LTX
ILUMINAÇÃO TÉCNICA S.A.

AEC ILLUMINAZIONE
light life

AEC led lighting technology

AEC ILLUMINAZIONE

QUALITY AND CERTIFICATION

CB/ENEC Certificate

ENEC LICENCE

Licence No. ENEC-00937-A1
Page 1/48
Date of issue 2015-01-14

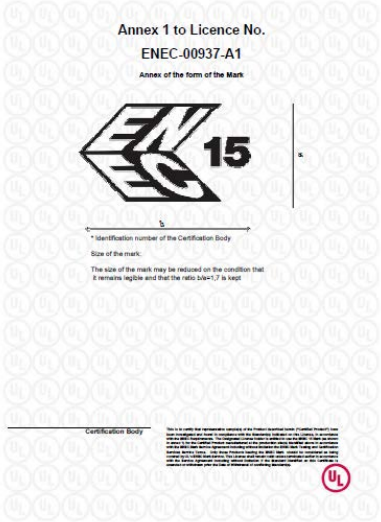
Licence Holder	AEC ILLUMINAZIONE SRL VIA A RIGHI 4 Z I CASTELNUOVO SUBBIANO, 52010 AR Italy
Production site	AEC ILLUMINAZIONE SRL VIA A RIGHI 4 Z I CASTELNUOVO SUBBIANO, 52010 AR Italy
Certification Mark	See Annex 1
Certified Product	Luminaires for road and street lighting
Model	See Page 2 to Page 47
Trademark	AEC ILLUMINAZIONE
Rated Voltage / Frequency	See Page 2 to Page 47
Rated Current / Power	See Page 2 to Page 47
Insulation Class	II
Degree of protection (IP)	66
Tested acc. to	EN 60598-1:2008/A11:2009, EN 60598-1:2008, EN 60598-2-3:2003/A1:2011, EN 60598-2-3:2003
Test Report No.	4786114396-1 issued on 2015-01-07
Additional	This certificate replaces the certificate No. ENEC-00937, dated 2014-07-08 due to add models and correct some typo errors.

Certification Manager

Jan-Erik Storgaard

Certification Body

UL International Demko A/S, Borupvang 5A, DK-2750 Ballerup, Denmark, Tel. +45 44 85 85 85, info.dk@ul.com
www.ul-europe.com



Annex 1 to Licence No.
ENEC-00937-A1

Annex of the form of the Mark

15

* Identification number of the Certification Body

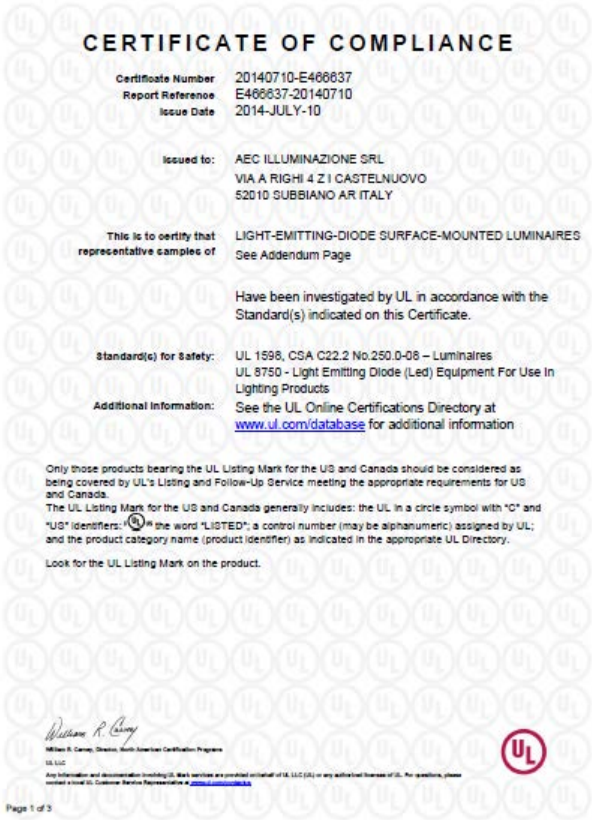
Size of the mark:

The size of the mark may be reduced on the condition that it remains legible and that the ratio b/a=1,7 is kept

Certification Body

- It covers both Class I and Class II
- It covers each model and version
- It covers each dimming version

UL Certificate



CERTIFICATE OF COMPLIANCE

Certificate Number	20140710-E466637
Report Reference	E466637-20140710
Issue Date	2014-JULY-10
Issued to:	AEC ILLUMINAZIONE SRL VIA A RIGHI 4 Z I CASTELNUOVO 52010 SUBBIANO AR ITALY
This is to certify that representative samples of	LIGHT-EMITTING-DIODE SURFACE-MOUNTED LUMINAIRES See Addendum Page
	Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL 1598, CSA C22.2 No.250.0-08 – Luminaires UL 8750 - Light Emitting Diode (Led) Equipment For Use In Lighting Products
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Listing Mark for the US and Canada should be considered as being covered by UL's Listing and Follow-Up Service meeting the appropriate requirements for US and Canada.
The UL Listing Mark for the US and Canada generally includes: the UL in a circle symbol with "C" and "US" identifiers; the word "LISTED"; a control number (may be alphanumeric) assigned by UL; and the product category name (product identifier) as indicated in the appropriate UL Directory.

Look for the UL Listing Mark on the product.

William R. Carney

William R. Carney, Director, North American Certification Programs
UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at www.ul.com/contactus

Page 1 of 3

It covers both
luminaires (UL1598)
and led module (UL8750)

EMC CB Certificate

IEC IECEE CB SCHEME

Ref. Certif. No.
DK-35674-UL

IEC SYSTEM FOR MUTUAL RECOGNITION OF TEST CERTIFICATES FOR ELECTRICAL EQUIPMENT (IECEE) CB SCHEME

SYSTEME CEI D'ACCEPTATION MUTUELLE DE CERTIFICATS D'ESSAIS DES EQUIPEMENTS ELECTRIQUES (IECEE) METHODE OC

CB TEST CERTIFICATE

CERTIFICAT D'ESSAI OC

Product Produit	Street LED lighting equipment
Name and address of the applicant Nom et adresse du demandeur	AEC ILLUMINAZIONE SRL VIA A RIGHI 4 Z I CASTELNUOVO SUBBIANO, 52010 AR Italy
Name and address of the manufacturer Nom et adresse du fabricant	AEC ILLUMINAZIONE SRL VIA A RIGHI 4 Z I CASTELNUOVO SUBBIANO, 52010 AR Italy
Name and address of the factory Nom et adresse de l'usine	AEC ILLUMINAZIONE SRL VIA A RIGHI 4 Z I CASTELNUOVO SUBBIANO, 52010 AR Italy ☐ Additional Information on page 2
Ratings and principal characteristics Valeurs nominales et caractéristiques principales	See Page2
Trademark (if any) Marque de fabrique (si elle existe) Type of Manufacturer's Testing Laboratories used Type de programme du laboratoire d'essais constructeur	AEC Illuminazione
Model / Type Ref. Réf. De type	ITALO 1 STE-M PLM-R
Additional information (if necessary may also be reported on page 2) Les informations complémentaires (si nécessaire, peuvent être indiquée sur la 2ème page	☐ Additional Information on page 2
A sample of the product was tested and found to be in conformity with Un échantillon de ce produit a été essayé et a été considéré conforme à la	CISPR CISPR 15(ed.7), CISPR CISPR 15(ed.7);am1, CISPR CISPR 15(ed.7);am2, IEC 61000-3-2(ed.3), IEC 61000-3-2(ed.3);am1, IEC 61000-3-2(ed.3);am2, See Page 2
As shown in the Test Report Ref. No. which forms part of this Certificate Comme indiqué dans le Rapport d'essais numéro de référence qui constitue partie de ce Certificat	47961162226-02 issued on 2013-11-06

This CB Test Certificate is issued by the National Certification Body
Ce Certificat d'essai OC est établi par l'Organisme National de Certification

Date: 2013-11-15

Signature:

Jan-Erik Storgaard

1/2

- It covers both Class I and Class II
- F-DA-DAC-PLM version

EMF Certificate

STATEMENT OF CONFORMITY

Statement No.:	UL-EMF-14-0190
Applicant:	ARC Illuminazione S.r.l. Via A. Righi, 4 (Zona Industriale Castelnuovo) 52010 Subbiano (AR) Italy
Product:	Street LED lighting equipment
Manufacturer:	ARC Illuminazione S.r.l. Via A. Righi, 4 (Zona Industriale Castelnuovo) 52010 Subbiano (AR) Italy
Trademark:	ARC Illuminazione
Model/Type:	ITALO 1 PLM-R
Test Standards:	EN 62493:2010
Test Reports No.:	4786121475-01 and 14-0190M

