process, such as purity, pH, chemical concentrations, temperature, etc. This ensures the best achievable substrate penetration and uniformity of the conversion coat, thereby ensuring optimum corrosion resistance and powdercoat adhesion.

3. Powder

UV-stabilised, architectural grade polyester powder is electrostatically applied (60-100 µm) and oven cured at ~ 200°C. The grade of polyester powder used is based on saturated polyester resins. Combined with UV resistant cross-linking agents and selected pigments, it features outstanding resistance to atmospheric ageing and UV light exposure. Properly applied to a suitable metal substrate, the resulting powdercoat finish exhibits excellent outdoor durability, and complies with German GSB and European QUALICOAT standards.

4. PCS Hardware

All exposed hardware is made from austenitic stainless steel, and additionally sealed with a tough, impregnated polymer coat, which fulfills two functions:

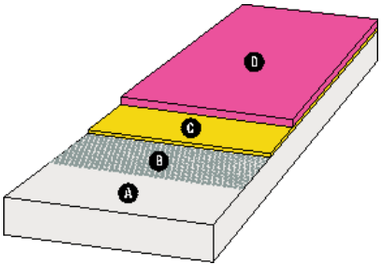
- Reduced friction between male and female thread causes tighter fit between connected parts.
- Non-metallic barrier between the two metals, aluminium and steel, prevents galvanic corrosion that otherwise occurs, when metals of dissimilar electro-negativities are in contact.

5. Process Control

All materials and production steps are part of a tightly controlled process under ISO9001 quality assurance. It includes ongoing spectrometer analysis of aluminium alloy used, daily checks of chemicals concentration in the pre-treatment phase, quality control checks on finished parts, up to 2,000 hours salt spray exposure tests etc.

The Final Product

The final result is a quality product of excellent corrosion resistance, that can be serviced after years of operation, and features a powdercoat finish of outstanding adhesion and colour stability.



A Marine Grade Aluminium Alloy
B Etched Surface
C Conversion Coating
D Architectural Grade Powder Coat

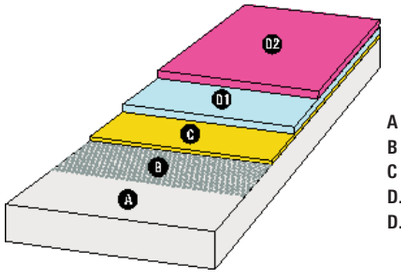
5CE + Primer

For installations where corrosion protection over and above the 5CE system is required, 5CE+ Primer introduces an additional element to the process:

1. Substrate
2. Conversion Coating + Primer
3. Powder Top Coat
4. PCS Hardware
5. Process control

Primer

Immediately after conversion coating, a specially formulated 'intercoat' bonding epoxy primer is electrostatically applied (80-100 µm), and initially semi-cured in a 180°C oven. Following the subsequent application of the polyester powder top coat, full curing and essential 'intercoat' bond is achieved at 200°C.



A Metal substrate
B Etched Surface
C Conversion Coating
D.1 'Intercoat' bonding primer
D.2 Architectural Grade Powder Coat

Luminaires

WE-EF luminaires may be custom ordered to feature the described 5CE+ Primer finish.

PRODUCT INFORMATION

ASC Anti Slip Coating for Inground Uplights

A translucent, tough and highly abrasion resistant ceramic material is fused into the surface of the luminaire's safety glass lens. Slip resistance, as required in pedestrian traffic and wet environments, conforms with DIN 51130 (class R10) and AS/NZS4586:1999 (class V). Corresponding tests were performed at the German BIA and the Australian CSIRO institutes. Arranged in a stochastic (irregular) pattern, the ASC Anti Slip Coating has only moderate effect on the luminaire's light distribution and LOR (light output ratio).

CTA® Cool Touch Adaptor for Inground Uplights

Designed for inground uplights, this unique accessory provides significant reduction in glass surface temperature, while maintaining high LOR (light output ratio). The matt black die-cast aluminium adaptor features a prismatic glass insert, and is hinged to permit easy relamp. The effect on operating temperature of electrical components is negligible (WE-EF Patent DE 10013304).

Lenses and Diffusers

Toughened safety glass, borosilicate glass, acrylic (PMMA) and UV-stabilised polycarbonate (PC) are used throughout the WE-EF product range. Usage is depending on product and application. Safety glass lenses used in inground luminaires are load rated up to 5 tonnes.

Gasketing

Weatherproof and non-ageing silicone rubber is used extensively in the WE-EF range. It provides excellent sealing qualities in corrosive and high temperature environments. A number of luminaires are also designed with CCG (Controlled Compression Gasket) technology for a maintained protection rating.

Electronic Control Gear

WE-EF luminaires equipped with ECG control gear provide energy savings, extended lamp life and stable colour temperature. The circuit's power factor is up to 0.97.

Electromagnetic Control Gear

WE-EF luminaires equipped with magnetic ballasts and power factor correcting capacitors feature an HPF high power factor of up to 0.95. LPF low power factor versions are available on request.

Voltage

WE-EF luminaires and electrical accessories are supplied ready for connection to a 230 V 50 Hz supply. Control gear for other voltages and frequencies is available on request.

Electrical Protection

German and European industrial standards DIN/EN 60598, VDE 0711 and DIN 40050, specify electrical protection and IP classification of luminaires. WE-EF products comply with these as well as with equivalent international standards. WE-EF luminaires conform to electrical protection class I. The compulsory earthing terminal is marked with the symbol ⏚. In the event of a fault, a correctly installed luminaire shall cause the circuit protection device to trip. Special luminaire versions with protection according to Class II ⧈ are available on request.

Ambient Temperatures

The WE-EF range of products is generally designed for operation at 25°C. In many cases, test data confirm higher ratings, at 40°C or more. For installations where excessive ambient temperatures exist, special luminaires and equipment can be supplied on request.

