

## Contents

1	<b>PLL2215EW</b>	<b>60° FWHM for High-Bay Applications</b>	Pag. 2
2	<b>PLL2215UW</b>	<b>90° FWHM for High-Bay Applications</b>	Pag. 3
3	<b>PLL2215EL</b>	<b>Elliptical Beam for High-Bay Applications</b>	Pag. 4
4	<b>PC 5.0 - Specifications</b>		Pag. 5
5	<b>Application Examples</b>		Pag. 6 - 7
6	<b>Light Distribution of the Beam Angles</b>		Pag. 8
7	<b>Polyurethane Foam Gasket</b>		Pag. 9
8	<b>KFP44 - PCB for Testing</b>		Pag. 10
9	<b>Assembly Specifications</b>		Pag. 11
10	<b>IK Test</b>		Pag. 12
11	<b>IP X5 Test</b>		Pag. 13
12	<b>Packaging</b>		Pag. 14
13	<b>Materials / Use and Maintenance / Disclaimer</b>		Pag. 15

### Note:

**The PCB can hold a variable number of LEDs, provided the overall power output is within 50W to 200W. You can use LEDs of different type, colors and packages - 2835, 3030, 3535, 5050, 7070 -**

**STRATOS** are high-tech lenses designed for high bay applications, with a special focus on warehouses. Available with 60°, 90° and elliptical beam angles. The elliptical beam is the core project of Stratos family, unique on the market for this kind of applications. All beam versions do not perform the roto-symmetric distribution. In fact, Stratos lenses are unique solutions for all those lighting applications where a typical roto-symmetric distribution is not sufficient. Comparative tests we carried out with homologous models from the market, prove that Stratos lenses perform up to 37% more lux (average value) on the floor and up to 47% more uniformity in front of the shelves. Also, you can create different layouts with the same lens, based on the number and type of LEDs you will place along the 6 linear lenses forming the lens 6-row array.

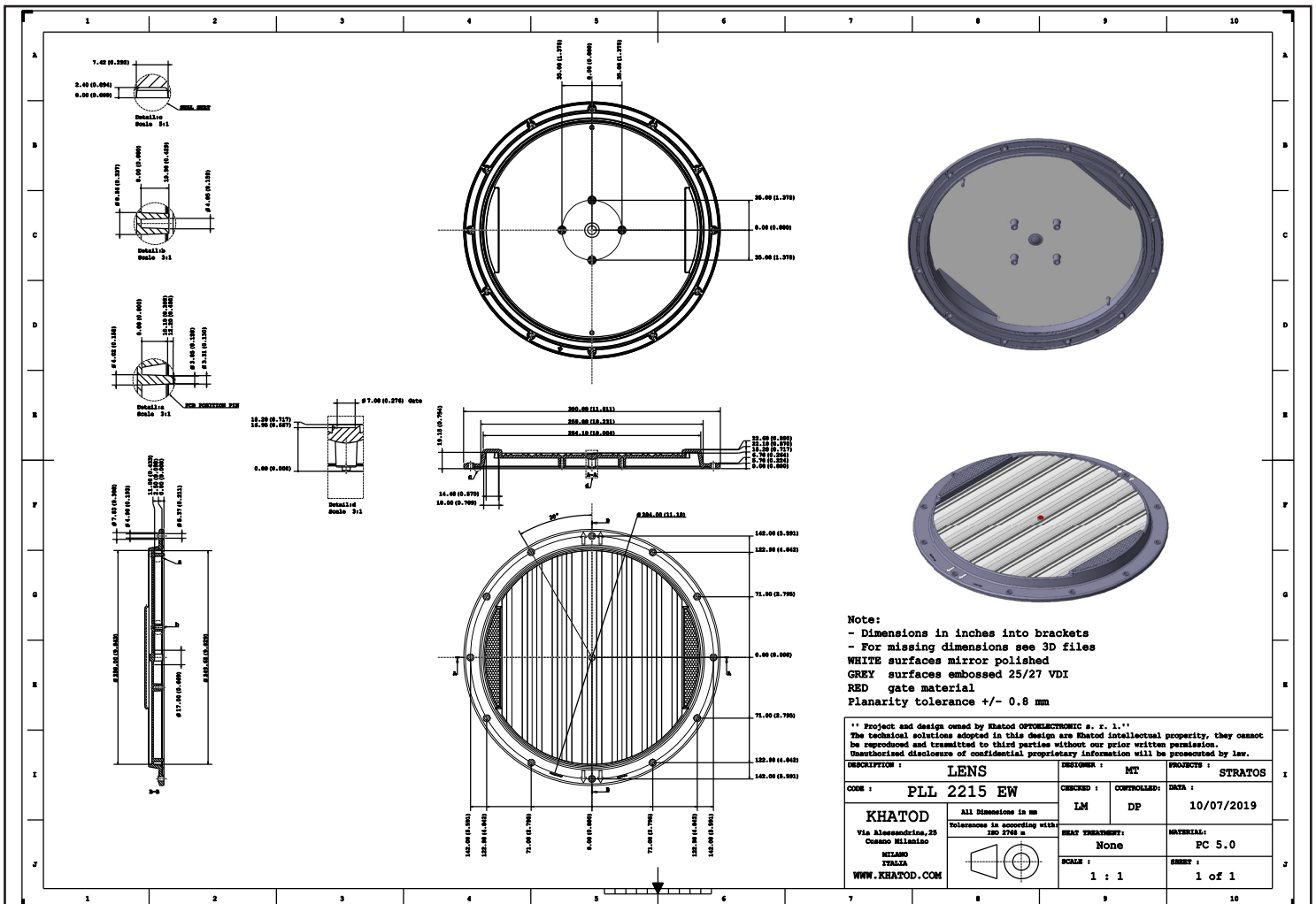
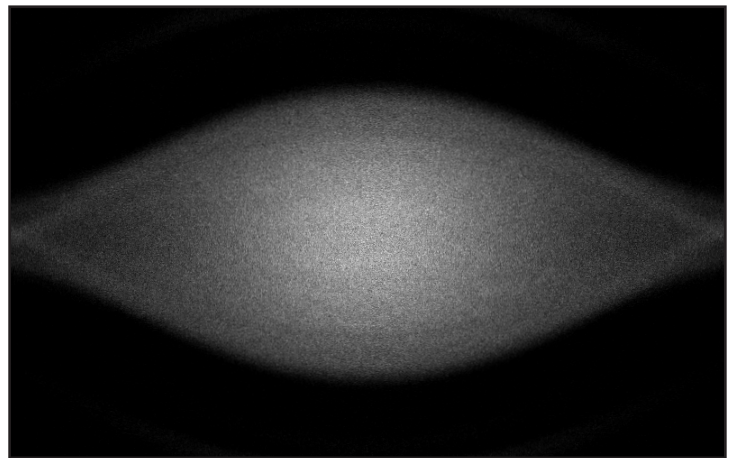
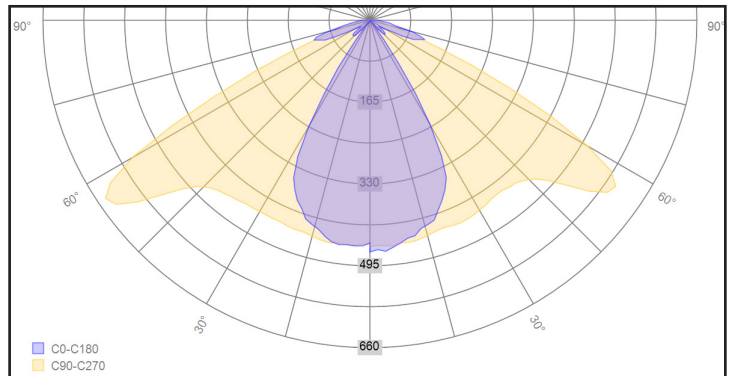
## PLL2215EW - 60° FWHM for High-Bay Applications