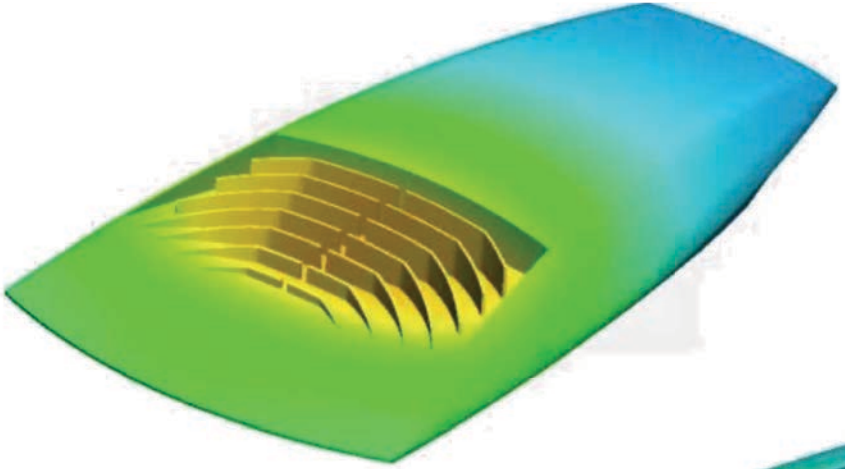
This statement of conformity applies only to the particular sample of the product and its technical documentation provided for testing. It is the responsibility of the company shown above that the products are in compliance with the applicable requirements. The detailed test results are described in the test report mentioned above. This statement does not imply assessment of the production and does not permit the use of UL's logo.

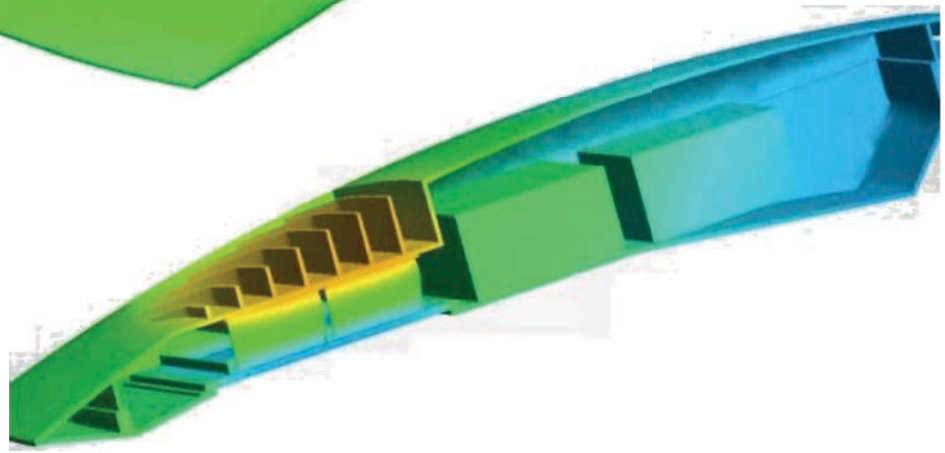
March 4th, 2014
Date of issue

Rivoltella Dario
Eng. Dario Rivoltella
Laboratory Manager

UL International Italia S.r.l.
Via delle Industrie, 6, 20061 Carugate (MI), Italy
T: +39.02.925035.01 / F: +39.02.925035.85 / W: ul.com

MECHANICAL/THERMAL DESIGN and TESTING





MECHANICAL/THERMAL DESIGN

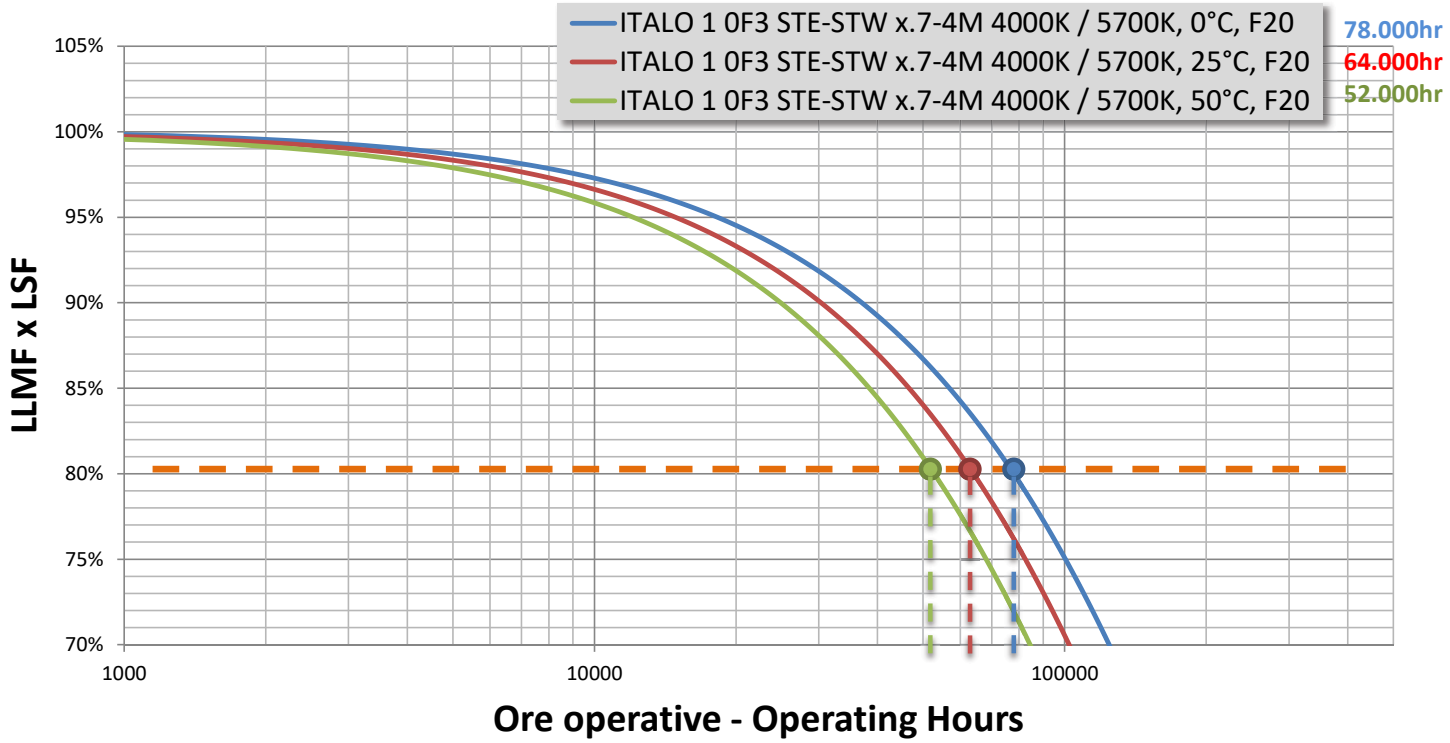
One of the most critical LED issue is the HEAT DISSIPATION

If LED works at high temperature…

The luminous flux decrease
The depreciation of flux is faster
The probability of LED failure increase

MECHANICAL/THERMAL DESIGN

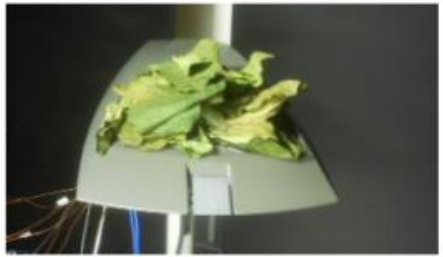
TEMPERATURE AFFECTS THE LED LIFETIME



MECHANICAL/THERMAL DESIGN

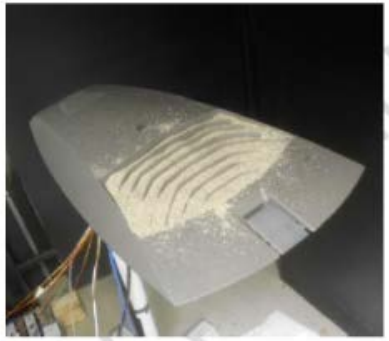
…. AND DIRTY AS WELL !