Standards

WE-EF luminaires, floodlights and lighting columns are designed to conform with present DIN/EN and VDE standards. Furthermore, all luminaires manufactured for the European market bear the CE standards conformity mark. WE-EF is constantly developing and improving its products. The technical information given, including data and designs, can be subject to change without prior notice. The dimensions and weights stated are approximate values, subject to manufacturing tolerances. Special finishing, executions and constructions are available on request.

LED Light Emitting Diodes

Only first grade (bin-1) High Efficiency LEDs by leading international manufacturers are used. LED performance in terms of light output and life is substantially influenced by effective thermal management and suitably matched control devices. These are critical issues particularly when applied to sealed, IP rated exterior luminaires.

Lamps

Luminaires exclude lamps, which are ordered separately. Refer to Lamp Chart on pages 424-426 for lamp manufacturers' cross references.

Installation

Installation instructions are provided with all WE-EF products. Suitably qualified personnel must be engaged for installation and maintenance in compliance with the latest applicable regulations and relevant legislation.

Customer Service

Supported by WE-EF expertise, authorised agents provide planning services to consulting engineers, lighting designers and other professionals. The current status of our global distribution network as well as substantial technical and product information, such as product specifications, photometric data and software can be obtained by visiting our website at www.we-ef.com.

IP-Classification

The international Protection Code (IP) classifies luminaires according to their protection against the ingress of dust, solid foreign bodies and water.

IP1X Protection against solid objects of diameter greater than 50 mm
IP2X Protection against finger touch and solid objects of diameter greater than 12 mm
IP3X Protection against solid objects of diameter greater than 2.5 mm
IP4X Protection against solid objects of diameter greater than 1.0 mm
IP5X Complete protection against solid objects and harmful dust deposits (dust proof)
IP6X Total protection against dust (dust-tight)
IPX1 Protection against vertically dripping water (drip proof)
IPX2 Protection against dripping water up to 15° from the vertical
IPX3 Protection against spraying water or falling rain up to 60° from the vertical (rain proof)
IPX4 Protection against splashing water from any direction (splash proof)
IPX5 Protection against water jets from any direction (jet proof)
IPX6* Protection against heavy seas or powerful water jets
IPX7* Protection against the effects of immersion (watertight-immersible)
IPX8* Protection against submersion (pressure watertight-submersible)

The combination of both numerals describes the IP classification of a luminaire.
All WE-EF luminaires are marked accordingly, e.g. IP66 (dust and water jet tight).

* WE-EF luminaires that comply with IPX7 and/or IPX8 are always additionally tested to meet IPX6 requirements under DIN EN 60529. This is because the test conditions and procedures for IPX7 and IPX8 differ significantly from those for IPX6 and compliance for all is not automatically assured.

LIGHTING DATA AND PROJECT SUPPORT

Light Distribution (Fig. 1 and 2)

The three dimensional light distribution pattern of a luminaire is measured by means of a so-called photo goniometer. Depending on their application, WE-EF luminaires feature light distributions that are either symmetrical, bi-symmetrical or asymmetrical. Luminous intensities are measured in cd/klm, and form the basis for lighting design calculations. This catalogue features a range of different photometric diagrams, in order to enable the lighting practitioner to conduct rough calculations. Detailed and precise calculations can be made by using lighting design software.

Isolux Diagrams (Fig. 3)

Illuminance, as a measure, indicates how strongly a surface is lit. The distribution of illuminance on a surface is presented by the isolux diagram. All points of identical illuminance levels are connected by a line. Variations in mounting height or aiming of a luminaire will result in an altered diagram.

Luminance Diagrams (Fig. 4)

Luminaires with opal or frosted lenses are generally used for orientation. For functional and aesthetic evaluation, the level of the average luminance on the lens, as well as its uniformity, have to be taken into consideration.

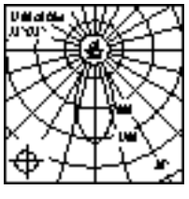


Fig. 1

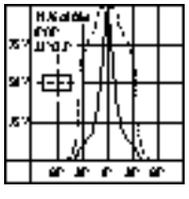


Fig. 2

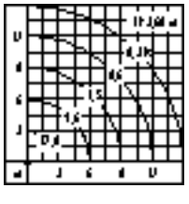


Fig. 3

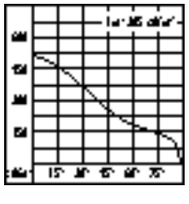


Fig. 4

Luminance diagrams shown in this catalogue present the lens' luminance as a function of the observer's viewing angle. They are based on a maintenance factor of 1.0 for new installations. The unit of measure is candelas per square metre (cd/sqm).

Project Support

WE-EF's customer service includes lighting design and planning support for project engineers, lighting consultants and other professionals. While varying specific customer requirements and installation practices are taken into consideration, the following German/European standards are generally used as a working basis:

DIN EN 12464 Workplace lighting
DIN EN 12193 Sport lighting
DIN EN 13201 Street lighting

LIGHTING DATA AND PROJECT SUPPORT

Streetlighting standards – EN 13201

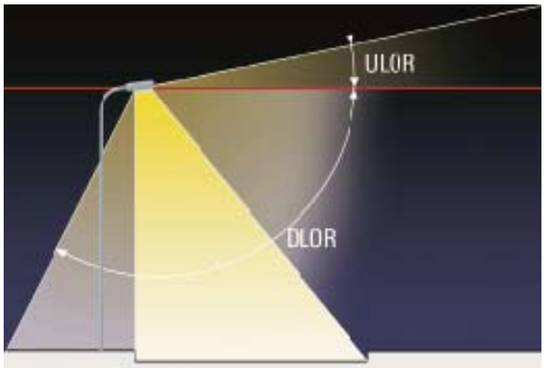
Among other things, the EN 13201 streetlighting standard requires that safety standards and standards related to comfortable lighting conditions be met. Currently, economic operation in conjunction with environmentally-friendly and sustainable luminaire design are essential. Depending on the application, visual systems are employed that optimise luminance and illuminance. WE-EF guarantees modern optical state-of-the-art systems. Highly-specialised employees, suitable simulation software, a technical lighting laboratory and corresponding tool construction constitute the foundation on which WE-EF realises its goal of becoming a world leader in the field of reflector and lens system development.