Product images are for illustrative purposes only

- Material = PC 5.0 Clear, **Non-yellowing**
- Full angle C0-C180 at 50% from maximum:  $\sim 60^\circ \times 130^\circ$
- Full angle C0-C180 at 10% from maximum:  $\sim 150^\circ \times 160^\circ$
- The light spots here represented refer to tests carried out with 54 LEDs 5.0mm  $\square$ , and  $\sim 15897$  Lumen @  $\sim 200$  Watt

Nanotechnologies-treated moulds and dies for top performance



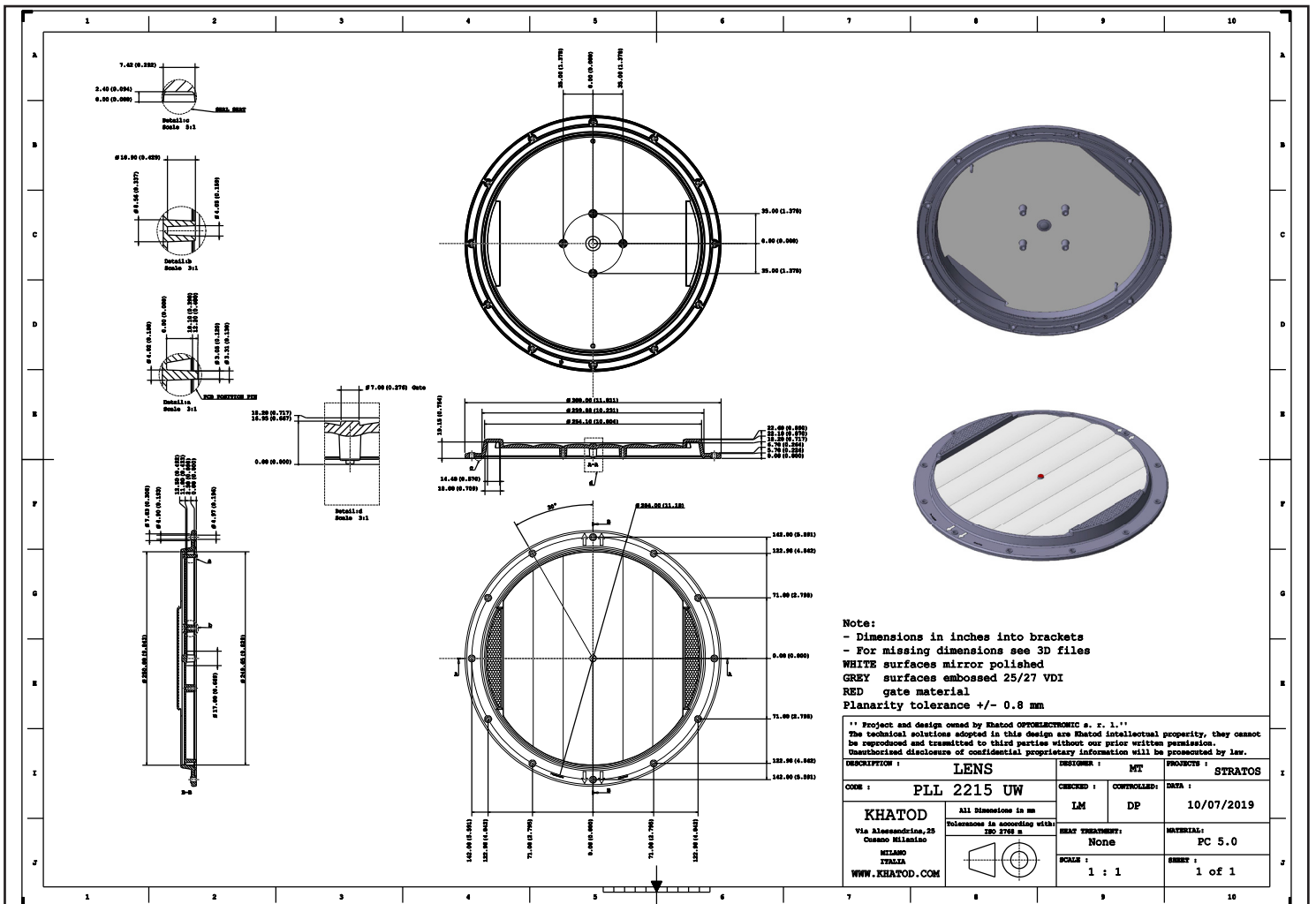
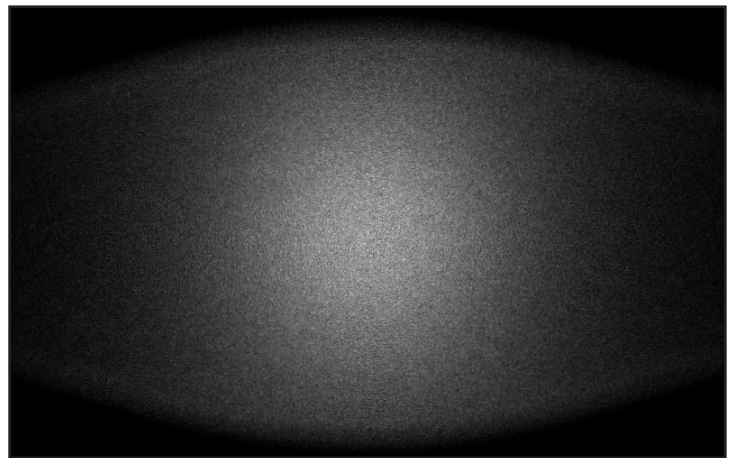
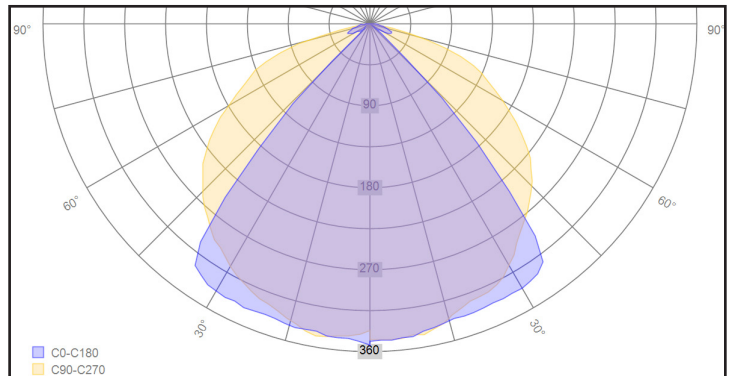
## PLL2215UW - 90° FWHM for High-Bay Applications



Product images are for illustrative purposes only

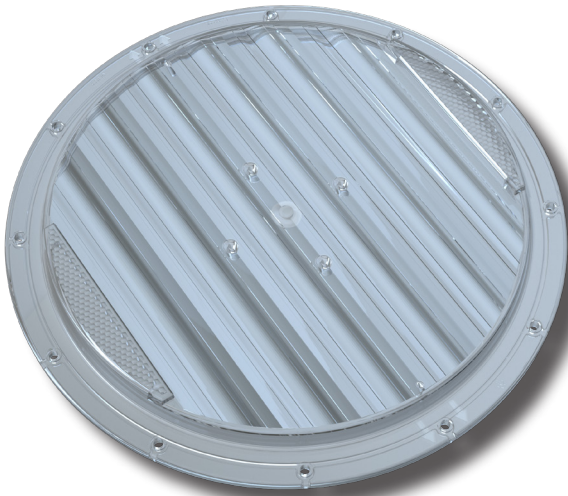
- Material = PC 5.0 Clear, **Non-yellowing**
- Full angle C0-C180 at 50% from maximum:  $\sim 85^\circ \times 120^\circ$
- Full angle C0-C180 at 10% from maximum:  $\sim 95^\circ \times 155^\circ$
- The light spots here represented refer to tests carried out with **54 LEDs 5.0mm** □, and  $\sim 15897$  Lumen @  $\sim 200$  Watt