Test with leaves accumulation



+5/10°C

Test with sand accumulation



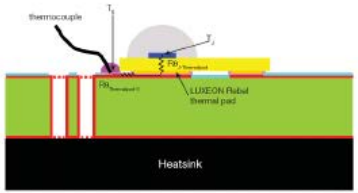
Extreme temperature test

Technical Dossier

Thermal Study — *ITALO SERIES*

Junction temperature of LED Tj

Referring to the Philips Lumileds technical documentation (AB103-LUXEON-M) the solder-point temperature is connected with the junction temperature of LED according to the following scheme:



According with these scheme we can write the following equation :

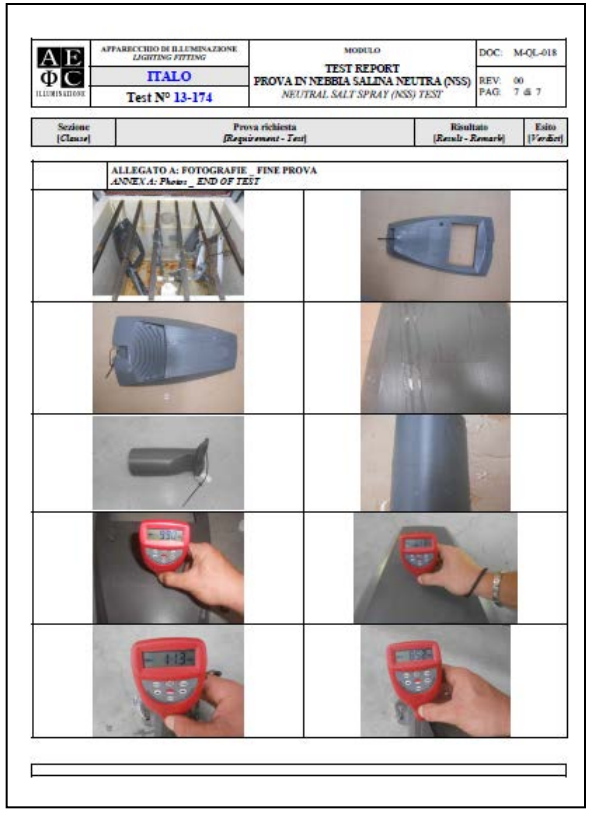
$$T_J = T_S + (R_{\theta\_thermalpad\text{-}S} + R_{\theta\_J\text{-}thermalpad}) \cdot P_D$$

Where :

P_D = Vf * I_F = 11.01*0.698 = 7.69 W dissipation power from a single LED (ITALO 1 0F3 STE 4.7-4M)

$R_{\theta\_J\text{-}S}$= 1.8 °C/W thermal resistance between solder point and junction ($R_{\theta\_thermalpad\text{-}S}$ + $R_{\theta\_J\text{-}thermalpad}$)

Salt Environment Test



APPARECCHIO DI ILLUMINAZIONE *LIGHTING FITTING*	MODULO	DOC: M-QL-018
ITALO	TEST REPORT PROVA IN NEBBIA SALINA NEUTRA (NSS) *NEUTRAL SALT SPRAY (NSS) TEST*	REV: 00 PAG: 7 di 7
Test N° 13-174		

Sezione *[Clause]*	Prova richiesta *[Requirement - Test]*	Risultato *[Result - Remark]*	Esito *[Verdict]*

ALLEGATO A: FOTOGRAFIE _ FINE PROVA
ANNEX A: Photos _ END OF TEST

Vibration Test

analytical CETACE

ATTESTATO

ATTESTATO N. **CRT_001_15**

CERTIFICATE N.

CETACE Laboratory in collaboration with *Electronic and Telecommunication Department of the University of Florence*

ANALYTICAL attesta la conformità ai requisiti stabiliti dalla procedura per test di vibrazione eseguito in accordo al Protocollo prova "Vibration Test", (AEC Illuminazione S.r.l. internal document) (2012/11) del seguente prodotto:
ANALYTICAL assesses the compliance with the requirements stated by vibration test procedure according to Dossier Technique "Vibration Test", (AEC Illuminazione S.r.l. internal document) (2012/11) of the product hereunder:

Tipo apparecchio: Apparecchio di illuminazione stradale
mod. ITALO 3 STW F

Type appliance: luminaire for road and street lighting mod. ITALO 3 STW F

Costruito da:/*Manufactured by:* AEC ILLUMINAZIONE S.r.l.

a:/At: Via A. Righi, 4 - C.P. 63 - 52010 Soliano (AR)

Caratteristiche dell'oggetto in prova ***(Characteristics of the object under test):***

- Tensione nominale di alimentazione *(Rated voltage)*: 220-240 Vac
- Frequenza nominale *(Rated frequency)*: 50/60Hz
- Potenza nominale *(Rated power)*: 285 W
- Tipo di lampada *(Type of lamp)*: LED
- Grado di mobilità *(Equipment mobility)*: Apparecchio fisso / *Fixed luminaire*
- Tipo di funzionamento *(Operating mode)*: Continuo / *Continuous*

Sulla base delle valutazioni costruttive e dei risultati delle prove eseguite, l'oggetto in prova è stato riconosciuto conforme alle prescrizioni Protocollo prova "Vibration Test", (AEC Illuminazione S.r.l. internal document) (2012/11)

On the basis of the construction evaluations and test results the equipment under test is in compliance with Dossier Technique "Vibration Test", (AEC Illuminazione S.r.l. internal document) (2012/11)

Le procedure, le condizioni ed i risultati di prova sono riportati nel Rapporto di Prova n. **TRP_040_15** rilasciato il **04/03/2015** a completamento del presente attestato.
The procedures, conditions and results of the tests are reported in Test Reports n. ***TRP_040_15*** *issued on* ***2015/03/04*** *completing this certificate of conformity.*

Firenze, **05/03/2015**

Il Responsabile Tecnico
(Ing. M. Fiaschi)

Laboratory Address:
Via dei Cadolingi 6, int.6/7
50018 Scandicci (FI) - Italy
Tel. 0039-055 –7350330
Fax. 0039-055 – 756473
E-mail: cetace@analytical.it

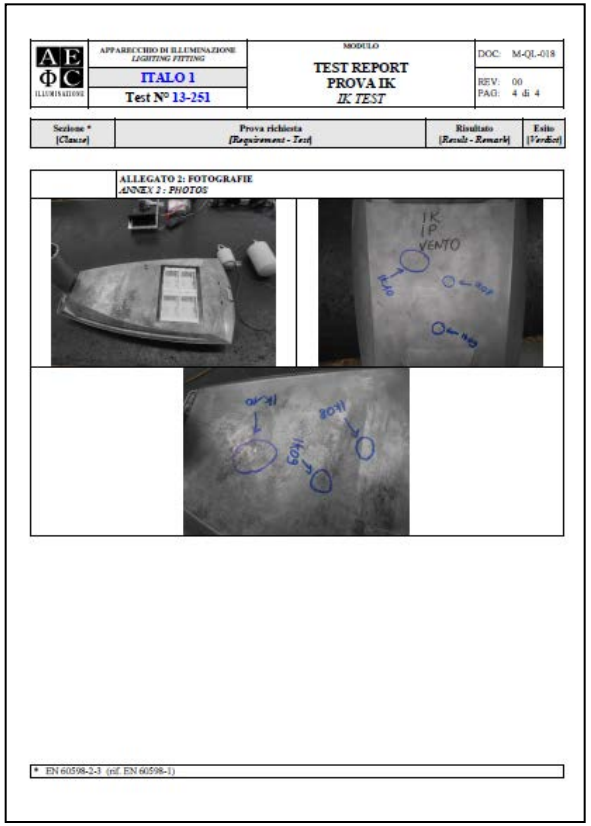
Registered Office:
Via dell'Industria, 24
36071 Arzignano (VI) – Italy
Tel. 0039-0444-452022
Fax. 0039-0444-671432
E-mail: info@analytical.it

Annex 2: Pictures of Test setup

*Pict.01 – fixture and reference axes (**Z** vertical **Y** transversal **X** longitudinal)*