Illuminance (Lux/lx)

The illuminance measures the amount of light thrown by a streetlighting luminaire onto a surface, e.g., a road (the reference surface). The reflection properties of the illuminated surface are not taken into account. This means that, with the same technical features (luminaire type, number of luminaires, mounting height, road geometry etc.), the results are identical even if road surfaces differ (dark R3 asphalt or light R2 cement) and how the human eye perceives them varies. The criterion of illuminance is therefore only used for smaller roads with low to medium volumes of traffic. Classes S1 to S6 are used depending on requirements. Typical assessment criteria are the mean illuminance (Em) and total uniformity (Uo).

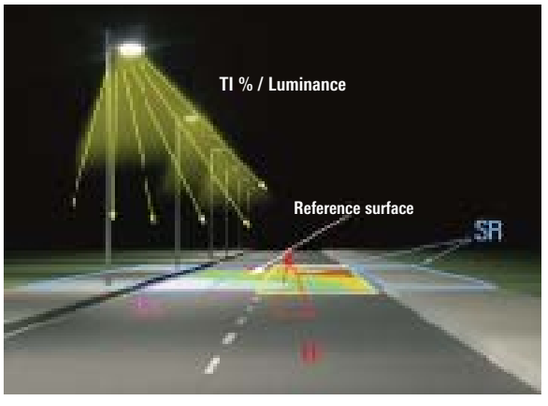
Luminance (candela per square metre/cd/m²)

The calculation of luminance takes into account the reflective properties of a road surface. This means that, with the same technical features (luminaire type, number of luminaires, mounting height, road geometry etc.), the results vary with different road surfaces (dark R3 asphalt or light R2 cement). Road conditions (e.g., dry or wet) also affect the results as does the point of view selected for the calculation. Classes ME1 to ME6 are used here depending on requirements. Typical assessment criteria are the mean luminance (Lm), total uniformity (Uo), longitudinal uniformity (Ul), threshold increment (TI) and the ambient illuminance ratio (SR).



Surroundings Road and, if necessary, pavement and cycle path Surroundings

ULOR: The main task of optical systems is to effectively direct light onto target surfaces that are to be illuminated. With regard to streetlighting, this means light emitted above the horizontal is not only useless, but will also unnecessarily light up the night sky. The upwards flux light output ratio (ULOR) is a measure of how much light escapes from the luminaire into the sky. A ULOR of zero per cent therefore indicates that no light whatsoever escapes from the luminaire into the night sky. The better the optical systems, the lower the burden on the environment.



Reference surface = surface for which the calculation is carried out

Uo = total uniformity of luminance or illuminance on the reference surface.

UI = Uniformity of luminance on the reference surface in the direction of travel.

TI = Threshold increment.

SR = Ambient illuminance ratio.

Lighting Class ME					
	Lm cd/m²	Uo	UI	TI %	SR
ME1	2	0.4	0.7	10	0.5
ME2	1.5	0.4	0.7	10	0.5
ME3a	1	0.4	0.7	15	0.5
ME3b			0.6		
ME3c			0.5		
ME4a	0.75	0.4	0.6	15	0.5
ME4b			0.5		
ME5	0.5	0.35	0.4	15	0.5
ME6	0.3	0.35	0.4	15	–

Lighting Class S		
Class	Em lx	Emin lx
S1	15	5
S2	10	3
S3	7.5	1.5
S4	5	1
S5	3	0.6
S6	2	0.6

In accordance with EN 13201-2 Streetlighting – Part 2: Performance requirements.

LIGHTING DATA AND PROJECT SUPPORT

Recommended Values (excerpt) as per DIN EN 12464-2:2014

General requirements for areas and for cleaning at outdoor work places	Em (lux)	U0	RG_L	Ra ≥	Ref. No. EN 12464-2:2014 (E)
Walkways exclusively for pedestrians	5	0.25	50	20	5.1.1
Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators	10	0.40	50	20	5.1.2
Regular vehicle (max. 40 km/h) traffic	20	0.40	45	20	5.1.3
Pedestrian passages, vehicle turning, loading and unloading points	50	0.40	50	20	5.1.4
Cleaning and servicing	50	0.25	50	20	5.1.5

Canals, locks and harbours	Em (lux)	U0	RG_L	Ra ≥	Ref. No. EN 12464-2:2014 (E)
Waiting quays at canals and locks	10	0.25	50	20	5.4.1
Gangways and passages exclusively pedestrians	10	0.25	50	20	5.4.2
Lock control and ballasting areas	20	0.25	55	20	5.4.3
Cargo handling, loading and unloading	30	0.25	55	20	5.4.4
Passenger areas in passenger harbours	50	0.40	50	20	5.4.5
Coupling of hoses, pipes and ropes	50	0.40	50	20	5.4.6
Dangerous part of walkways and driveways	50	0.40	45	20	5.4.7

Building Sites	Em (lux)	U0	RG_L	Ra ≥	Ref. No. EN 12464-2:2014 (E)
Clearance, excavation and loading	20	0.25	55	20	5.3.1
Construction areas, drain pipes mounting, transport, auxiliary and storage tasks	50	0.40	50	20	5.3.2
Framework element mounting, light reinforcement work, wooden mould and framework mounting, electric piping and cabling	100	0.40	45	40	5.3.3
Element jointing, demanding electrical, machine and pipe mountings	200	0.50	45	40	5.3.4

Parking Areas	Em (lux)	U0	RG_L	Ra≥	Ref. No. EN 12464-2:2014 (E)
Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks	5	0.25	55	20	5.9.1
Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes	10	0.25	50	20	5.9.2
Heavy Traffic, e.g. parking areas of schools, churches, major sport and multipurpose building complexes	20	0.25	50	20	5.9.3

