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LEDflood BCP730

Range application guide

EDUCATION
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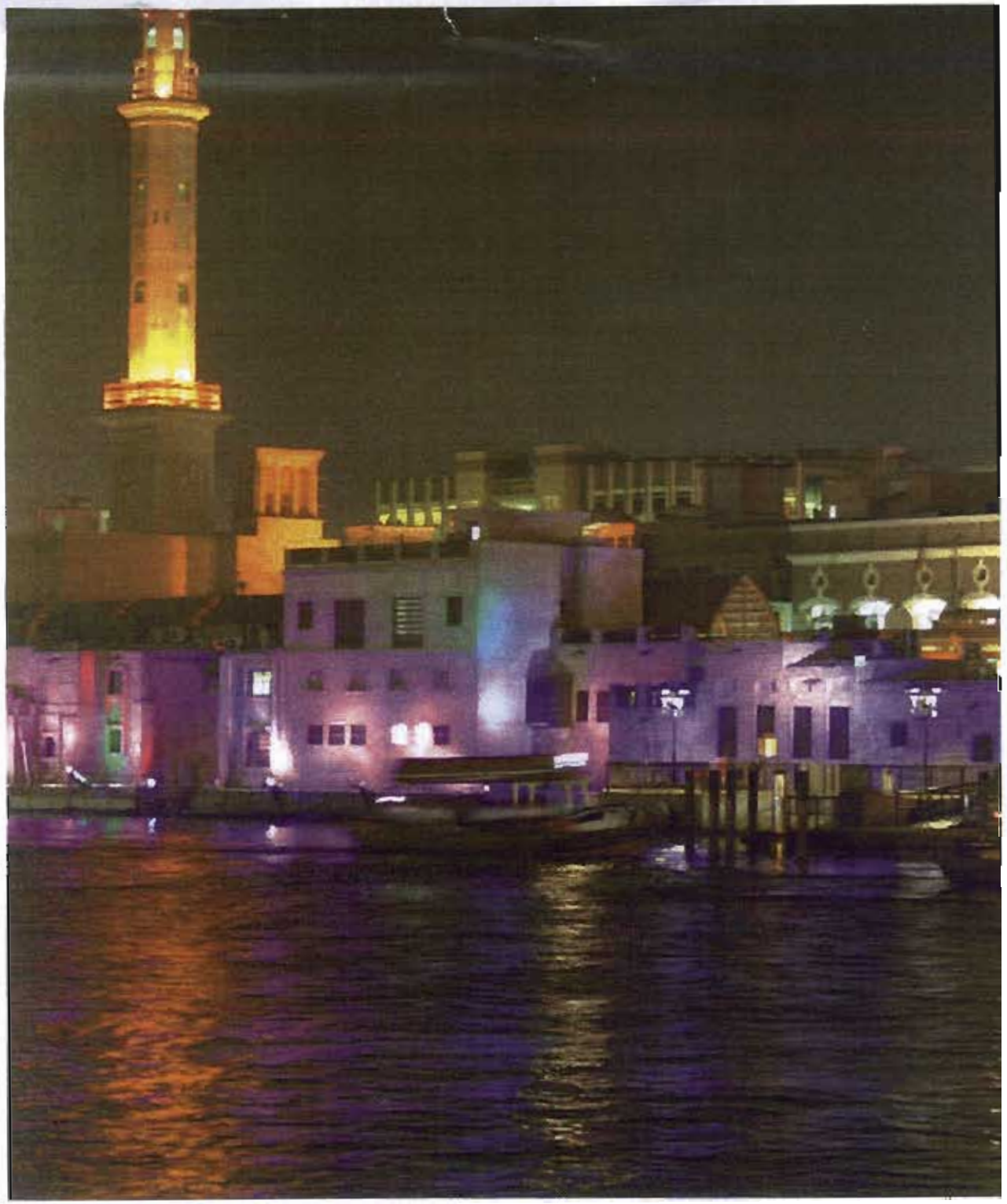

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Preface

The objective of the study is to develop a guide which can be used as a tool to obtain the best possible results when using the product. This booklet provides the following information:

- Product specifications, which define the product performance parameters in terms of light output, construction, range, optics and installation.
- A comparison of the performance of the product with other conventional light sources and a detailed study into how the superior optics deliver better results with fewer lumens.
- An exploration of the relationship between our perception of visible objects in relation to their surroundings and the parameters that define how well we see the objects for a particular set of applications.
- The visual performance requirements are matched with the product specifications to determine the situations and limits within which the best results can be achieved. A step-by-step guide that can be applied in real-life situations is also included.
- A brief introduction to color mixing with examples of how colored light reacts with different materials.