**Nanotechnologies-treated moulds and dies for top performance**





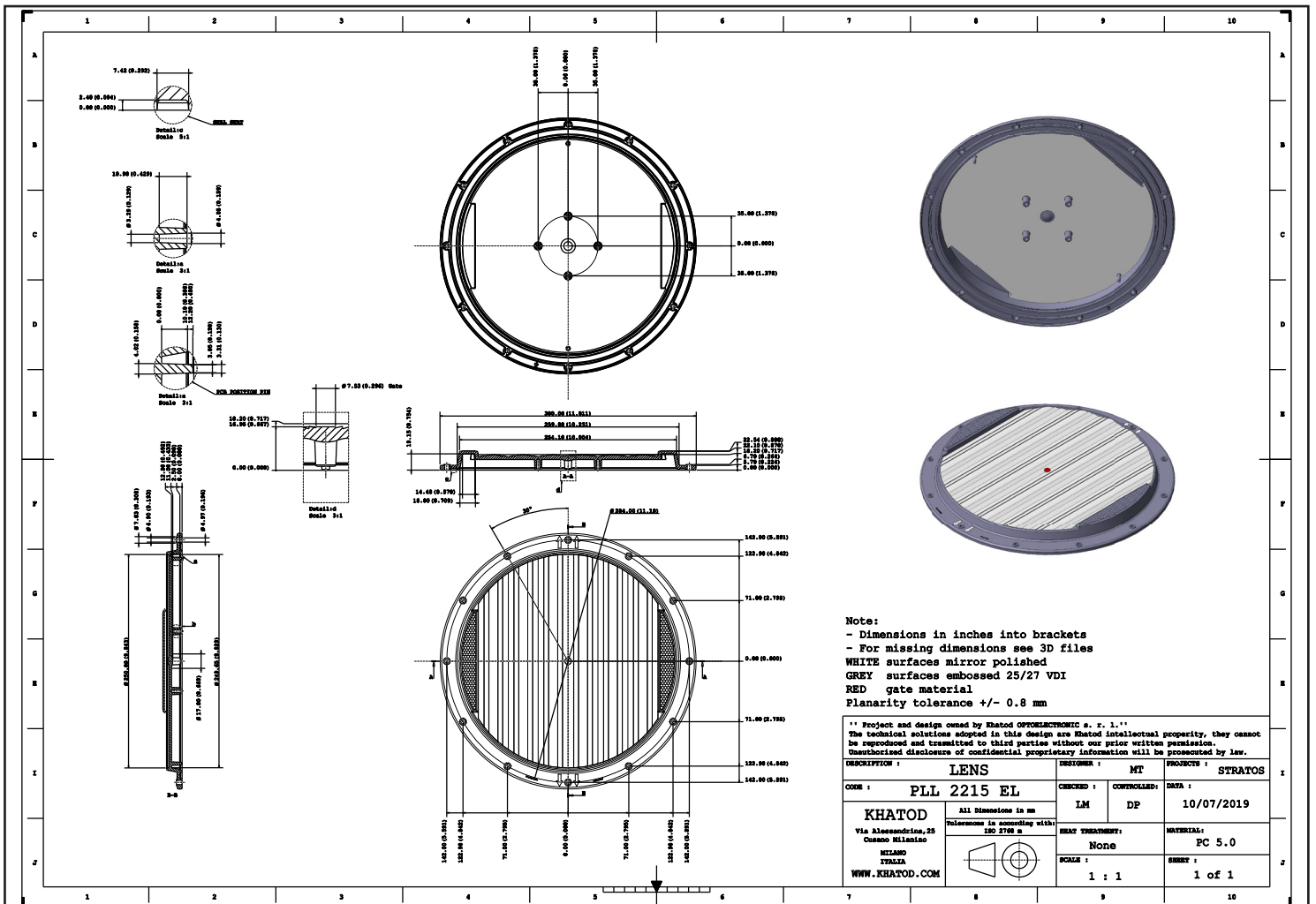
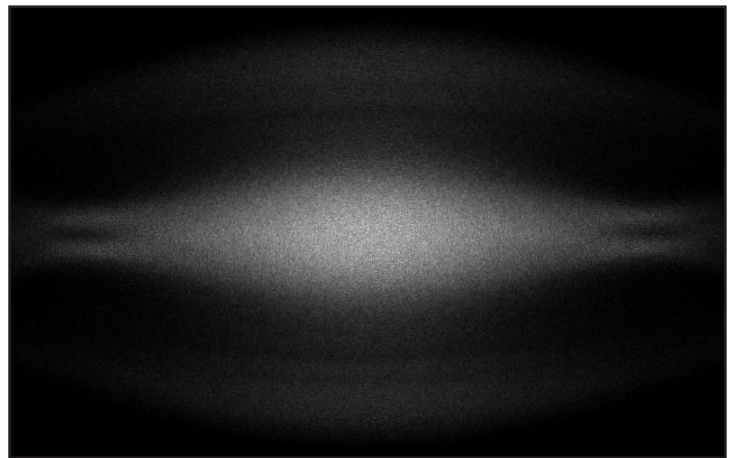
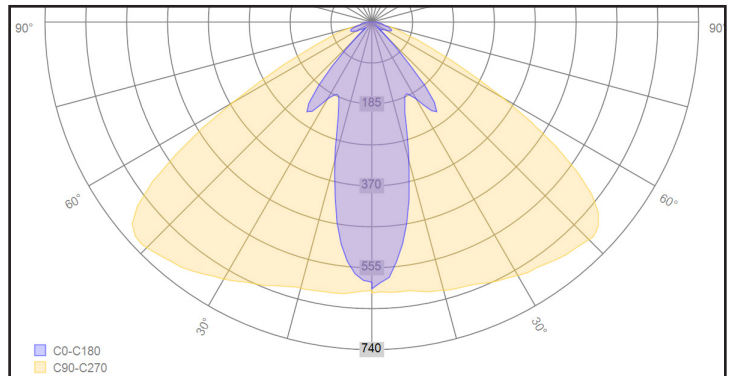
## PLL2215EL - Elliptical Beam for High-Bay Applications



Product images are for illustrative purposes only

- Material = PC 5.0 Clear, **Non-yellowing**
- Full angle C0-C180 at 50% from maximum:  $\sim 33^\circ \times 120^\circ$
- Full angle C0-C180 at 10% from maximum:  $\sim 90^\circ \times 145^\circ$
- The light spots here represented refer to tests carried out with **54 LEDs 5.0mm** □, and  $\sim 15897$  Lumen @  $\sim 200$  Watt