Em = Rated illuminance (lux)

U0 = Uniformity of illuminance Emin/Em

RG_L = upper limit of glare by CIE Glare Rating system

Ra = Colour rendering index

Recommended Values (excerpt) as per DIN EN 13201

ME-series of lighting classes	Luminance of the road surface of the carriageway for the dry road surface condition				
	Ln	U_0	U_l	TI[a]	SR[b]
ME1	2.0	0.4	0.7	10	0.5
ME2	1.5	0.4	0.7	10	0.5
ME3a	1.0	0.4	0.7	15	0.5
ME3b	1.0	0.4	0.6	15	0.5
ME3c	1.0	0.4	0.5	15	0.5
ME4a	0.75	0.4	0.6	15	0.5
ME4b	0.75	0.4	0.5	15	0.5
ME5	0.5	0.35	0.4	15	0.5
ME6	0.3	0.35	0.4	15	no requirement

[a] An increase of 5 percentage points in **TI** can be permitted where low luminance light sources are used. (see note 6)

[b] This criterion can be applied only where there are no traffic areas with their own requirements adjacent to the carriageway.

Note 6

The Threshold increment (**TI**) indicates that although road lighting improves visual conditions it also causes disability glare to a degree depending on the type of luminaires, lamps and geometric situation. Low-pressure sodium lamps and flourescent tubes are normally considered to be low luminance lamps. For these lamps, and luminaires providing less or equivalent luminance, footnote a of Table 1a and footnote b of Table 1b permits higher values.

S-series of lighting classes	Horizontal Illuminance	
	$\bar{E}$ in lx[a]	E_{min} in lx
S 1	15	5
S 2	10	3
S 3	7.5	1.5
S 4	5	1
S 5	3	0.6
S 6	2	0.6
S 7	performance not determined	performance not determined

[a] To provide uniformity, the actual value of the maintained average illuminance may not exceed 1.5 times the minimum $\bar{E}$ value indicated for the class.

Ln = Average luminance (cd/m²)

UI = Longitudinal uniformity Lmin/Lmax

TI = Threshold Increment in %

SR = Surrounding Ratio

Recommended Values (excerpt) as per DIN EN 12193 (Illumination of Sports Grounds)

	Class I			Class II			Class III		
Outdoor	**Em (lux)**	**Emin/Em**	**Ra ≥**	**Em (lux)**	**Emin/Em**	**Ra ≥**	**Em (lux)**	**Emin/Em**	**Ra ≥**
Riding - jumping & dressage, light athletics	500	0.7	60	200	0.5	60	100	0.5	20
Basketball, soccer, handball, rugby, volleyball	500	0.7	60	200	0.6	60	75	0.5	20
Golf (Driving Range)*	-	-	-	-	-	-	100	0.8	20
Hockey	500	0.7	60	200	0.7	60	200	0.7	20
Competition swimming, water polo	500	0.7	60	300	0.7	60	200	0.5	20
Tennis	500	0.7	60	300	0.7	60	200	0.6	20
Horse racing* - trotting track, race track and derby	200	0.6	60	100	0.4	60	50	0.2	20

	Class I			Class II			Class III		
Indoor	**Em (lux)**	**Emin/Em**	**Ra ≥**	**Em (lux)**	**Emin/Em**	**Ra ≥**	**Em (lux)**	**Emin/Em**	**Ra ≥**
Badminton, ice-hockey, fencing*, hockey, squash, table-tennis	750	0.7	60	500	0.7	60	300	0.7	20
Basketball, handball, fist-ball, volleyball, judo	750	0.7	60	500	0.7	60	200	0.5	20
Riding - jumping & dressage, light athletics	500	0.7	60	300	0.6	60	200	0.5	20
Competition swimming, water polo	500	0.7	60	300	0.7	60	200	0.5	20
Tennis	750	0.7	60	500	0.7	60	300	0.5	20

* There are additional requirements for vertical illuminance

LAMP CHART

This catalogue lists lamp designations in accordance with the lamp designation system of the German electrotechnical industry. The lamp chart is for comparison purposes only and for luminaires listed in this catalogue. It is not complete and errors are expected.

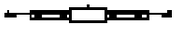
Due to ongoing research and development by the manufacturers, lamp specifications may change. Ensure that all technical data is checked prior to application.