Range Overview

Features

- With its remote gear, LEDflood features a smooth, clean product design.
- Electronic gear 220 – 240 V AC, 50/60 Hz.
- 2 internal cable glands PG 13.5 (3 x 2.5 mm² max).
- LEDflood optical module is supplied with a cable of type HO7RNF 3 x 0,5 mm², length 3 m, for connection to the remote gear.
- An external cable gland PG7 is supplied as standard in the remote gear box for controls.
- Two protocols are available for mono- and bi-color dimming: DALI and 1 - 10 V. The DMX protocol is available for tri-color dimming.
- Consumption less than 36 W.
- Operating temperature from –20 °C up to 25 °C outdoors.
- Long lifetime of 50,000 hours; -30% flux depreciation.
- LEDflood optical module sealed for life.
- Thermal management system to ensure long lifetime.

This is a new concept for illuminating and enhancing structures with white and colored light that expands the creative palette.
The new LEDflood for front and accent lighting applications integrates state-of-the-art technologies, such as high power LEDs and lighting control systems. Its high visual quality combined with an innovative light source with a long lifetime, and high-efficiency collimating optics provides a new and advanced lighting solution for outdoor flood-lighting applications.

Materials and finish

Die-cast aluminium housing with a high-quality finish ensures a robust, solid construction. LEDflood is able to withstand harsh outdoor environments (IP66) and features tempered glass with a silver screen print and transparent optical window. The frosted stainless steel frame displays the Philips brand name.
The primary and secondary optics are made of PMMA. LEDflood is painted as standard in anodic grey (closest RAL 9006); other colors are available on request.

Installation and maintenance

LEDflood can be fixed on any surface or wall and upon request can be fixed with a pole-mounting arrangement. It has a highly flexible aiming and positioning mechanism. The tilt can be adjusted from -67.5° to +67.5° and the span from -270° to +170°. This ensures a wide choice of lighting effects and freedom of installation. The remote gear box can be installed up to 30 m away from the LEDflood optical module. A junction box (not supplied) is required for electrical connection to the mains.

Main applications

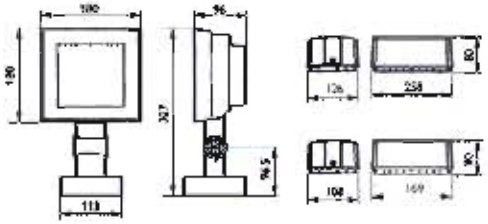
- Parks/gardens
- Classical and modern buildings
- Bridges and structures

Table 1: Suitable lamp types

LUXEON™ I	Approx. 1 W (typical)
LUXEON™ III	Approx. 2.4 W (typical)
Blue LUXEON™ III	23 lm (typical)
Green LUXEON™ III	64 lm (typical)
White LUXEON™ III	65 lm (typical)
Red LUXEON™ I	44 lm (typical)
Amber LUXEON® I	36 lm (typical)
Mono-color:	
blue, green, white (6500 K typical)	9 x LUXEON™ III
red, amber	9 x LUXEON™ I
Bi-color:	
cyan	5 x LUXEON™ III blue + 4 x LUXEON™ III green
warm white (3500 K typical)	5 x LUXEON™ III white + 4 x LUXEON™ I amber

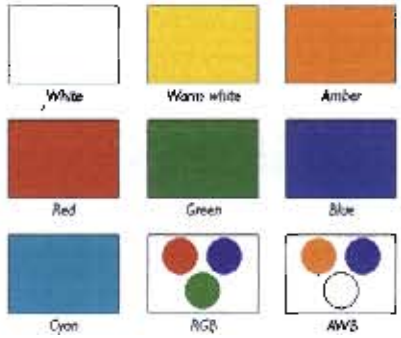
Optical system: Zoom Spot & Beam Locker

Each LED is fitted with a high-efficiency collimating optic to ensure precise light distribution and uniform illuminance.
LEDflood has a revolutionary new, patented system called Zoom Spot, with the help of which the beam can be continuously adjusted from 2 x 3° to 2 x 13° within one floodlight. The Beam Locker ensures that the lens position is locked after adjustment.
Spill light is therefore perfectly controlled without the need for screening accessories.