**Nanotechnologies-treated moulds and dies for top performance**

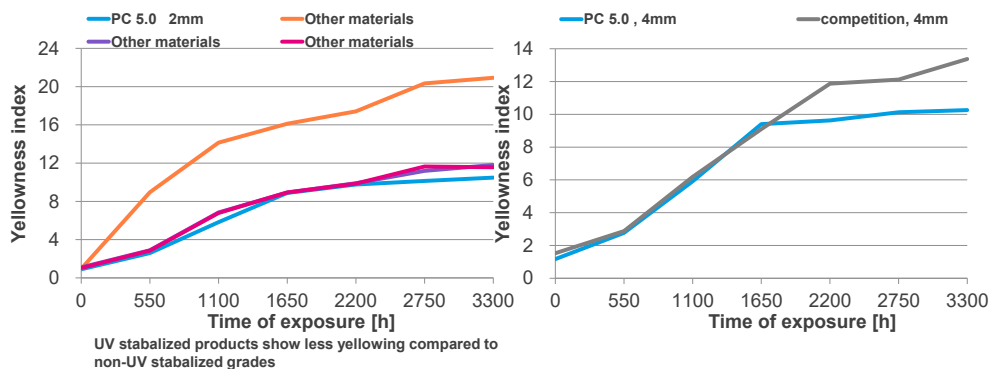


## PC 5.0 - Specifications

Property	Test Condition	Unit	Standard	Typical Value**
<b>Rheological Properties</b>				
Melt volume-flow rate (MVR)	300 °C / 1.2 kg	cm <sup>3</sup> /10 min	ISO 1133	34
Molding shrinkage, parallel	60x60x2; 500 bar	%	b.o. ISO 2577	0,65
Molding shrinkage, normal	60x60x2; 500 bar	%	b.o. ISO 2577	
<b>Mechanical properties (23 °C, 50 % r. F.)</b>				
Tensile modulus	1 mm/min	MPa	ISO 527-1,-2	2350
Yield stress	50 mm/min	MPa	ISO 527-1,-2	63
Yield strain	50 mm/min	%	ISO 527-1,-2	6
Nominal strain at break	50 mm/min	%	ISO 527-1,-2	>50
Stress at break	50 mm/min	MPa	ISO 527-1,-2	60
Strain at break	50 mm/min	%	ISO 527-1,-2	125
Flexural modulus	2 mm/min	MPa	ISO 178	2350
Flexural strength	2 mm/min	MPa	ISO 178	97
Flexural strain at flexural strength	2 mm/min	%	ISO 178	7,1
Flexural stress at 3.5 % strain	2 mm/min	MPa	ISO 178	73
Izod notched impact strength	23 °C; 3 mm	kJ/m <sup>2</sup>	ISO 7391	55
Izod notched impact strength	-30 °C; 3 mm	kJ/m <sup>2</sup>	ISO 7391	12
<b>Thermal properties</b>				
Temperature of deflection under load	1.80 MPa	°C	ISO 75-1,-2	123
Temperature of deflection under load	0.45 MPa	°C	ISO 75-1,-2	136
Vicat softening temperature	50 N; 50 °C/h	°C	ISO 306	143
Vicat softening temperature	50 N; 120 °C/h	°C	ISO 306	145
Coefficient of linear thermal exp., parallel	23-55 °C	10 <sup>-4</sup> /K	ISO 11359-1,-2	0,65
Coefficient of linear thermal exp., transverse	23-55 °C	10 <sup>-4</sup> /K	ISO 11359-1,-2	0,65
Oxygen index	Method A	%	ISO 4589-2	28
Glow wire test (GWFI)	1,0 mm	°C	IEC 60695-2-12	850
Glow wire test (GWIT)	0,75 mm	°C	IEC 60695-2-13	875
<b>Optical Properties</b>				
Luminous transmittance (clear transparent materials)	2 mm	%	ISO 13468-2	90
Luminous transmittance (clear transparent materials)	4 mm	%	ISO 13468-2	>89
<b>Other properties (23 °C)</b>				
Density	-	kg/m <sup>3</sup>	ISO 1183	1,19
<b>Material specific properties</b>				
Refractive index	Procedure A		ISO 489	1,584
Haze for transparent materials	3mm		ISO 14782	<0,5

### Weatherability / UV resistance

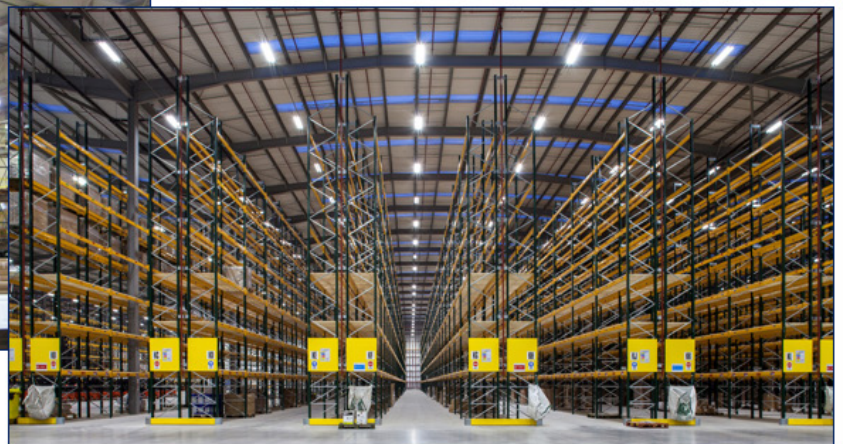
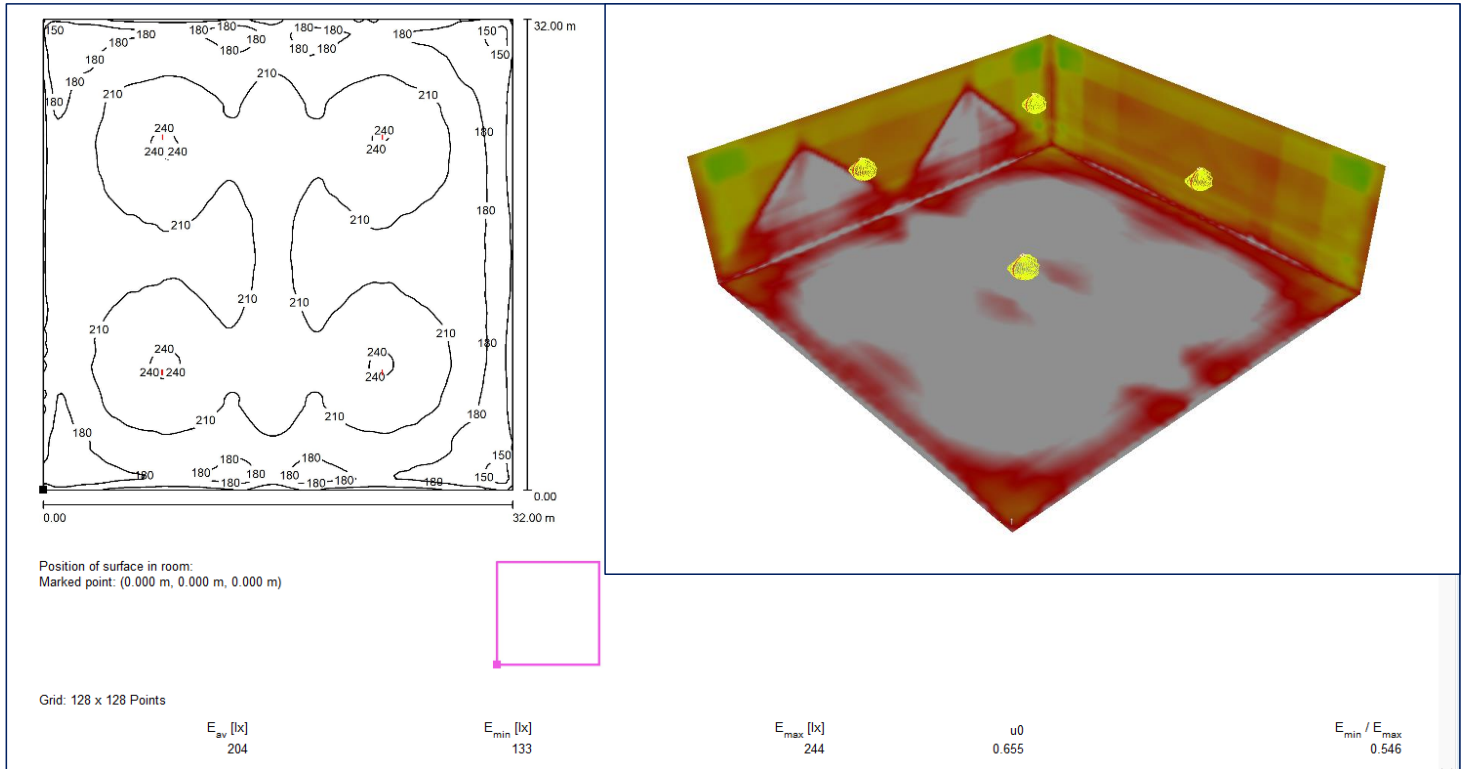
ISO 4892-2A Cycle 1