				OSRAM	PHILIPS	GE
	QT (Tungsten Halogen Lamps)					
	QT 12 (-LP) ax 35W/c GY6.35 12V	Ra100	3000 K	64432 ES	---	---
	QT 12 (-LP) ax 65W/c GY6.35 12V	Ra100	3000 K	64447 ES	---	---
	QT18 25W/m B15d	Ra100	2900 K	64466AM	---	---
	QT18 40W/m B15d	Ra100	2900 K	64467AM	---	---
	QT18 60W/m B15d (l=67mm)	Ra100	2900 K	64481AM	---	---
	QT18 75W/m B15d (l=86mm)	Ra100	2900 K	64473AM	12123	---
	QT18 100W/m B15d (l=86mm)	Ra100	2900 K	64475AM	12122	---
	QT-DE 12 150W R7s-15	Ra100	2900 K	64696	---	---
	QT-DE 12 200W R7s-15	Ra100	2900 K	64698	200 T3Q/CL/P small	K11/Q200T3/CL
	QT-DE 12 300W R7s-15	Ra100	2900 K	64701	300 T3Q/CL/P small	K9/Q300T3/CL
	TC (Compact Flourescent Lamps)					
	T5 21W/ … G5	Ra 80	27/30/4000 K	HE 21W/ …	TL5 HE 21W/ …	T5 HE 21W/ …
	T5 39W/ … G5	Ra 80	27/30/4000 K	HE 39W/ …	TL5 HE 39W/ …	T5 HE 39W/ …
	T26 58W/827 G13	Ra > 80	2700 K	L 58W/827	---	
	T26 58W/830 G13	Ra > 80	3000 K	L 58W/830	TL-D 58W/830 SLV	
	T26 58W/835 G13	Ra > 80	3500 K	L 58W/835	---	
	T26 58W/840 G13	Ra > 80	4000 K	L 58W/840	TL-D 58W/840 SLV	
	T26 58W/865 G13	Ra > 80	6500 K	L 58W/865	TL-D 58W/865 SLV	
	T26 58W/880 G13	Ra > 80	8000 K	L 58W/880	---	
	TC-TEL 13W/... GX24-q1	Ra 85	27/30/4000 K	DULUX T/E 13W/…PLUS	---	F13TBX/.../4P
	TC-TEL 18W/... GX24-q2	Ra 85	27/30/4000 K	DULUX T/E 18W/…PLUS	---	F18TBX/.../4P
	TC-TEL 26W/... GX24-q3	Ra 85	27/30/4000 K	DULUX T/E 26W/…PLUS	---	F26TBX/.../4P
	TC-TEL 32W/... GX24-q3	Ra 85	27/30/4000 K	DULUX T/E 32W/…PLUS	---	F32TBX/.../4P
	TC-TEL 42W/... GX24-q4	Ra 85	27/30/4000 K	DULUX T/E 42W/…PLUS	---	F42TBX/.../4P
	TC-TELI 26W/... GX24-q3	Ra 85	30/4000 K	DULUX T/E 26W/…IN PLUS	---	---
	TC-TELI 32W/... GX24-q3	Ra 85	27/30/4000 K	DULUX T/E 32W/…IN PLUS	---	---
	TC-TELI 42W/... GX24-q4	Ra 85	27/30/4000 K	DULUX T/E 42W/…IN PLUS	---	---
	TC-TELI 57W/... GX24-q5	Ra 85	30/4000 K	DULUX T/E 57W/…IN PLUS	---	---
	TC-L 18W/... 2G11	Ra 85	27/30/4000 K	DULUX L 18W/…	PL-L 18W/4p	F18BX/…
	TC-L 24W/... 2G11	Ra 85	27/30/4000 K	DULUX L 24W/…	PL-L 24W/4p	F24BX/…
	MH (Metal Halide Lamps)					
	HIT-COS 45W/628 PGZ12	Ra > 60	2800 K	---	CPO-TW 45W/628 PGZ12	---
	HIT-COS 60W/628 PGZ12	Ra > 65	2800 K	---	CPO-TW 60W/728 PGZ12	---
	HIT-COS 90W/628 PGZ12	Ra > 65	2800 K	---	CPO-TW 90W/728 PGZ12	---
	HIT-COS 140W/628 PGZ12	Ra > 65	2800 K	---	CPO-TW 140W/728 PGZ12	---
	HIT-TC-CE 20W/830 PGJ5	Ra > 85	3000 K	---	CDM-Tm 20W/830 PGJ5	---
	HIT-TC-CE 35W/930 PGJ5	Ra > 85	3000 K	---	CDM-Tm 35W/930 PGJ5	---