Available colors

LEDflood is available in the following colors:







Optical performance

Table 2

Colour	Lumens	Watts	Lm/W
WHITE	585	21.6	27.1
WARM WHITE	469	16.0	29.3
RED	396	9.0	44.0
BLUE	207	21.6	9.6
GREEN	576	21.6	26.7
AMBER	324	9.0	36.0
CYAN	371	21.6	17.2
RGB	393	17.4	22.6
AWB	372	17.4	21.4

Table 3

Lamp	Lumens	Watts	Lm/W
12V20W HALOGEN	250	20	12.5
12V50W HALOGEN	800	50	16.0
HALOGEN 75W	975	75	13.0

Table 4

Filter	Spectroradiometer			
	L(cd/m²)	T(%)	x	y
Without filter	265.00		0.381	0.364
Cooler filter F-COF	197.11	74	0.339	0.355
Warmer filter F-AF	170.30	64	0.439	0.393
Tinted yellow filter F-YL	198.50	75	0.439	0.418
Tinted green filter F-GN	67.67	26	0.297	0.543
Tinted blue filter F-BL	25.17	9	0.185	0.151
Tinted red filter F-RD	21.79	8	0.695	0.305
Dichroic red filter DF-RD	24.10	9	0.696	0.294
Dichroic green filter DF-GN	68.47	26	0.179	0.708
Dichroic magenta filter DF-MG	33.12	13	0.451	0.177
Dichroic yellow filter DF-YE	223.60	84	0.498	0.489
Dichroic cyan filter DF-CY	143.60	54	0.215	0.372
Dichro blue filter DF-BL	38.85	15	0.131	0.166

Comparison with conventional light sources

The total lumen output of each version of LEDflood is given in Table 2. The lumen output of some of the nearest comparable conventional lamps is given in Table 3 for comparison.

White light comparison:

This comparison is quite useful because it allows us to determine at a glance the applications for which LEDflood is suitable: A 20 W, 50 W or 75 W halogen lamp would be ideal in many outdoor accent lighting applications and similar results can be obtained when using LEDflood in such applications.

Colored light applications:

The situation in the case of colored light applications is quite different, however. With conventional light sources a filter is required to obtain colored light. Because some of the light is absorbed by the filter, the efficacy of the output is much lower.

With LEDs no filters are required as they intrinsically emit colored light. Furthermore, the spectral sensitivity of the human eye to different colors is also factored into the lumen output measurements. LEDs are therefore more efficient in colored light applications.

Table 4 shows the extent to which light is absorbed when filters are used with conventional light sources. T denotes the percentage transmittance measured for each filter. The measurement was performed using MVF606NB / CDM-T 150W/942 with dichroic filters and tested with a spectroradiometer in order to measure the luminance and the chromatic co-ordinates of the light source. The angle of incidence i = 0

The lumen output of LEDflood makes it ideal for many accent lighting applications. It is even better suited to colored light applications since there is no loss from absorption.

Figure 1

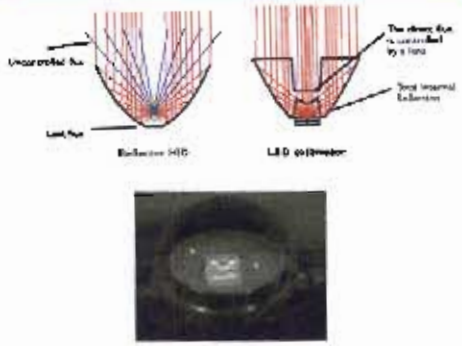


Figure 2

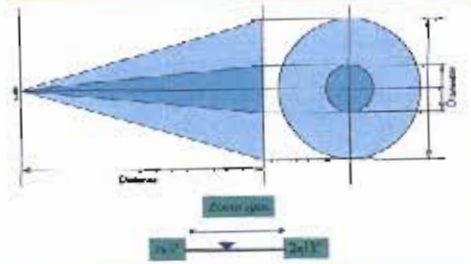
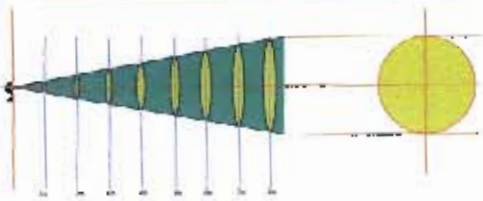


Figure 3



LEDflood uses a different principle of light control than conventional floodlights. Whereas conventional floodlights use a reflector around the light source, LEDflood uses a collimator around each LED. The light is controlled using the principle of total internal reflection. Furthermore, the direct flux from the LED is also controlled with the help of a lens. Consequently, a significantly higher level of flux control is achieved with LEDflood.