3300 h ~ 2 years Florida ~ 4 years Europe (directly facing the sunlight)

## Application Examples

Warehouse application using the 90° beam lens, simulated with Dialux:

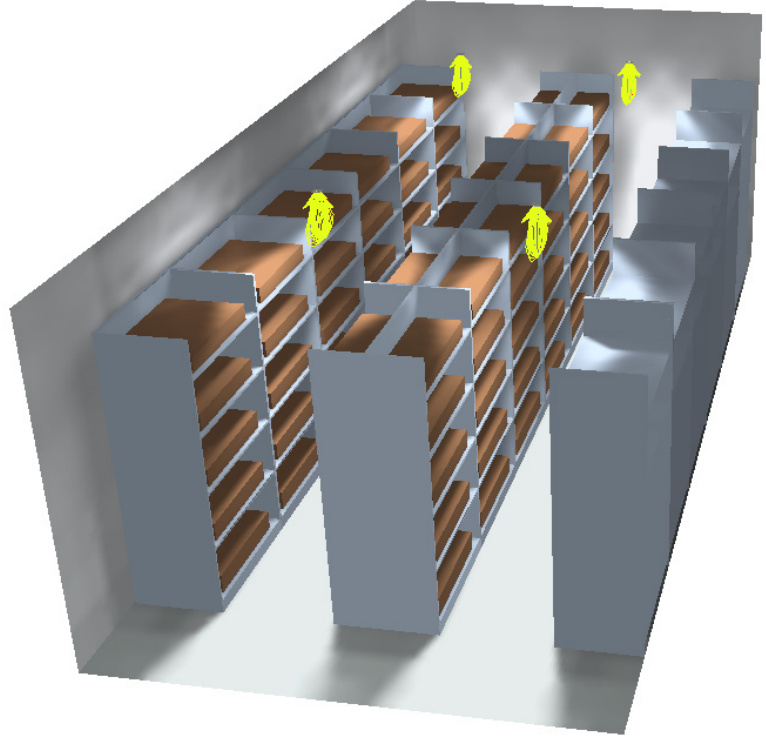




## Application Examples

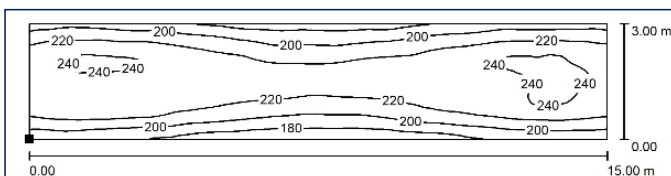
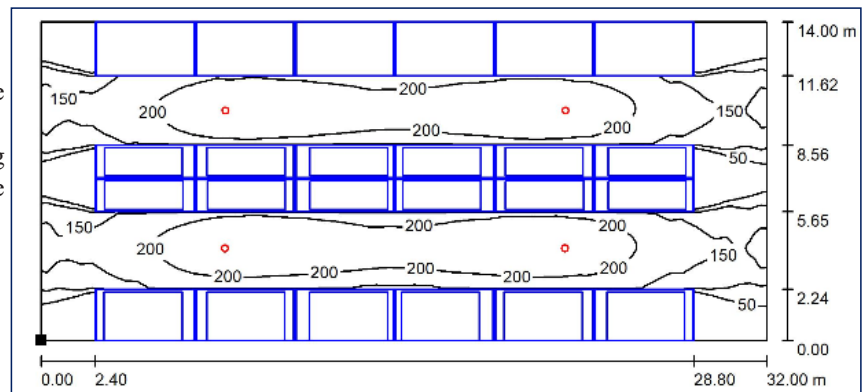
High-shelving application using the elliptical beam lens, simulated with Dialux:

- Shelves height = 8m
- Hallway width = 3m
- Luminaire height = 10m
- Luminaire distance = 15m
- LEDs total flux = 31000lm

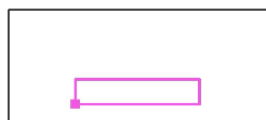


Isolines (lux):

- Image on the right: illuminance distribution between the shelf units.
- Image below: detail of the area between two lighting fixtures. Average, minimum and maximum values are indicated.



Position of surface in room:  
Marked point: (8.103 m, 2.552 m, 0.000 m)



Values in Lux, Scale 1 : 108

Grid: 128 x 32 Points

$E_{av}$  [lx]  
217

$E_{min}$  [lx]  
162

$E_{max}$  [lx]  
244

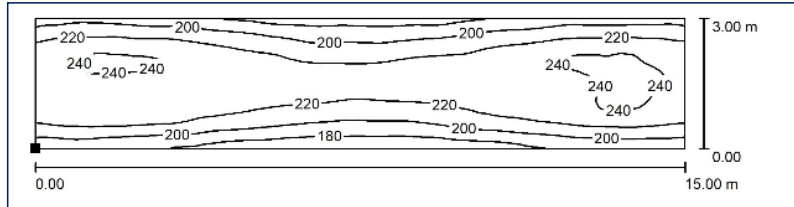
$u0$   
0.749

$E_{min} / E_{max}$   
0.665

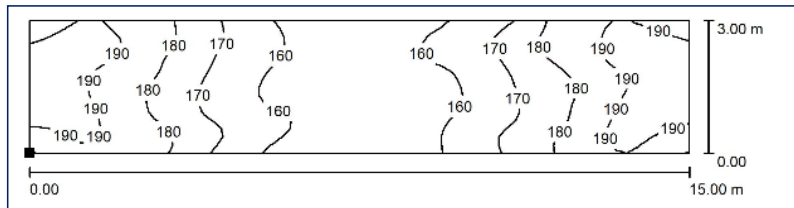
## Light Distribution of the Beam Angles

Comparison of the illuminance distribution of STRATOS beam angles - Elliptical, 60°, 90° - using the same application examples and luminaire configurations.