Pict.02a – vibration test – transversal

IK Impact Resistance Test



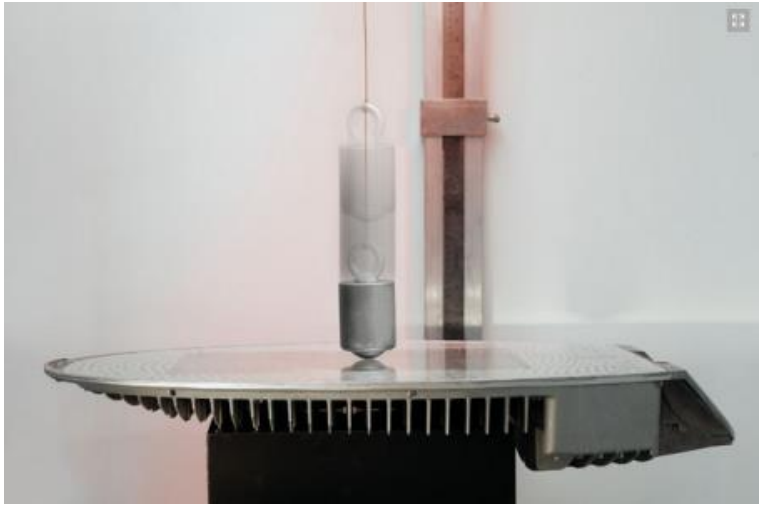
APPARECCHIO DI ILLUMINAZIONE *LIGHTING FITTING*	MODULO	DOC: M-QL-018
ITALO 1	TEST REPORT PROVA IK *IK TEST*	REV: 00
Test N° 13-251		PAG: 4 di 4

Sezione * *[Clause]*	Prova richiesta *[Requirement - Test]*	Risultato *[Result - Remark]*	Esito *[Verdict]*

ALLEGATO 2: FOTOGRAFIE
ANNEX 2 : PHOTOS

* EN 60598-2-3 (ref. EN 60598-1)

IK 09



IP Protection degree Test

AEC ILLUMINAZIONE	APPARECCHIO DI ILLUMINAZIONE *LIGHTING FITTING* ITALO 1 Test N° 13-409	MODULO TEST REPORT VERIFICA IP *IP TEST*	DOC: M-QL-018 REV: 02 PAG: 4 di 4

Sezione * *(Clause)*	Prova richiesta *(Requirement - Test)*	Risultato *(Result - Remark)*	Esito *(Verdict)*
	ALLEGATO: FOTOGRAFIE *ANNEX: PHOTOS*		
	IPX6		
			

Note:

* EN 60598-2-3 (ref. EN 60598-1)

IP 66

Surge test EN 61547

	APPARECCHIO DI ILLUMINAZIONE *LIGHTING FITTING*	MODULO [*MODULE*]	DOC: M-SA-095
AEC ILLUMINAZIONE	I-TRON ZERO B	**TEST REPORT** **IMPULSI DI TENSIONE** *SURGE TEST*	REV: 01 PAG: 1 di 8
	Test N° 20-0094		

Apparecchio di illuminazione sottoposto a collaudo [*Lighting fitting*]

Codice [*Product code*]	-
Descrizione [*Description*]	I-TRON ZERO B 2W8 4.50-3M cl.1
Alimentazione [*Rating*]	220-240V 50/60Hz
Ottica [*Optic*]	STU-M
Pilotaggio Led [*Led piloting*]	500mA
Tipo di montaggio [*Mounting type*]	Orizzontale / *Horizontal*

Riferimenti normativi e qualitativi [*Test specification*]

Norma [*Standard*]	Titolo [*Title*]
EN 61547	Apparecchiature per illuminazione generale – Prescrizioni di immunità EMC *Equipment for general lighting purposes – EMC immunity requirements*
EN 61000-4-5	Compatibilità elettromagnetica (EMC) Parte 4-5: Tecniche di prova e di misura – Prova di immunità ad impulso *Electromagnetic compatibility (EMC)* *Part 4-5: Testing and measurement techniques – Surge immunity test*
IEC 60060-1 :2010	Tecniche di prova in alta tensione – Parte 1: Definizioni generali e prescrizioni di prova *High voltage test techniques – Part 1: General definitions and test requirements*
P-QL-006	Procedura del Sistema di Gestione Qualità, Progettazione e Sviluppo *Quality System Procedure , Planning and Development*

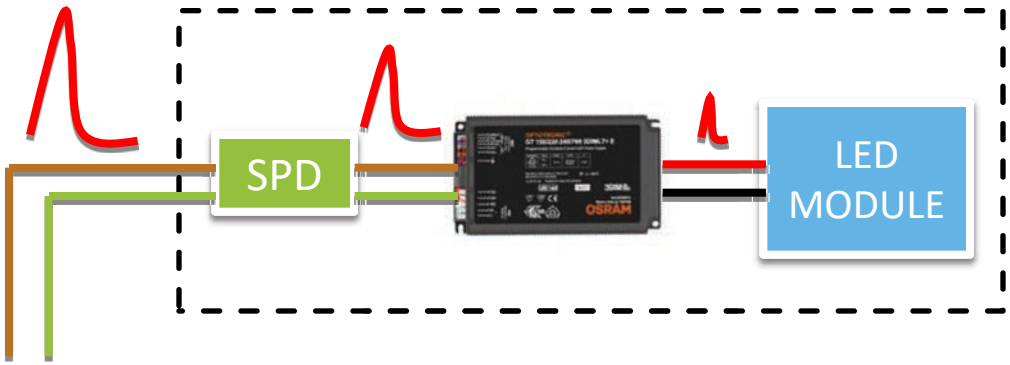
Data [*Date*] 06/02/20

Testato [*Tested*] M. Tinti

Approvato [*Approved*] L. Ginepri

SURGE PROTECION

SURGE PROTECTIONS



Common Mistake 1

«The protection level of the luminaire is the protection level of the power supply or of the SPD»

Common Mistake 2

«It’s enough to add an SPD to protect the luminaire»

AEC SURGE PROTECTION LEVEL

ALL the AEC luminaire has :

- 6-10kV CM/DM TOTAL Pulse Withstand (F/DA/DAC)
- Integrated SPD
  - **Type II,** In=**5kA**
  - Imax=10kA, Uoc=10kV
- Optionally integrated protection fuse
- Luminaire Switch off at the end of SPD life
- **SPD available in both CLASS I and II luminaire**

italo

- Classe I: from 10kV to 16kV MC/MD
- Classe II: from 6kV to 10kV MC/MD

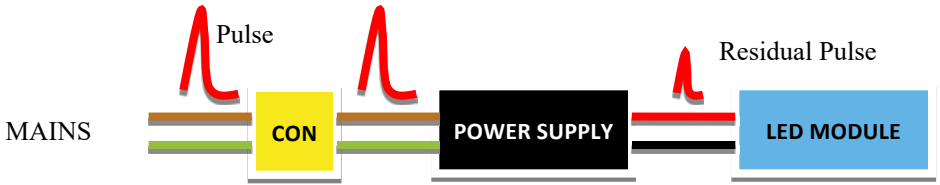
SURGE PROTECTIONS

To coordinate

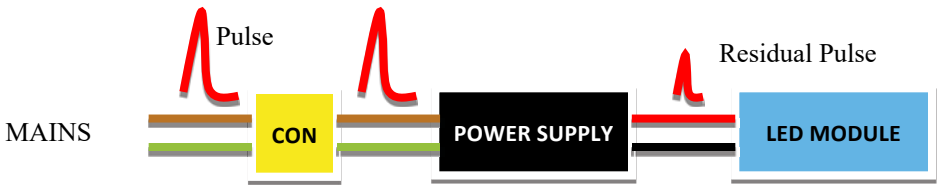
the protections !

SURGE PROTECTIONS

COORDINATE PROTECTIONS INSIDE THE LUMINAIRE



Requirements



Statements:

1) Is not enought to be in compliance with minimum requirements : 1000Vac DM and 2000Vac CM

2) Component for protection must be coordinated

3) Without SPD the whole overvoltage is effecting the Driver AND LED modules

4) With SPD the connection to the PE (Class1) is maximizing the protection and minimising the “Stress” of the electronic components

Photobiological Safety Certificate

STATEMENT OF COMPLIANCE

Photobiological safety of Lamp and Lamp system

Project No.:	4786114396
Applicant:	AEC Illuminazione SRL
Product:	LED Luminaire for street lighting
Manufacturer:	AEC Illuminazione SRL
Trademark:	AEC Illuminazione SRL
Model/Type:	ITALO 1
Ratings:	AC 120-277 V 50/60 Hz
Test Standards:	IEC/EN 62471
Test Report No.:	4786114396.2.1
Lamp Classification Group:	**EXEMPT**
Date of issue:	2013-11-28
Laboratory Manager:	Walter Parmiani

The product complies with the standards IEC 62471:2006 and EN 62471:2008 based on EU Directive 2006/25(EC). This statement of compliance applies only to the particular sample of the product and its technical documentation provided for testing. It is the responsibility of the company shown above that the products are in compliance with the applicable requirements. The detailed test results are described in the test report mentioned above. This statement does not imply assessment of the production and does not permit the use of UL's logo.