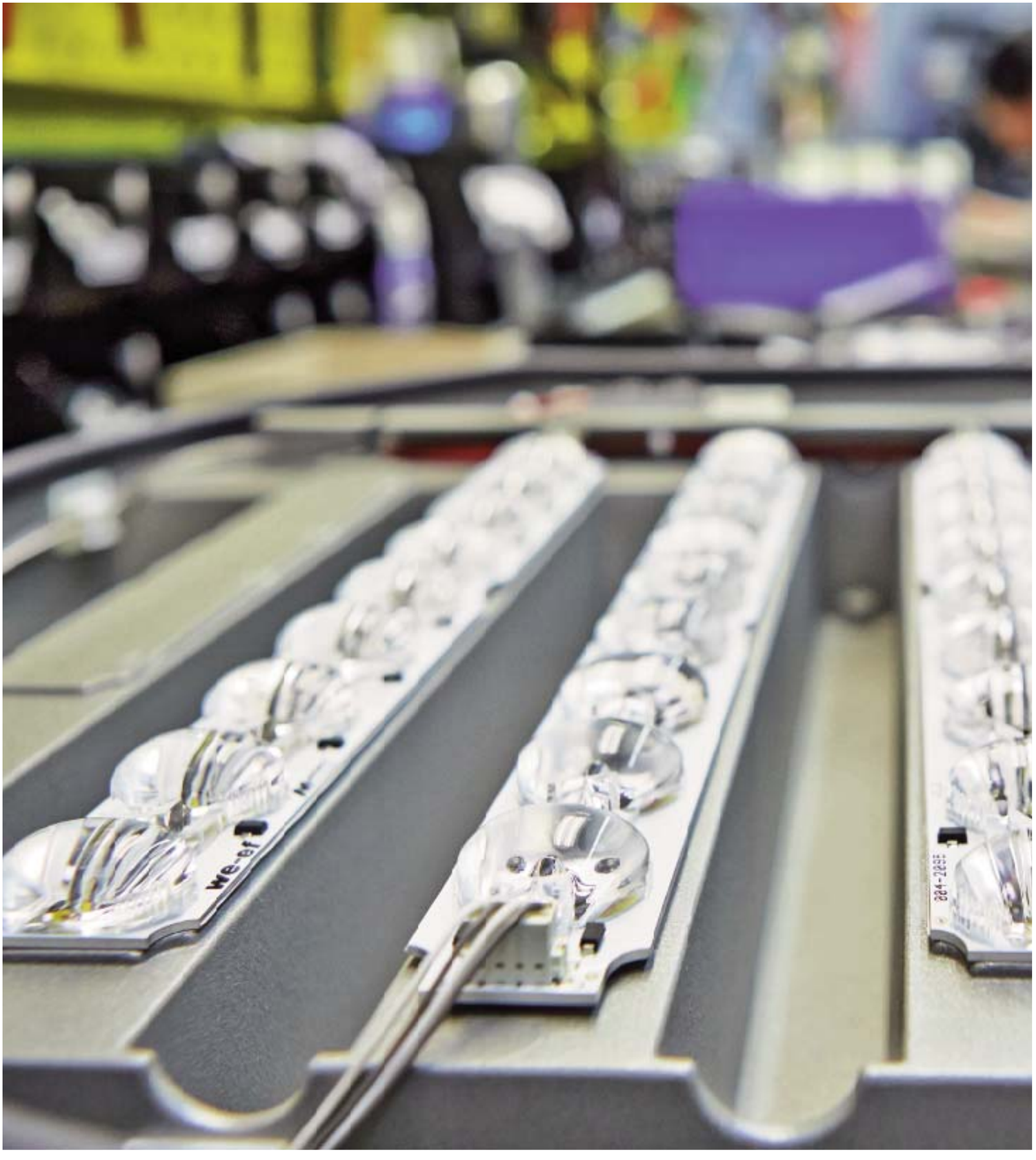
				OSRAM	PHILIPS	GE
	HIT-TC-CE 20W/830 GU6.5	Ra > 80	3000 K	HCI-TF 20W/830 WDL PB	CDM-Tm Mini GU6.5 20W/830	CMH20/T/UVC/830/GU6.5
	HIT-TC-CE 35W/930 GU6.5	Ra > 90	3000 K	HCI-TF 35W/930 WDL PB	CDM-Tm Elite Mini GU6.5 35W/930	CMH35/T/UVC/930/GU6.5
	HIT-TC-CE 35W/942 GU6.5	Ra > 90	4200 K	---	---	CMH35/T/UVC/942/GU6.5
	HIT-TC-CE 50W/930 GU6.5	Ra > 90	3000 K	---	CDM-Tm Elite Mini GU6.5 50W/930	---
	HIT-TC-CE 20W/830 G8.5	Ra > 80	3000 K	HCI-TC 20W/830 WDL PB	---	CMH20/TC/UVC/U/830/G8.5
	HIT-TC-CE 35W/830 G8.5	Ra > 80	3000 K	HCI-TC 35W/830 WDL PB	CDM-TC 35W/830	CMH35/TC/UVC/U/830/G8.5
	HIT-TC-CE 35W/930 G8.5	Ra > 90	3000 K	HCI-TC 35W/930 WDL PB SHOP	CDM Elite - TC 35W/930	---
	HIT-TC-CE 35W/942 G8.5	Ra > 90	4200 K	HCI-TC 35W/942 NDL PB	---	---
	HIT-TC-CE 70W/830 G8.5	Ra > 80	3000 K	HCI-TC 70W/830 WDL PB	CDM-TC 70W/830	CMH70/TC/UVC/U/830/G8.5
	HIT-TC-CE 70W/930 G8.5	Ra > 90	3000 K	HCI-TC 70W/930 WDL PB SHOP	CDM Elite - TC 70W/930	---
	HIT-TC-CE 70W/942 G8.5	Ra > 90	4200 K	HCI-TC 70W/942 NDL PB	---	CMH70/TC/UVC/U/942/68.5
	HIT-CE 20W/830 G12	Ra > 80	3000 K	---	CDM T 20W/830	---
	HIT-CE 35W/830 G12	Ra > 80	3000 K	HCI-T 35W/830 WDL PB	CDM T 35W/830	CMH35/T/UVC/U/830/G12
	HIT-CE 35W/930 G12	Ra > 90	3000 K	HCI-T 35W/930 WDL PB SHOP	CDM Elite-T 35W/930	---
	HIT-CE 35W/942 G12	Ra > 90	4200 K	HCI-T 35W/942 NDL PB	CDM T 35W/942	CMH35/T/UVC/U/942/G12
	HIT-CE 70W/830 G12	Ra > 80	3000 K	HCI-T 70W/830 WDL PB	CDM T 70W/830	CMH70/T/UVC/U/830/G12
	HIT-CE 70W/930 G12	Ra > 90	3000 K	HCI-T 70W/930 WDL PB SHOP	CDM Elite-T 70W/930	---
	HIT-CE 70W/942 G12	Ra > 90	4200 K	HCI-T 70W/942 NDL PB	CDM T 70W/942	CMH70/T/UVC/U/942/G12
	HIT-CE 100W/830 G12	Ra > 85	3000 K	HCI-T 100W/830 WDL PB	---	---
	HIT-CE 100W/942 G12	Ra > 90	4200 K	HCI-T 100W/942 NDL PB	---	---
	HIT-CE 150W/830 G12	Ra > 85	3000 K	HCI-T 150W/830 WDL PB	CDM T 150W/830	CMH150/T/UVC/U/830/G12
	HIT-CE 150W/942 G12	Ra > 90	4200 K	HCI-T 150W/942 NDL PB	CDM T 150W/942	CMH150/T/UVC/U/942/G12
	HIT-CE 250W/830 G12	Ra > 85	3000 K	---	CDM T 250W/830	---
	HIT-CE/S 250W/830 G22	Ra > 80	3000 K	HCI-TM 250W/830 WDL PB	---	---
	HIT-CE/S 250W/942 G22	Ra > 90	4200 K	HCI-TM 250W/942 NDL PB	---	---
	HIT-CE/S 400W/942 G22	Ra > 90	4200 K	HCI-TM 400W/942 NDL PB	---	---
	HIT 1000W/961 G22	Ra > 90	6100 K	HQI-TM 1000W/961 D	---	---
						