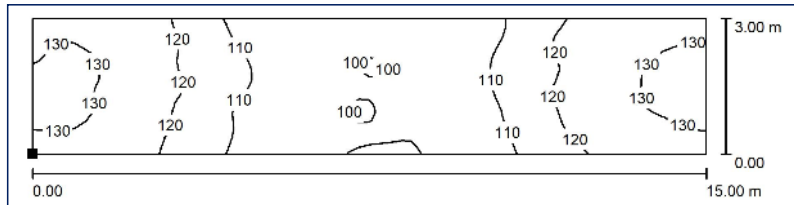
Illuminance distribution on the floor:



STRATOS EL



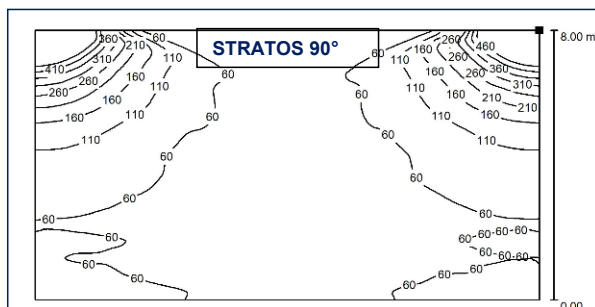
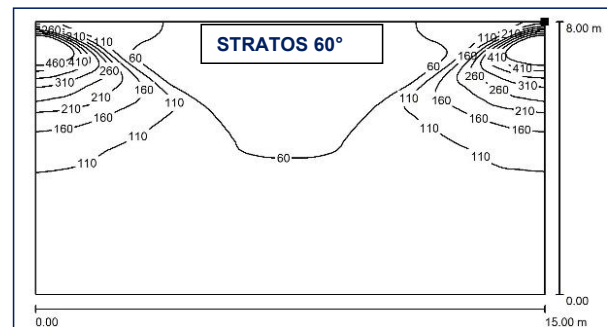
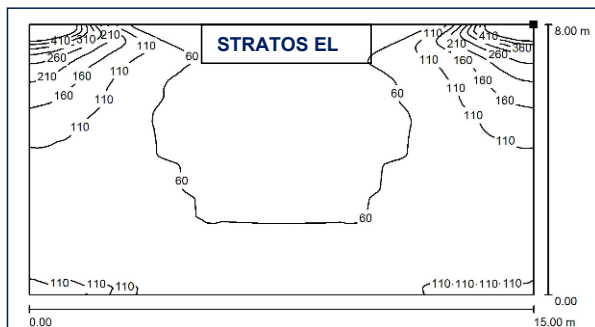
STRATOS 60°



STRATOS 90°

Nominal flux = 31000 lm	Eav [lx]	Emin [lx]	Emax [lx]	U0	Emin/Emax
Stratos EL	217	162	244	0.749	0.665
Stratos 60°	174	151	199	0.870	0.761
Stratos 90°	116	99	133	0.855	0.746

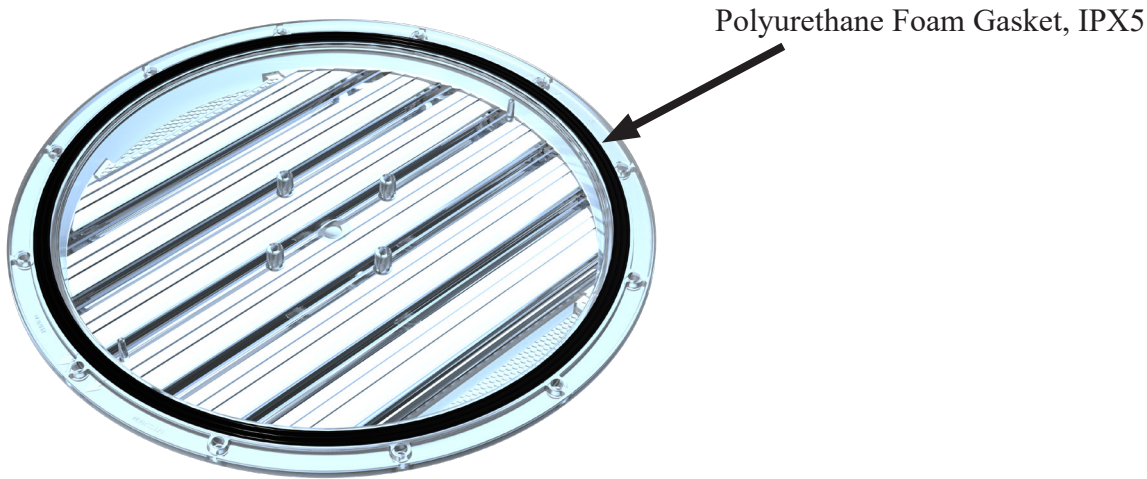
Illuminance distribution in the area in front of the shelves:



Nominal flux = 31000 lm	Eav [lx]	Emin [lx]	Emax [lx]	U0	Emin/Emax
Stratos EL	91	27	835	0.299	0.033
Stratos 60°	99	20	606	0.198	0.032
Stratos 90°	97	21	1019	0.219	0.021



Polyurethane Foam Gasket



Physical Characteristics

- Description

**RAKU-PUR® 31-3131-1 Black** is a liquid, two-component polyurethane system. It consists of a filled resin component A and a hardener component B (MDI). The system contains no solvents, plasticizers or halogenated hydrocarbons. It is characterized by:

- well formed integral skin and reliable sealing
  - listed UL 50
  - very low water absorption
  - low assembly resistance

- good and prompt compression recovery
  - smooth surface
  - balanced reactivity / flowing properties

Temperature resistance			
	long-term	- 40 °C	to + 100 °C
	short exposure		up to + 160 °C

Application

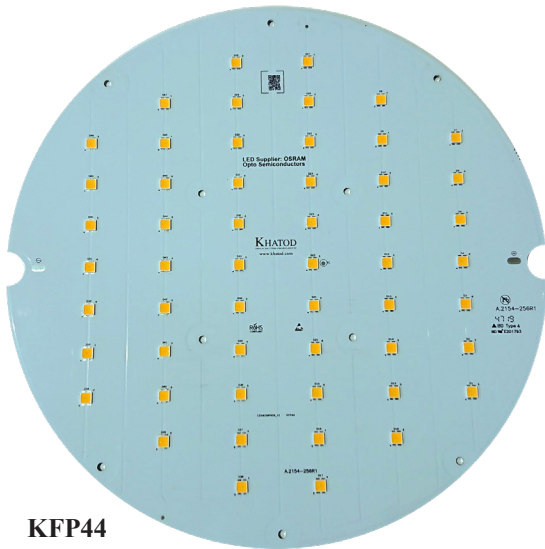
The product is used for the production of formed-in-place foam gaskets (FIPFG). Physical properties of the cured foam such as hardness and density may be adjusted by changing the mixing ratio.

Processing

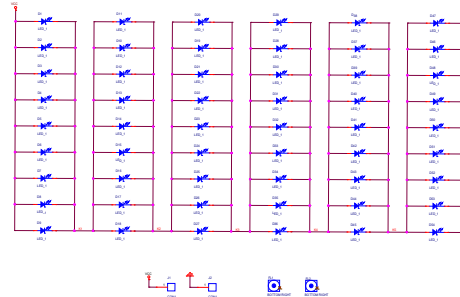
Before use, the component A must be homogenized, as additives tend to cause phase separation. The density of the material can be adjusted to the processing specification of 0.90 - 1.00 g/ml by adding dispersed air through stirring. The air helps to ensure a uniform foam structure. The component B is very sensitive to moisture and must not be stirred. Due to its high reaction rate, the system is usually processed by two-component mixing and dispensing machines.

## KFP44 - PCB for Testing

To make Stratos lenses testing easier for the customers, Khatod has created a ready-to-use PCB: KFP44.  
PCB diagrams and photos are shown below.