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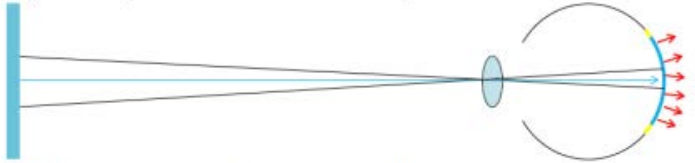
Via XXV Aprile 3R, 20875 Burago di Molgora (MB), Italy
T: +39.039.63.45.801 / F: +39.039.63.45.845 / W: UL.com

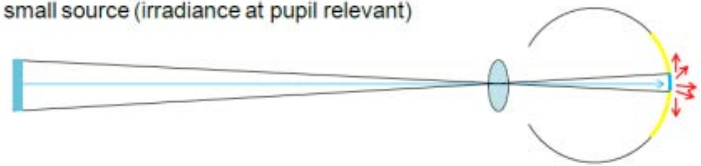
Photobiological safety

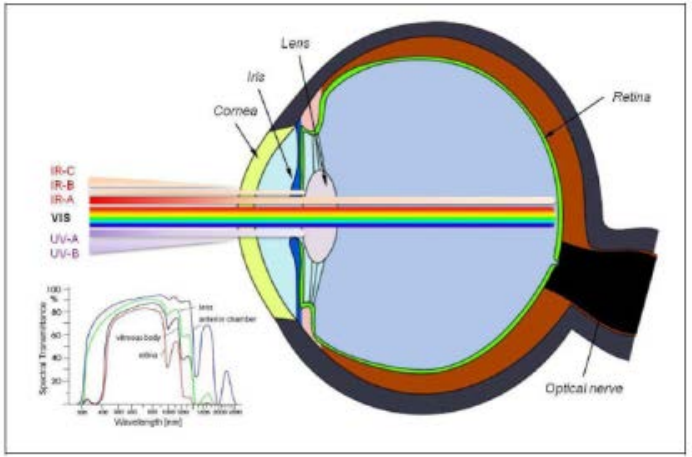
- Eye sensitivity
- Width of source
- Exposure time
- Intensity
- Distance

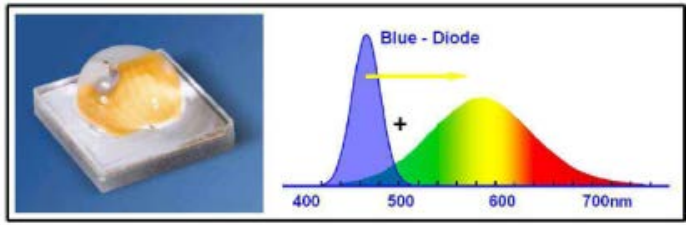
- large source (radiance of source relevant)



- small source (irradiance at pupil relevant)







Limits according to IEC/TR 62778

RG0 (Exempt)

It NEVER CAUSES DAMAGES even if there is a long exposure time.

RG1 (Low risk)

SAFETY EXPOSURE calculated for shorter exposure times and it doesn't cause damages

RG2 (Moderate risk)

It DOESN'T CAUSE DAMAGES BECAUSE OF AN ISTINCTIVE REACTION (such as the sunlight exposure).
ADDITIONAL MARKING ON THE LUMINARIE

RG3 (High risk)

DANGER ALSO FOR SHORT EXPOSURE

OPTICAL UNIT

Why is it important an optic ?

- ENERGY SAVING
  - Distributing the light where it's necessary, without losses

- COMFORT
  - For the perception, controlling the luminous flux in the more glaring angles

- SAFETY
  - For the road user, distributing the light maximizing the uniformity

CIE 115 STANDARD

- Main Technical Requirements
  - LUMINANCE / ILLUMINANCE LEVELS (Lav, Eav)
  - UNIFORMITY (U0, Ul)
  - COMFORT (TI)
  - AMBIENT PERCEPTION (SR)

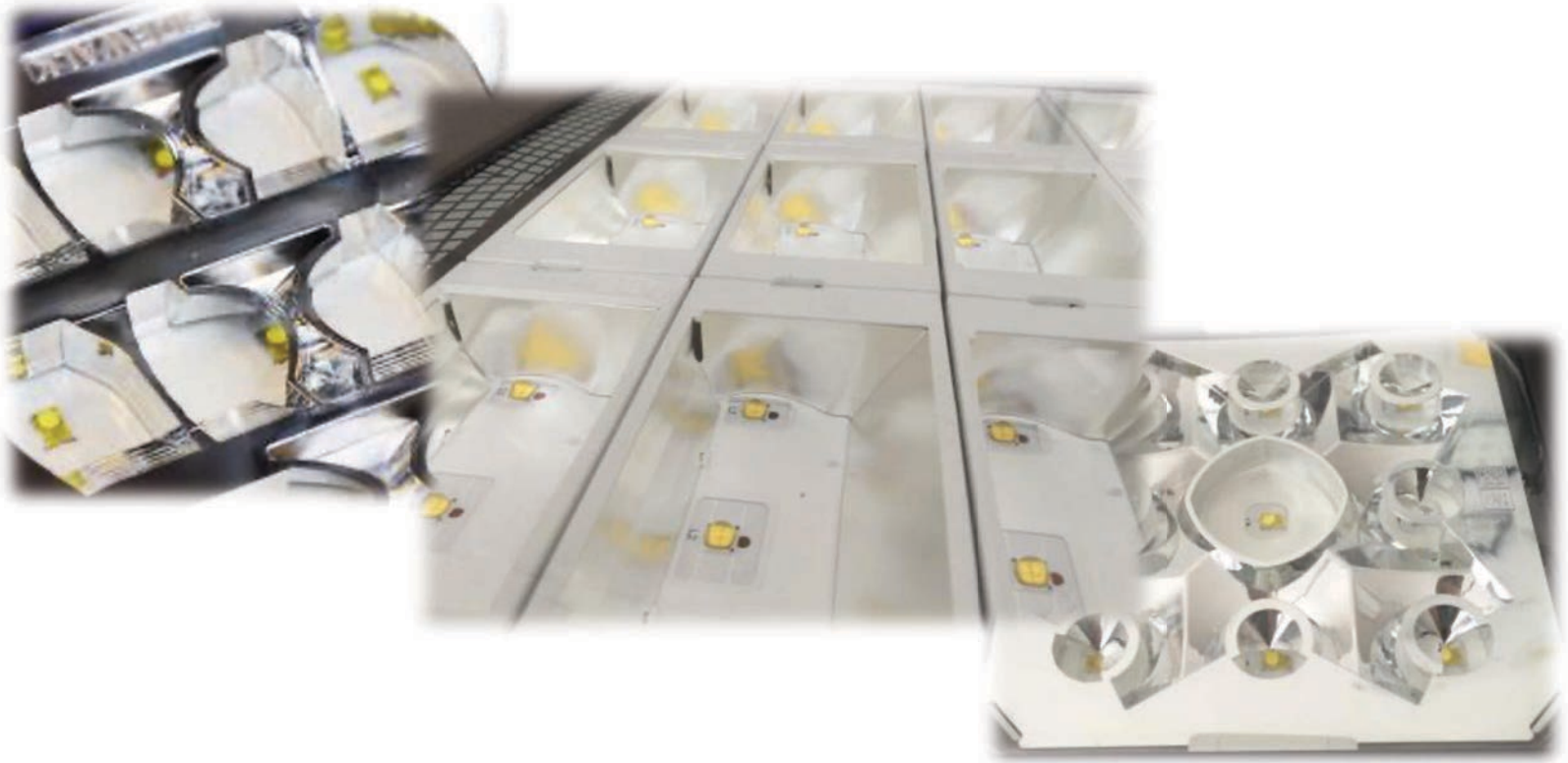
ROAD CLASSIFICATION

Different application

Different requirements

Different OPTICS !