	HIT-CE 70W/828 E27	Ra > 80	2800 K	---	CDO-TT 70W/828	---
	HIT-CE 70W/830 E27	Ra > 85	3000 K	HCI-TT 70W/830 WDL PB	---	CMH70/TT/U/830/E27
	HIT-CE 100W/830 E40	Ra > 85	3000 K	HCI-TT 100W/830 WDL PB	CDO-TT 100W/828	---
	HIT-CE 150W/828 E40	Ra > 85	2800 K	---	CDO-TT 150W/828	---
	HIT-CE 150W/830 E40	Ra > 85	3000 K	HCI-TT 150W/830 WDL PB	---	CMH150/TT/U/830/E40
	HIT-CE 250W/828 E40	Ra > 85	2800 K	---	CDO-TT 250W/828	---
	HIT-CE 250W/830 E40	Ra > 85	3000 K	HCI-T 250W/830 WDL PB	---	CMH250/TT/U/830/E40
	HIT-CE 250W/942 E40	Ra > 90	4200 K	HCI-T 250W/942NDL PB	---	-
	HIT 250W/952 E40	Ra > 90	5200 K	HQI-T 250W/952 D	---	---
	HIT 400W/635 E40	Ra > 65	3500 K	HQI-T 400W/635 N	---	---
	HIT 400W/952 E40	Ra > 90	5200 K	HQI-BT 400W/952 D	---	---
	HIT 1000W/973 E40	Ra > 90	7250 K	HQI-T 1000W/973 D	---	SPL1000/T/H/960/E40
	HIE-CE 35W/830 E27	Ra > 85	3000 K	HCI-E/P 35W/830 WDL PB coated*	---	---
	HIE-CE 35W/942 E27	Ra > 90	4200 K	HCI-E/P 35W/942 NDL PB coated*	---	---
	HIE-CE 50W/830 E27	Ra > 85	3000 K	HCI-E/P 50W/830 WDL PB coated*	---	---
	HIE-CE 50W/942 E27	Ra > 90	4200 K	HCI-E/P 50W/942 NDL PB coated*	---	---
	HIE-CE 70W/828 E27	Ra > 75	2800 K	---	CDO-ET 70W/828	CMH70/E/U/830/E27/D
	HIE-CE 70W/830 E27	Ra > 85	3000 K	HCI-E/P 70W/830 WDL PB coated*	---	---
	HIE-CE 70W/942 E27	Ra > 90	4200 K	HCI-E/P 70W/942 NDL PB coated*	---	---

* for open luminaire versions

LAMP CHART

				OSRAM	PHILIPS	GE
	HIE-CE 100W/830 E27	Ra > 85	3000 K	HCI-E/P 100W/830 WDL PB coated*	---	CMH100/E/U/830/E27/D
	HIE-CE 100W/942 E27	Ra > 90	4200 K	HCI-E/P 100W/942 NDL PB coated*	---	---
	HIE-CE 150W/930 E27	Ra > 90	3000 K	HCI-E/P 150W/930 WDL PB coated*	---	---
	HIE-CE 150W/942 E27	Ra > 90	4200 K	HCI-E/P 150W/942 NDL PB coated*	---	---
	HIE-CE 150W/828 E40	Ra > 80	2800 K	---	---	---
	HIE-CE 250W/830 E40	Ra > 85	3000 K	HCI-E 250W/830 WDL PB coated	---	---
	HIE 400W/947 E40	Ra > 90	4700 K	HQI-E/P 400W/947 D coated	---	---
	HIE 400W/952 E40	Ra > 90	5200 K	HQI-E 400W/952 D coated	---	---
	HIT-DE-CE 70W/830 RX7s	Ra > 80	3000 K	HCI-TS 70W/830 WDL PB	CDM-TD 70W/830	CMH70/TD/UVC/830/Rx7s
	HIT-DE-CE 70W/942 RX7s	Ra > 90	4200 K	HCI-TS 70W/942 NDL PB	CDM-TD 70W/942	CMH70/TD/UVC/942/Rx7s
	HIT-DE-CE 150W/830 RX7s	Ra > 85	3000 K	HCI-TS 150W/830 WDL PB	CDM-TD 150W/830	CMH150/TD/UVC/830/Rx7s
	HIT-DE-CE 150W/942 RX7s	Ra > 95	4200 K	HCI-TS 150W/942 NDL PB	CDM-TD 150W/942	CMH150/TD/UVC/942/Rx7s
	HIT-DE 250W/830 Fc2	Ra = 80	3200K	HQI-TS 250/830 WDL	---	---
	HIT-DE 250W/842 Fc2	Ra > 85	4200 K	HQI-TS 250W/842 NDL	MHN-TD 250W/842	RC250/TD/840/Fc2
	HIT-DE 250W/951 Fc2	Ra > 90	5100 K	HQI-TS 250W/951 D	---	---
	HIT-DE 400W/842 Fc2	Ra > 85	4200 K	HQI-TS 400W/842 NDL	---	---
	HIT-DE 400W/952 Fc2	Ra > 90	5200 K	HQI-TS 400W/952 D	---	---
	HIT-SA-DE 1000W/959 Cable	Ra > 90	5900 K	HQI-TS 1000W/959 D S	---	---
	HIT-SA-DE 2000W/959 Cable	Ra > 90	5900 K	HQI-TS 2000W/959 D S	MHN-SB Pro 2000W/956/400V	---
	HIT-LA-DE 1000W/842 Cable	Ra > 80	4200 K	---	MHN-LA 1000W/842 230V	---
	HIT-LA-DE 1000W/956 Cable	Ra > 90	5600 K	---	MHN-LA 1000W/956 230V	---
	HIT-LA-DE 2000W/842 Cable	Ra > 80	4200 K	---	MHN-LA 2000W/842 400V	---
	HIT-LA-DE 2000W/956 Cable	Ra > 90	5600 K	---	MHN-LA 2000W/956 400V	---
	HIT-LA-DE 1000W/642 Cable/FC	Ra > 65	4200 K	---	MHN-FC 1000W/740 230V X-W	---
	HIT-LA-DE 1000W/655 Cable/FC	Ra > 65	5500 K	---	MHN-FC 1000W/750 230V X-W	---
	HIT-LA-DE 2000W/642 Cable/FC	Ra > 65	4200 K	---	MHN-FC 2000W/740 400V X-W	---
	HPS (High Pressure Sodium Lamps)					
	HST-X4 50W/220 E27	Ra 25	2000K	NAV-T 50 SUPER 4Y	SON-T PLUS 50W	LU50/90/XO/T/27
	HST-X4 70W/220 E27	Ra 25	2000K	NAV-T 70 SUPER 4Y	SON-T PLUS 70W	LU70/90/XO/T/27
	HST-X4 100W/220 E40	Ra 25	2000K	NAV-T 100 SUPER 4Y	SON-T PLUS 100W	LU100/100/XO/T/40
	HST-X4 150W/220 E40	Ra 20	2000K	NAV-T 150 SUPER 4Y	SON-T PLUS 150W	LU150/150/XO/T/40
	HST-X4 250W/220 E40	Ra 20	2000K	NAV-T 250 SUPER 4Y	SON-T 250W	LU250/XO/T/40
	HST-X4 400W/220 E40	Ra 20	2000K	NAV-T 400 SUPER 4Y	SON-T 400W	LU400/XO/T/40
	HST-X4 600W/220 E40	Ra 25	2000K	NAV-T 600 SUPER 4Y	SON-T PLUS 600	LU600/XO/T/40
	HST 1000W/220 E40	Ra 20	2000K	NAV-T 1000	SON-T 1000W	LU1000/110/T/40 4pk
	HST-DE-X4 70W/220 RX7s	Ra 25	2000K	NAV-TS 70 SUPER 4Y	---	---
	HST-DE-X4 150W/220 RX7s	Ra 25	2000K	NAV-TS 150 SUPER 4Y	---	---
	HST-DE 250W/220 Fc2	Ra 20	2000K	NAV-TS 250	---	LU250/TD
	HST-DE 400W/220 Fc2	Ra 20	2000K	NAV-TS 400	---	LU400/TD