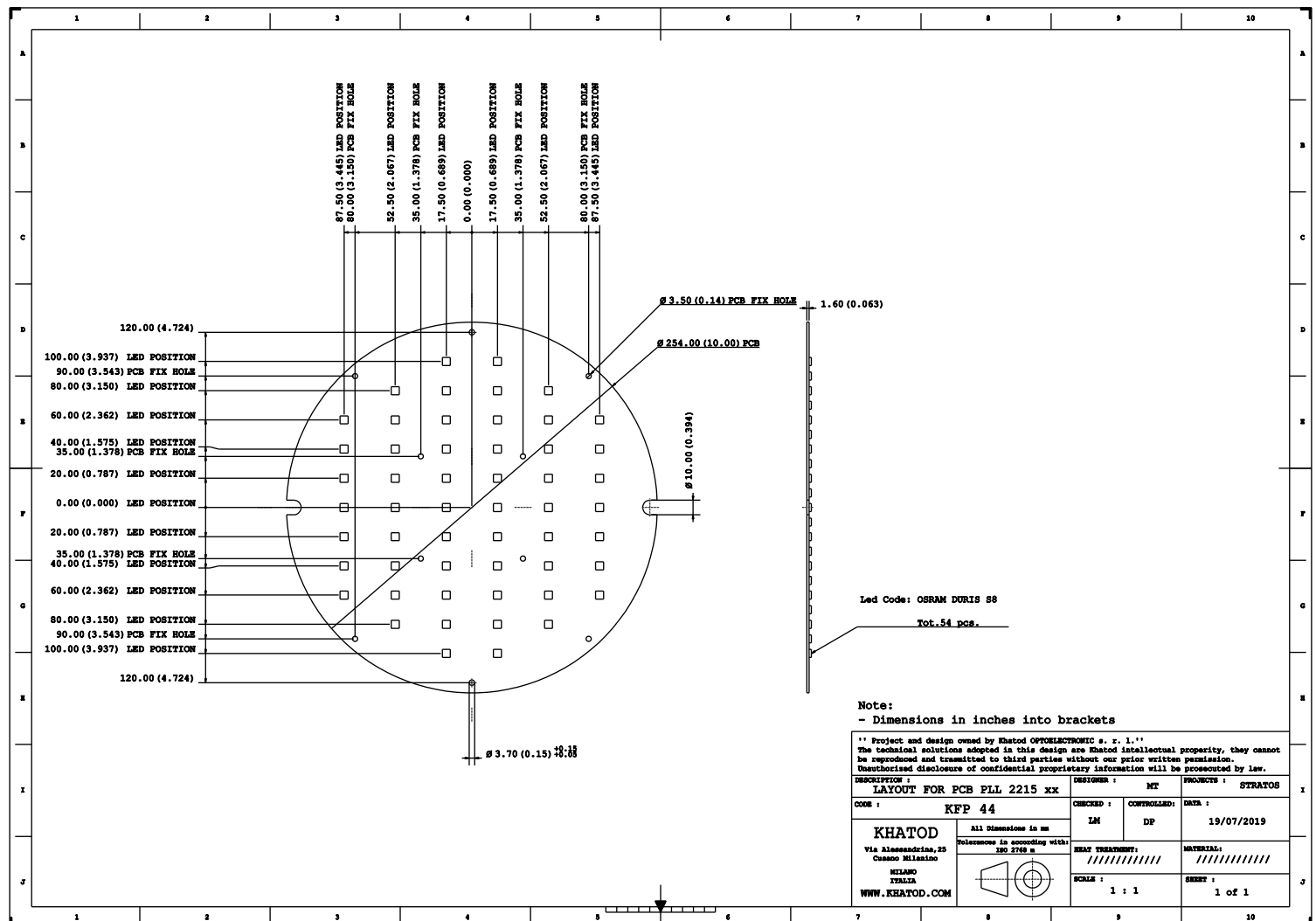


KFP44



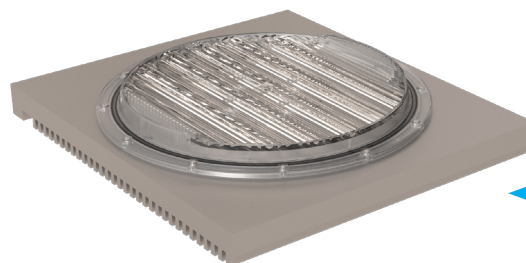
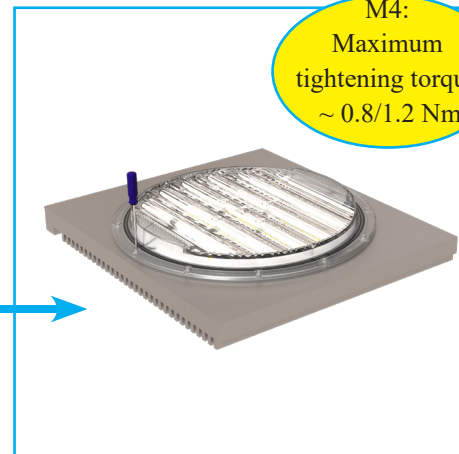
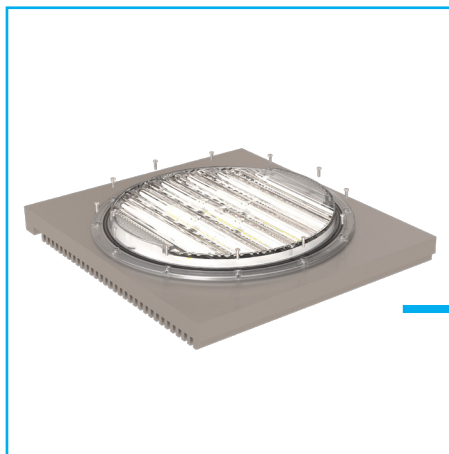
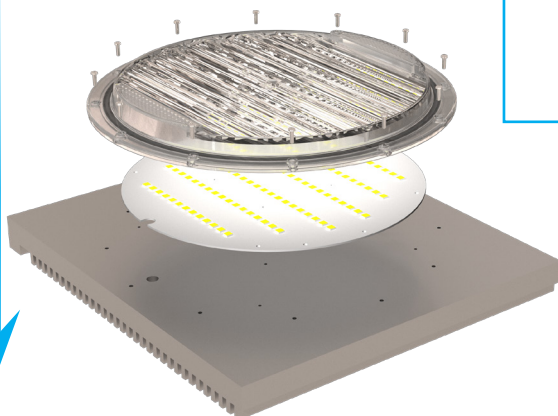
Example using 54 Osram S8 GW P9LMS2.EM-NSNU-50 LEDs  
~ 200Watt  
~ 16.000 Lumen

The PCB can hold a variable number of LEDs, provided the overall power output is within 50W to 200W.  
You can use LEDs of different type, colors and packages - 2835, 3030, 3535, 5050, 7070 -



Technical drawing of the PLL 2215 layout. The drawing shows a circular component with a central hole for a screw. Dimensions are given in inches and millimeters. A green circle highlights a specific area on the layout. A yellow box contains the text: "In green, the space available for the electronic components mounting." A detailed view of the component is shown in the top right corner.

M4:  
Maximum  
tightening torque  
~ 0.8/1.2 Nm



## IK Test - Determination of Mechanical Impact Resistance Degree

### Note

The present document is an internal document showing the tests carried out by Khatod in its laboratory. The tests, photos and videos presented in this document are made available for demonstration purposes only. Khatod, with its laboratory, is not a certification body. If customers need IK accredited certifications, they have to apply to the appointed Certification Bodies, under their sole care and responsibility.

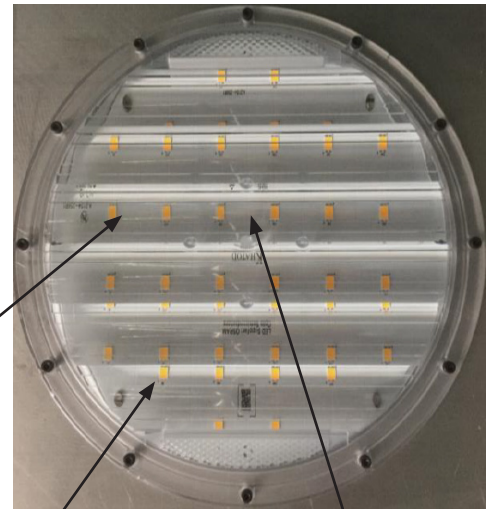
### Initial Visual Inspection

- Before starting with testing, a visual inspection was performed in order to check the integrity of the part under test. The part resulted physically intact.