For example, in Figure 1, we compare the light control of LEDflood with Decoflood. In the case of Decoflood, only 12% of the flux is inside the beam, whereas in the case of LEDflood 22% of the flux is inside the beam. This means that LEDflood is more effective in directing the light to where it is needed since it utilizes the light more efficiently. This is why LEDflood can deliver better results despite the smaller lumen package.

With the help of the Zoom Spot it is possible to adjust the beam from 2 x 7 degrees to 2 x 13 degrees. This makes it possible to make precise adjustments to the dimensions of the light spot at a given distance. It is also possible to produce two spots of equal size from different aiming distances. This is particularly useful when very precise light control is required due to certain site-related constraints. When it is used properly, good results can be achieved with the LEDflood in many accent lighting applications.

Figure 3 and Table 5 show the diameter of the light spot (up to 50% of peak intensity) for three beam options at distances between 3 meter and 8 meters. Table 6 gives the average illuminance achieved inside the circle in lux for the white version. The photometric data are also available in the CalculUX database. In the next section we evaluate how the illumination levels achieved match the lighting requirements for different accent lighting applications under different ambient and surface conditions.

Optical performance

Table 5

Beam	Beam Angle (degree)	Half Angle (degree)	Radians	Distance vs Diameter (m)							
				1	2	3	4	5	6	7	8
Narrow Beam	6	3	0.0524	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Medium Beam	14	7	0.1222	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0
Wide Beam	26	13	0.2269	0.5	0.9	1.4	1.8	2.3	2.8	3.2	3.7

Table 6

Beam	Beam Angle (degree)	Half Angle (degree)	Radians	Distance vs Average Illuminance (lux)							
				1	2	3	4	5	6	7	8
Narrow	6	3	0.0524	18564	2944	1400	759	492	361	245	199
Medium	14	7	0.1222	2900	504	244	139	89	59	44	34
Wide	26	13	0.2269	939	211	92	52	35	24	18	14

Table 7

Facing material	Illuminance in lux			Correction coefficient			
	Surrounding			Colour temperature		Surface condition	
	Poorly lit	Well lit	Brightly lit	Cool	Warm	Fairly clean	Dirty
Light stone, white marble	20	30	60	1.0	0.9	3.0	5.0
Medium stone, cement, light-coloured marble	40	60	120	1.1	1.0	2.5	5.0
Dark stone, grey granite, dark marble	100	150	300	1.0	1.1	2.0	3.0
Light yellow brick	35	50	100	1.2	0.9	2.5	5.0
Light-brown brick	40	60	120	1.2	0.9	2.0	4.0
Dark-brown brick, pink granite	55	80	160	1.3	1.0	2.0	4.0
Red brick	100	150	300	1.3	1.0	2.0	3.0
Dark brick	120	180	360	1.3	1.2	1.5	3.0
Architectonic concrete	60	100	200	1.3	1.2	1.5	2.0
Aluminium cladding Natural finish	200	300	600	1.2	1.1	1.5	2.0
Aluminium cladding Thermo-lacquer finish - saturated (10%) red, brown, yellow	120	180	360	1.3	1.1	1.5	2.0
Aluminium cladding Thermo-lacquer finish - saturated (10%) blue, green	120	180	360	1.0	1.3	1.5	2.0
Aluminium cladding Thermo-lacquer finish - medium (30-40%) red, brown, yellow	40	60	120	1.2	1.0	2.0	4.0
Aluminium cladding Thermo-lacquer finish medium (30-40%) blue, green	40	60	120	1.0	1.2	2.0	4.0
Aluminium cladding Thermo-lacquer finish - pastel (50-70%) red, brown, yellow	20	30	60	1.1	1.0	3.0	5.0
Aluminium cladding Thermo-lacquer finish - pastel (60-70%) blue, green	20	30	60	1.0	1.1	3.0	5.0

The lighting requirements in outdoor lighting applications depend on the type and surface condition of the facing material, the amount of ambient light present and also upon the type of light source used. Table 7 gives the lighting requirements for many commonly used architectural materials under different ambient conditions.
An explanation of how to use this table is given below with the help of an example.