OPTICAL DESIGN



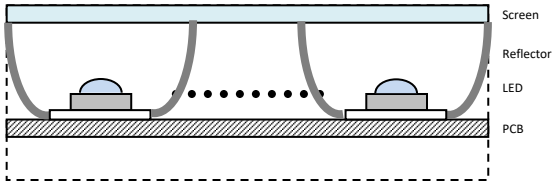
AEC COMFORT LIGHT OPTIC

LED

- High intensity Light source
- Reduced emission surface

REFLECTOR

- Bigger emitting surface
- Reduced glaring

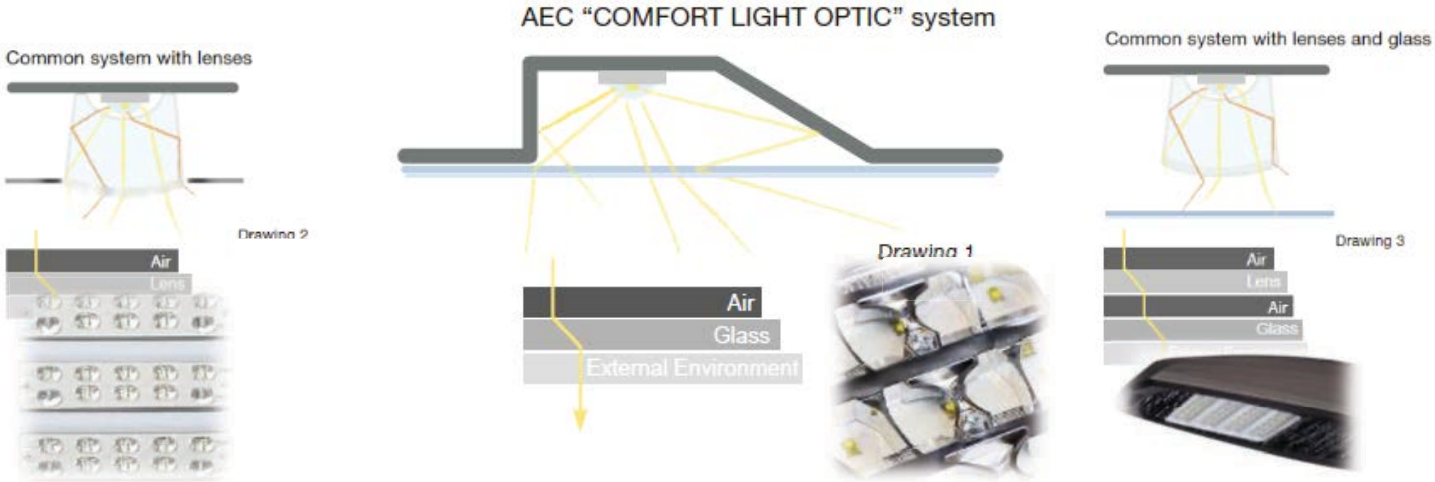


Led recessed in the reflector

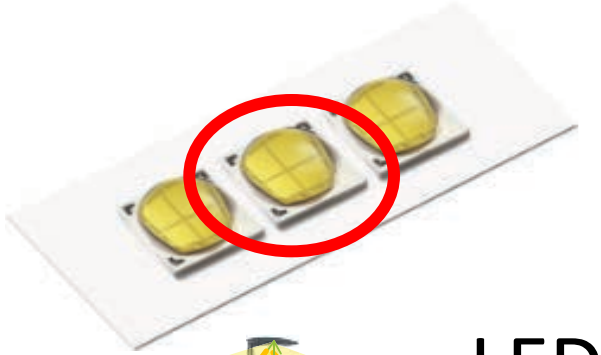
OPTICAL DESIGN

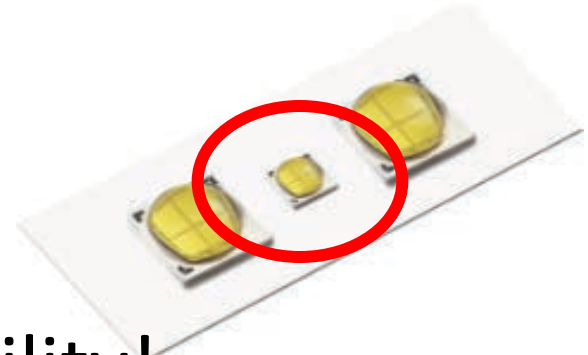
COMFORT LIGHT OPTIC ADVANTAGES:

- **Lower light dispersion** compared to lens system
- **The flat glass protects the LEDS** from accidental damages
- The widening of the emission surface ensures a **less density of dirt**
- **Better management of the luminous flux** of every single led
- **Less glaring** than with lens system

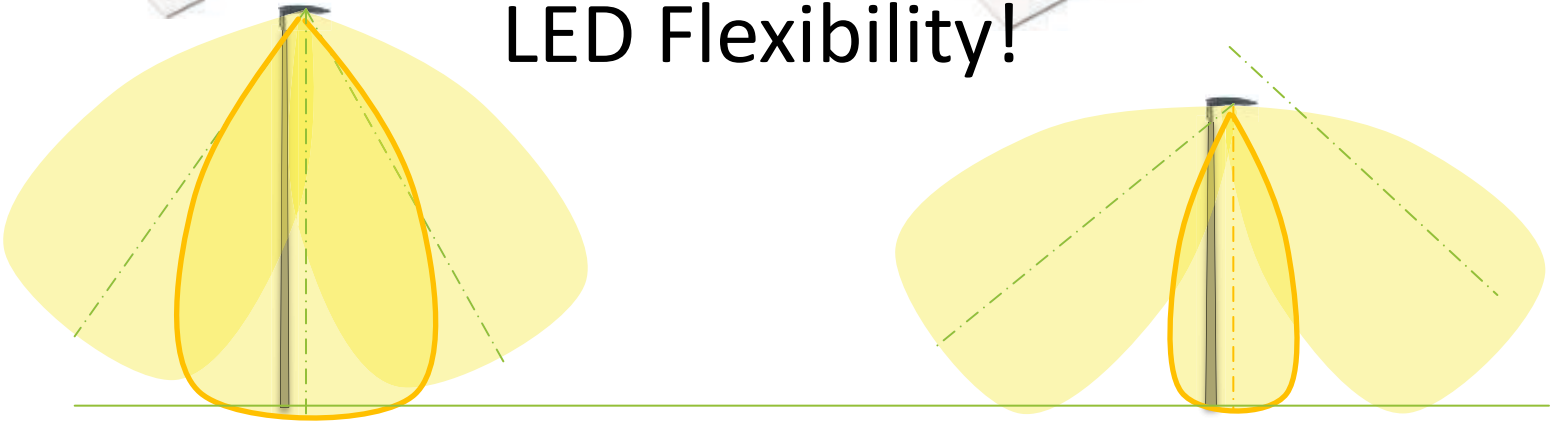


WHAT'S THAT ?





LED Flexibility!



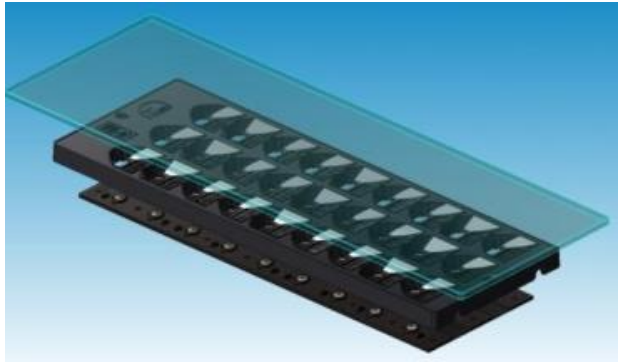
OPTICAL DESIGN

AEC developed "***Comfort Light Optic***", an optical solution able to guarantee a significant reduction of glare, whilst maintaining the photometric qualities of the light source

What is ***COMFORT LIGHT OPTIC*** ?

Pure aluminum reflector

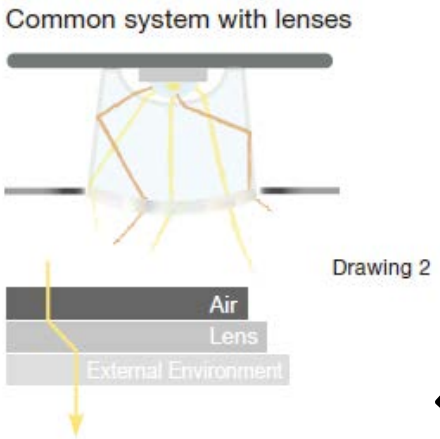
+



Protective glass

OPTICAL DESIGN

Cie 154:2003



Plastics, Acrylic (PMMA – polymethyl methacrylate) and Polycarbonate (PC)

Degradation is generally from dirt and atmospheric contaminants, and material ageing. Inappropriate use of, or exposure to solvents can produce rapid degradation as the plastic structure is attacked.
Regular cleaning with mild detergent and water will restore clarity. Remove intense grime with white spirit or other cleaners specifically formulated for PMMA or PC, and rinse well. Abrasives and scourers will demage the surface and add diffusion.