### Tests Execution

Tests were carried out on the part under test according to IK10 (20 Joule)  
Test parameters are as follows:

- Impact energy: 20 Joule
- Impacting element: 5.000 grams
- Distance between impacting element and the part under test: 40 cm
- Number of impacts: 5



1st impact test

2nd impact test

3rd impact test



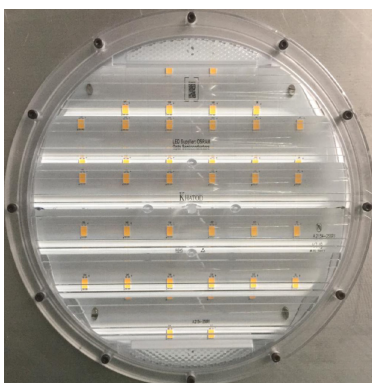
1<sup>st</sup> TEST



2<sup>nd</sup> TEST



3<sup>rd</sup> TEST



Final Visual Inspection:  
After testing, a final visual inspection was performed.  
The result was positive. (view photo)



## IP X5 Test

### Note

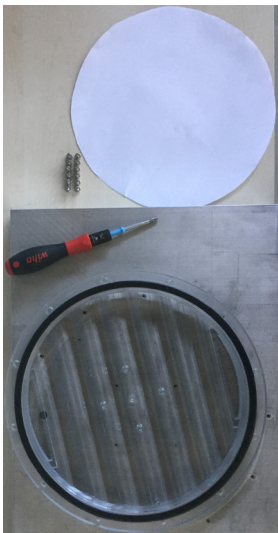
The present document is an internal document showing the tests carried out by Khatod in its laboratory. The tests, photos and videos presented in this document are made available for demonstration purposes only. Khatod, with its laboratory, is not a certification body.

If customers need IP accredited certifications, they have to apply to the appointed Certification Bodies, under their sole care and responsibility.

### Data and Analysis

The sample has been subjected to the water-penetration resistance test as follows:

- Assembly of the components to test :  
A moisture indicator paper sheet has been interposed between the lens and the clamping base
- Positioning of the assembled sample under the device of watering with nozzle Ø 6.3 millimeters
- Water flow: 12.5 l/min  $\pm$  5%
- Water pressure: 30 kPa @ distance of 3m
- Duration of water spraying test on the wrap surface per m<sup>2</sup> : 1 min
- Minimum duration of the test: 3 min
- Distance between the nozzle and the wrap surface: 2.5 Meters



PLL2215xx Assembled

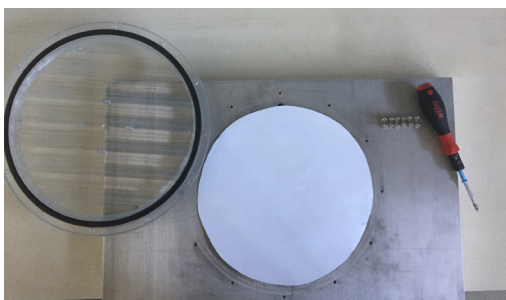


Test Under Water Jet



Test Under Water Jet

### Conclusion



The test paper sheet is dry

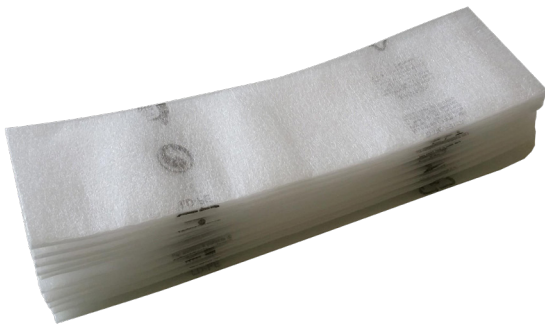
As shown in the photo, the test paper sheet is completely dry after disassembling the system.

Based on the water penetration resistance test, polyurethane gasket proved to be fit for purpose.

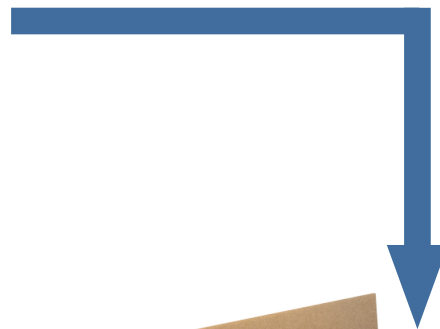
The product has passed the Khatod test.

## Packaging

Item	Quantity	Total Parts	Size (L*W*H)	G.W.
Multi-pocket plastic bag	1 piece per multi-pocket plastic bag	1 pcs	30*30 cm	0.371 Kg
Outer Box	20 multi-pocket plastic bags per Outer Box	20 pcs	58*33*33 cm	8,0 Kg



20 Lenses / Multi-pocket plastic bags



20 Multi-pocket plastic bags per Outer Box

## Materials

Material	Top
PC 5.0	-40°...120°C
PLL2215xx Temperature resistance: long-term	-40°...90°C
PLL2215xx Temperature resistance: short exposure	up to + 108 °C

## Notes:

- The optical values shown are the result of optical simulations carried out with LIGHTTOOLS, ASAP and ZEMAX software systems. The optical simulations are carried out on the basis of the typical values provided in the LED manufacturers' official datasheets. The photometric analysis has been carried out on physical samples. On request, by supplying your PCB, we can provide the measurement photometric file.

## Use and Maintenance

- DO NOT HANDLE OR INSTALL LENSES WITHOUT WEARING GLOVES, SKIN OILS MAY DAMAGE LENS OR LIGHT TRANSMISSION;
- CLEAN LENSES WITH MILD SOAP AND WATER AND A SOFT CLOTH;
- DO NOT USE ANY COMMERCIAL CLEANING SOLVENTS ON LENSES.

## Disclaimer

Please note that flow lines and weld lines on the external surfaces of the lenses are acceptable if the optical performance of the lens is within the specifications.

Should you require further information, please contact Khatod for advice. All lens testing must be subject to identical conditions as Khatod test condition. Khatod Optoelectronic, Milan, Italy, manufactures lenses for LEDs. Any other use of the lens shall void our liability and warranty. The lenses are an inert component to be used in the manufacture of various products. Our warranty and liability are limited only to the manufacture of the lens. You may not modify, copy, distribute reproduce, license or alter the lens and related materials of Khatod. Khatod does not warrant against damages or defects arising out of the use or misuse of the products; against defects or damage arising from improper installation, or against defects in the product or in its components. No warranty of any kind, expressed or implied, is made regarding the safety of the products. The entire risk as to the quality or performance of the product is with the buyer. In no event shall Khatod be liable for any direct, indirect, punitive, incidental, special, consequential damages, or any damages whatsoever arising out of or connected with the use or misuse of the product. Khatod shall not have any obligation with respect to the product or any part thereof, whether based on contract, tort, strict liability or otherwise. Buyer assumes all risks and liability from use of the product. The laws of Milan, Italy govern this product warranty and liability and you hereby consent to the exclusive jurisdiction and venue of courts in Milan, Italy in all disputes arising out of or relating to the use of this product. Production, marketing, distribution, sale of these products as well as their possible modifications and variations are only exclusive right of Khatod Optoelectronic. No company can perform any of these actions without written permission released by Khatod Optoelectronic. The information contained in this document is proprietary of Khatod Optoelectronic and may change without notice.

REPRODUCTION PROHIBITED.