For example, if we choose architectonic concrete in brightly lit surroundings and use cool white light, for a fairly clean surface we will need 390 (= 200 x 1.3 x 1.5) lux, whereas for a dirty surface we will need 520 (= 200 x 1.3 x 2) lux.

For a dirty surface the required illuminance would be achieved using a medium beam at a distance of 2 meters and using a narrow beam at a distance of 5 meters (Table 6). In both cases the diameter of the light spot is 0,5 meters!

In this way we can first choose how much illuminance is required in order for the object to be properly visible and then use the right beam and aiming distance to ensure that we obtain the desired illuminance on the object. The choice of beam in practice will depend on the size of the object to be highlighted. For this we refer to Table 5, which shows the diameter of the light spot at a given distance.

Figure 4



Accent factor = 2
Noticeable

Accent factor = 5
Low theatrical

Accent factor = 15
Theatrical

Accent factor = 30
Dramatic

Accent factor = 50
Very dramatic

Use of accent factors:
In accent lighting applications it is useful to use accent factors to achieve the desired visual effect.
The accent factor is defined as the ratio of the brightness of the object to the brightness of the background. Figure 4 gives the accent factors required to obtain certain visual effects. A higher accent factor makes an object more noticeable in relation to its surroundings. It is therefore possible to make an object more noticeable either by increasing its brightness or by reducing the brightness of its background.
For example, if the background is 10 lux and the illuminance on the object is 500 lux, the accent factor is 50 and the visual effect is 'very dramatic'.

Step-by-step guide

Step 1: Determine the size of the object to be illuminated, the aiming distance and the choice of beam, taking into account the site constraints (Table 5).

Step 2: Select the desired lux level, taking into account the facing material and ambient conditions (Table 7).

Step 3: Select the accent factor required to achieve the desired visual effect (Figure 4).

Step 4: Validate the luminaire positions to achieve the required lux levels (Table 6).

Survey of lighting effects

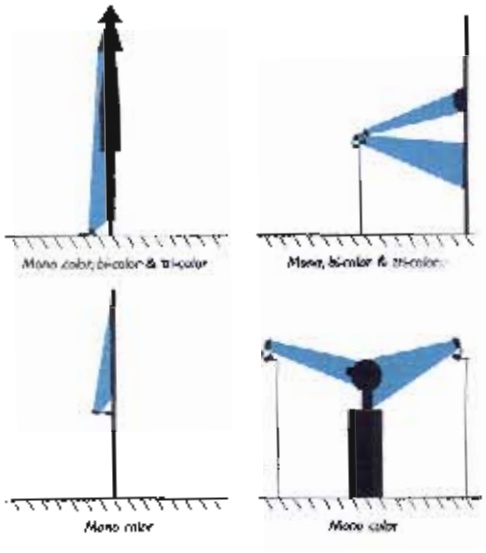


Figure 5

This figure shows some floor, wall and pole mounting options. It is important to note that grazing light options should be confined to mono-color versions only.

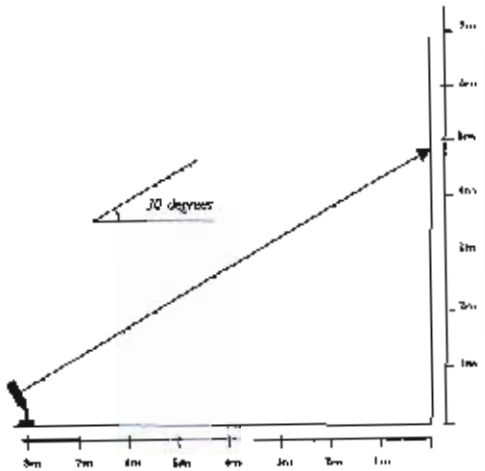


Figure 6

The following 3 pages show the lux levels achieved using one LEDflood aimed at an angle of 30 degrees above the horizontal, as shown in this figure.

The distance of the LEDflood from the wall varies from 1 meter to 8 meters at intervals of 1 meter. Results have been calculated for narrow beam, medium beam and wide beam for the white version.

Survey of lighting effects wide beam

Figure 7