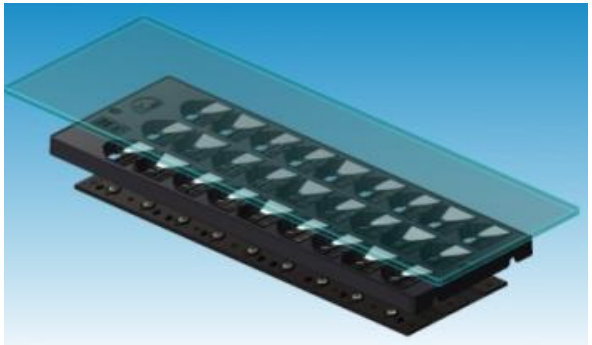
Adhesives used in construction or fixings mus be compatible otherwise degradation (short to long term) may occur.

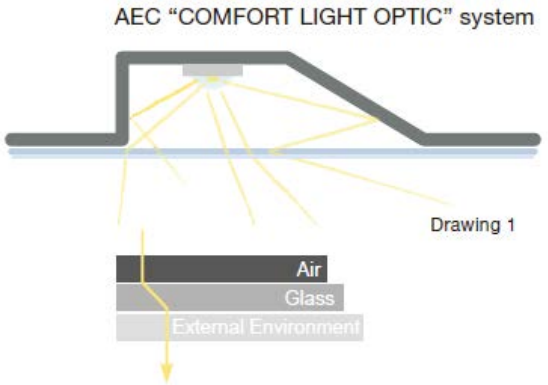
Polycarbonate

Its principal advantage over PMMA is its (initially) higher strength and resistance to impact. However the material degrades in the presence of UV – daylight, and UV – emitting lamps. The effect is accelerated by temperature. It is important therefore to keep the material service temperature below around 90° - 100°C, particularly when UV is present (e.g. by ensuring the lamp wattage used in the luminaire is limited appropriately). The degradation can be rapid.

OPTICAL DESIGN

THE CHOICE OF GLASS RATHER THAN POLYCARBONATE LENSES HAS BEEN WELL EVALUATED AND PROVEN.





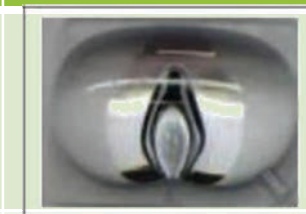
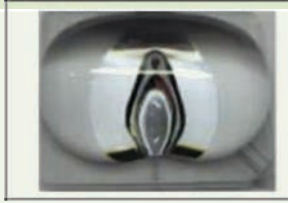
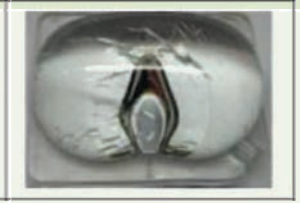
Cie 154:2003

Long term depreciation of reflector and diffuser materials
Outer glazing: Rifractors and diffusers:

Glass

Glass is easily cleaned to restore the original finish.

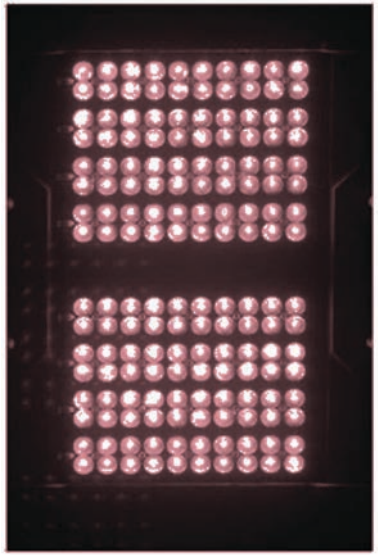
Effect of ageing and UV on lenses

TEST CONDITIONS	PMMA	PC
Initial / Non-aged lenses		
UV / 65°C – after 6.000hr		
130°C – after 6.000hr		
85%rh / 85°C after 8 weeks		

Feedback #1

Effect of ageing and UV on lenses

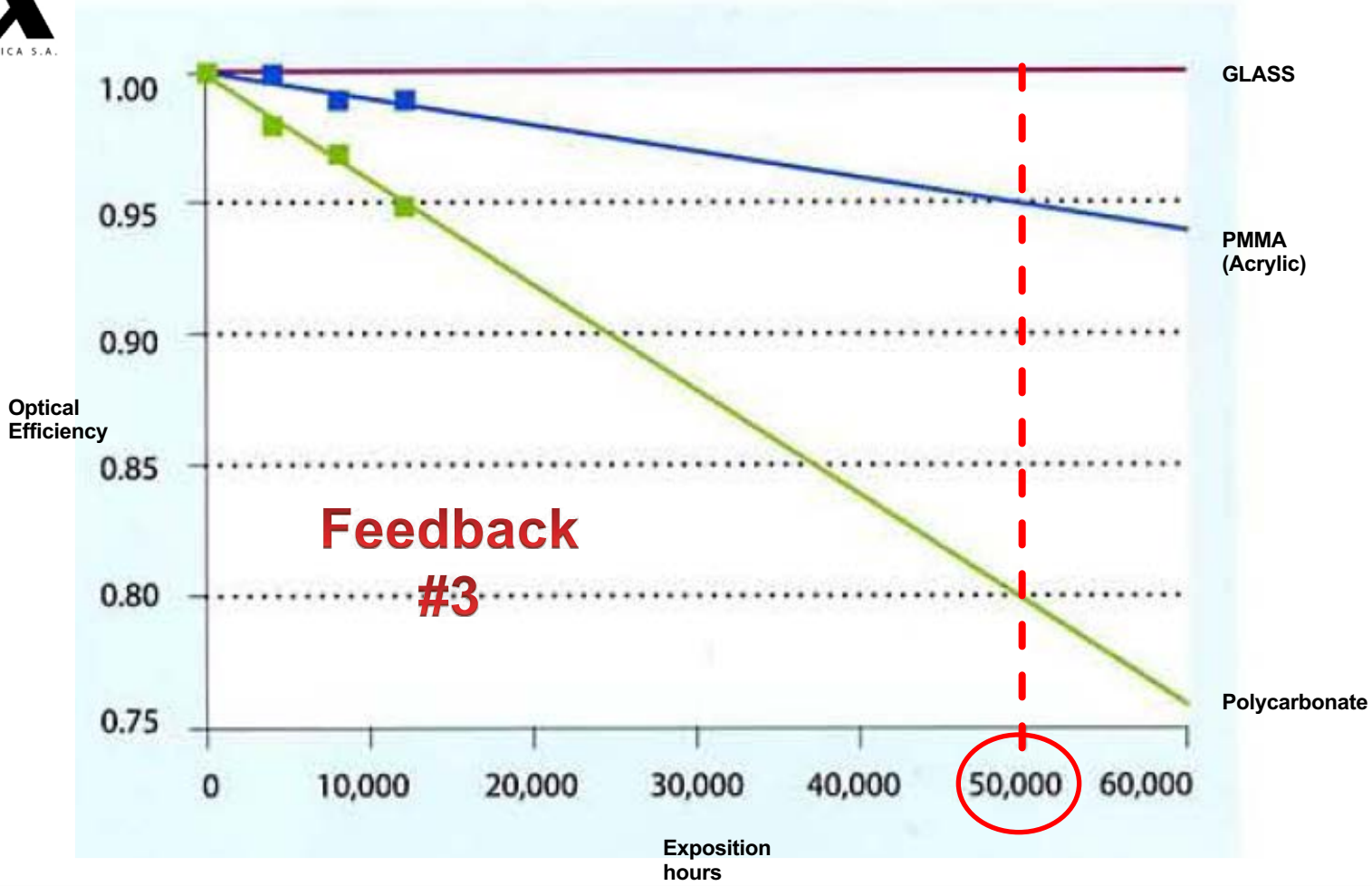
Feedback #2



NICE COLOUR CHANGE!

Abu Dhabi – 2 MONTHS AFTER INSTALLATION, ONLY.

350mA driven LED – SUPPOSED to be 6000K


1.00
0.95
0.90
0.85
0.80
0.75
Optical Efficiency
0
10,000
20,000
30,000
40,000
50,000
60,000
Exposition hours
GLASS
PMMA (Acrylic)
Polycarbonate
Feedback #3

Properties	Silicone	PC	PMMA	Glass
Light transmission	94%	88 – 90%	93%	95%
Refractive index	1,42	1,58	1,49	1,52
UV resistance	High	Low	Medium	High
Chemical resistance	High	Medium	Low	High
Service temperature max (°C)	>150	120	90	>200
Yellowing*	Low	High	High	Low
Micro detail replication	High	Low	Medium	Low
Large and thick parts	High	Low	Low	Medium
Minimal thickness**	<0,5 mm	2 mm	2 mm	–
Draft angle (manufacturing)**	None***	1 – 2°	1 – 2°	–
Weight	Low	Medium	Medium	High
Flexible material integration	High	Low	Low	Low
Cost	High	Low	Low	Low

*Yellowing due to high temperature, high lumen density or UV exposure.