* for open luminaire versions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Product specifications given in this catalogue reflect the status as of March 2016. Errors and omissions are excepted. Data given can be subject to change without prior notice.

The conditions of sale, as published in WE-EF's current price lists and/or business forms apply. Export transactions require special agreements, particularly regarding shipment and payment.

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WE-EF Farben | Colours | Couleurs

WE-EF Standard	**RAL 9004**	Signalschwarz Signal black Noir de sécurité
WE-EF Standard	**RAL 9006**	Weißaluminium White aluminium Aluminium blanc
WE-EF Standard	**RAL 9007**	Graualuminium Grey aluminium Aluminium gris
WE-EF Standard	**RAL 9016**	Verkehrsweiß Traffic white Blanc signalisation
		Classic Silver
	RAL 1015	Hellelfenbein Light ivory Ivoire clair
	RAL 3002	Karminrot Carmine red Rouge carmin
	RAL 3005	Weinrot Wine red Rouge vin
	RAL 3011	Braunrot Brown red Rouge brun
	RAL 3020	Verkehrsrot Traffic red Rouge signalisation
	RAL 5003	Saphirblau Sapphire blue Bleu saphir
	RAL 5004	Schwarzblau Black blue Bleu noir
	RAL 5014	Taubenblau Pigeon blue Bleu pigeon
	RAL 5021	Wasserblau Water blue Bleu d'eau
	RAL 5023	Fernblau Distant blue Bleu distant
	RAL 6005	Moosgrün Moss green Vert mousse
	RAL 6009	Tannengrün Fir green Vert sapin
	RAL 6011	Resedagrün Reseda green Vert réséda
	RAL 6012	Schwarzgrün Black green Vert noir
	RAL 6020	Chromoxidgrün Chrome green Vert chromique
	RAL 6021	Blassgrün Pale green Vert pâle
	RAL 7006	Beigegrau Beige grey Gris beige
	RAL 7012	Basaltgrau Basalt grey Gris basalte
	RAL 7016	Anthrazitgrau Anthracite grey Gris anthracite
	RAL 7022	Umbragrau Umbra grey Gris terre d'ombre
	RAL 7024	Graphitgrau Graphite grey Gris graphite
	RAL 7030	Steingrau Stone grey Gris pierre
	RAL 7032	Kieselgrau Pebble grey Gris silex
	RAL 7035	Lichtgrau Light grey Gris clair
	RAL 7037	Staubgrau Dusty grey Gris poussière
	RAL 7045	Telegrau 1 Telegrey 1 Telegris 1
	RAL 8004	Kupferbraun Copper brown Brun cuivré
	RAL 8016	Mahagonibraun Mahogany brown Brun acajou
	RAL 8017	Schokoladenbrau Chocolate brown Brun chocolat
	RAL 8019	Graubraun Grey brown Brun gris
	RAL 9002	Grauweiß Grey white Blanc gris
	RAL 9005	Tiefschwarz Jet black Noir foncé
	RAL 9010	Reinweiß Pure white Blanc pur
	RAL 9018	Papyrusweiß Papyrus white Blanc papyrus
	DB 501 WE-EF 51	Gris bleu clair
	DB 502 WE-EF 52	Gris bleu foncé
	DB 701 WE-EF 71	Gris clair
	DB 702 WE-EF 72	Gris moyen
	DB 703 WE-EF 73	Gris foncé

Geringe Abweichungen in Farbton und Glanz sind drucktechnisch bedingt. Maßgeblich für RAL-Farben sind allein die RAL-Register 840-HR (seidenmatt) oder 841-GL (glänzend). **Gültig ab März 2016**

The colour shades and gloss levels are for guidance only. For accurate colour matching, use the official 840-HR (semi-gloss) and 841-GL (gloss) reference charts. **Valid from March 2016**

Un léger écart de couleur est dû aux techniques d'imprimerie. L'origine des couleurs RAL provient du registre RAL-840-HR (brillant satiné) ou 841-GL (brillant). **Valable à partir d' Mars 2016**