**Injection moulding process.

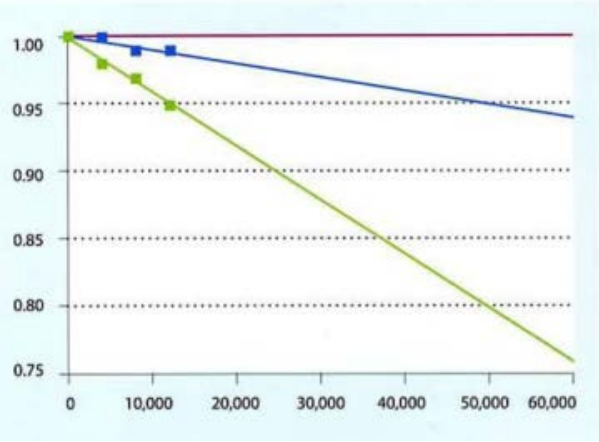
***Negative draft angles are possible <0°

Table 1: Comparison with other optical materials.

COURTESY: BEKA / SCHREDER S.A.

Standard material used is **PC and PMMA**; since mostly of the secondary optics are placed very close to the LEDs, the solder temperature of the LED heats up the optical material to a similar temperature…

MAINTENANCE FACTOR



Plastic material introduce

IRREVERSIBLE LOSSES

in the luminous flux

HOW CAN THIS INFLUENCE THE **MAINTENANCE FACTOR** ?

MAINTENANCE FACTOR

Different MF on LED and HID?

NO! The MF has the same criterias for both technologies

MAINTENANCE FACTOR

DEFINITION

(FOR OUTDOOR LIGHTING)

MF = LMF x LLMF x LSF

(CIE 154:2003)

- Maintenance factor of the luminaire (optical unit)
- Depreciation factor of the sources luminous flux
- Survival factor of luminous source

MAINTENANCE FACTOR

Parameters that influence the MF :

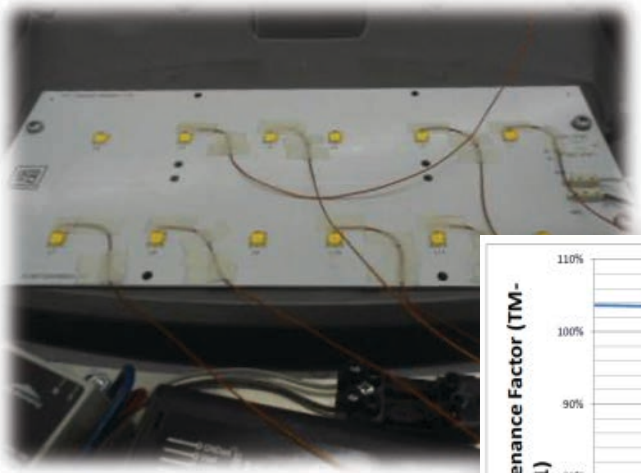
- Operating Temperature
- Operating Current
- Optical Unit material
- Cleaning period and installation condition
- Design life time

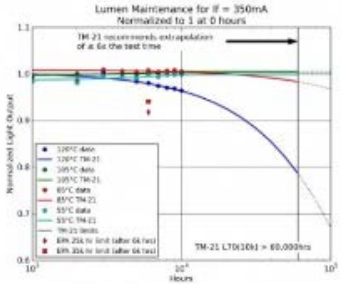
Enough?

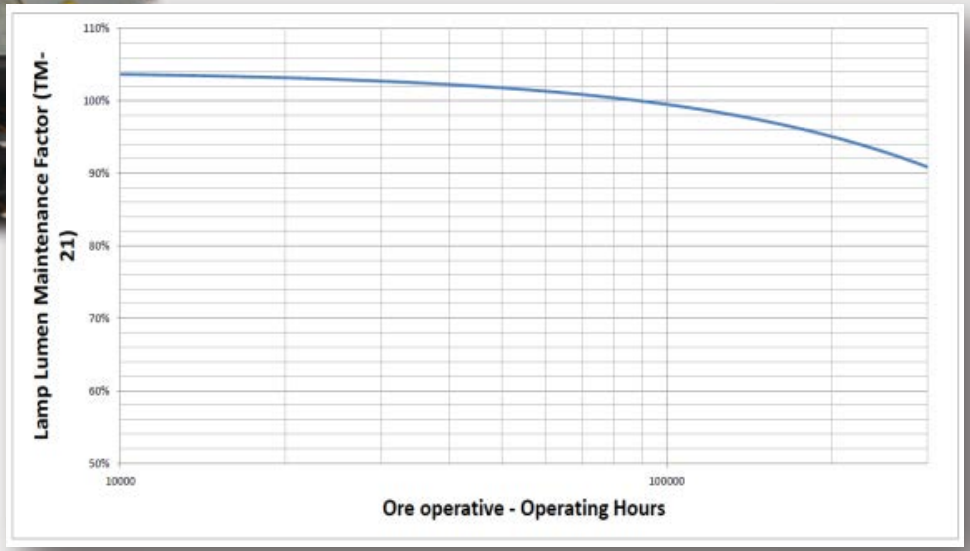
NO!

The **LED lifetime method and metrics**
can make the difference …….

LM-80 / TM-21 / EN 62717







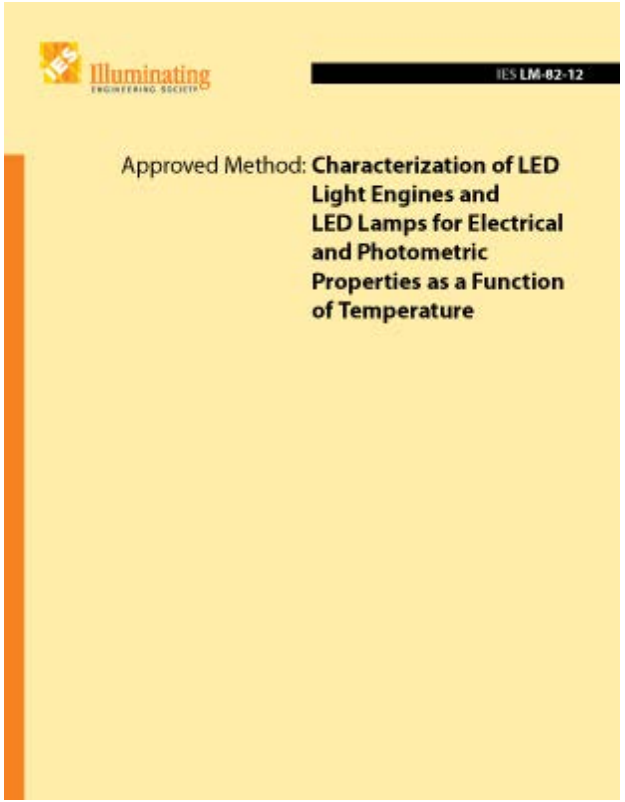
LM-82

Permit to measure **parameters at different working temperature** :

- **Solder point temperature (useful for lifetime extrapolation acc. to TM-21)**
- **Input Power**
- **Output Flux**
- **Luminous efficiency**
- **CCT**

And to define the temperature **correction factors** for :

- **Power**
- **Flux**
- **CCT**



STANDARD

UP TO NOW:

IES **LM80**

MEASURING LUMEN MAINTENANCE OF **LED SOURCE**

LED DATA COLLECT **EVERY 6000hrs**

3 DIFFERENTE CASE TEMPERATURE: 55°C, 85°C + 1 SELECTED BY MANUFACTURER (105°C)

IES **TM21**

TM21 EXYRAPOLATED METHOD PROVIDES PREDICTED LUMEN DEPRECIATION (**OF LED**) OVER AND ABOVE THE 6000hrs USING LM80 REPORT

ACCEPTED TO PREDICT LUMEN DEPRECIATION OVER THE OPERATING TIME (i.e. 50,000hrs @ L70)

NEW STANDARDS

IN USE (PROGRESS):

IES **LM82**

Projecting Long-Term Luminous Flux Maintenance of LED Lamps and Luminaires

IES **TM28**

LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature

IES **LM84**

IES Approved Method for Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires

LTX
ILUMINAÇÃO TÉCNICA S.A.

Quality is the critical factor for the performance and long life expectancy of a LED street luminaire

AEC ILLUMINAZIONE

Obrigado

Nuno Patrício