Apples & Pears: *why standardisation of performance requirements for LED luminaires is important.*

Singapore 1-2 November

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Asia-Pacific Economic Cooperation

Australian Government
Department of Climate Change and Energy Efficiency

Agenda

1. Introduction
2. Apples & Pears
3. Quality criteria initial & maintained
4. Quality criteria over time
5. Take away

Standards & Regulations

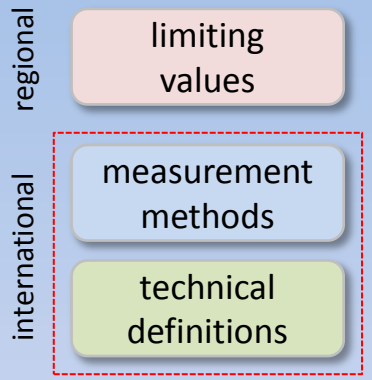
product standards
- product safety;
- product performance.




application norms
- lighting requirements;
- limiting performance values.


governmental regulations
- efficiency targets & timelines;
- product & application related.

Standards & Regulations



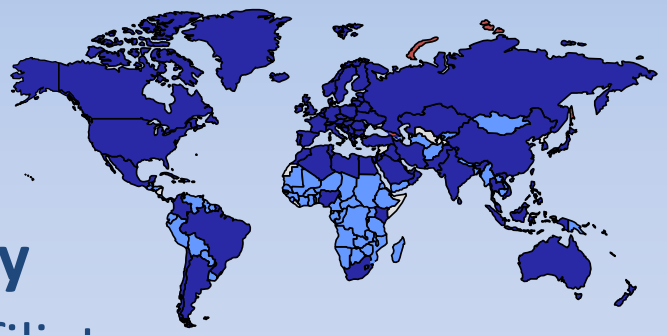
type	technical definitions	measurement methods	limiting values
product standards	yes	yes	safety
application norms	yes	yes	sometimes
regulations	by reference	by reference	yes

- **all standards are voluntary – till there is a legislative reference!**

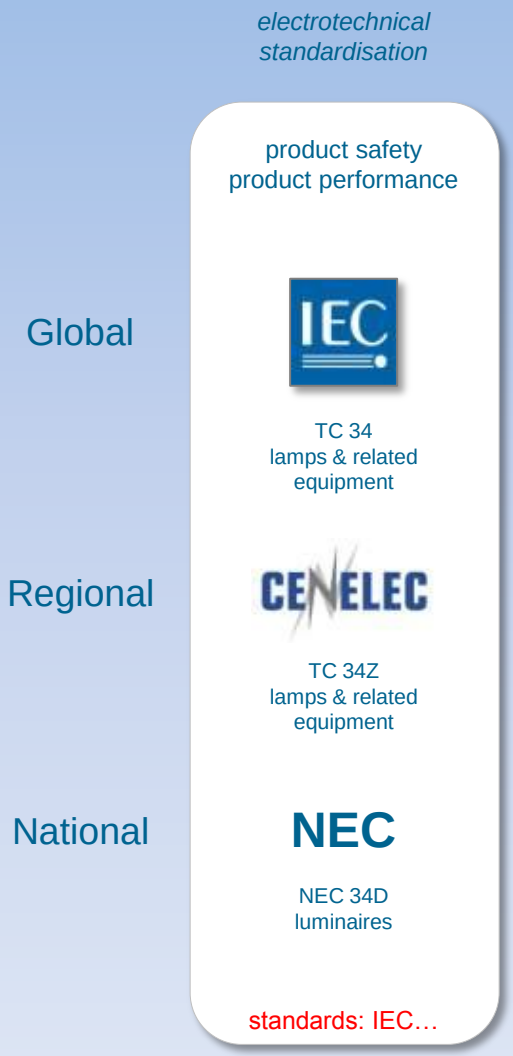
IEC International Standards

INTERNATIONAL ELECTROTECHNICAL COMMISSION

- **international standards**
  - consensus-based;
  - one vote per country;
  - best experience & experts.
- **whole world of electro technology**
  - 163 countries: 81 members - 82 affiliates.
- **TC34: lighting products & accessories**
  - product safety;
  - product performance.



TC 34 IEC International Standards For Lighting



BIS ET24
SAC/TCC224
JISC TC24
AS/NZS EL034

IEC TC34

Experts nominated by National Standards Committees from those countries around the globe who are members of IEC.

Maintenance Teams

34A: PRESCO – lamps
34B: EPC – components
34C: COMEX – control gear
34D: LUMEX – luminaires (40 members)

Preparation Panels

e.g. PAP – luminaires (8 members)

TC 34 IEC International Standards For Lighting

Public Available Specification (PAS)

1) Draft for Comment (DC) ➔ information document;
2) Public Available Specification (PAS) ➔ result of vote;
3) Published IEC/PAS.

International Standard

1) New work item Proposal (NP) ➔ vote;
2) Committee Draft (CD) ➔ comments;
3) Committee Draft for Vote (CDV) ➔ result of voting and comments;
4) Final Draft International Standard (FDIS) ➔ result voting document;
5) Published IEC International Standard.

Work In Progress

1) IEC TS 62405: definitions (in liaison with CIE);
2) IEC 62663-1: non-ballasted LED lamps – safety requirements;
3) IEC 62663-2: non-ballasted LED lamps – performance requirements;
4) IEC xxxxx: LED lifetime (lumen maintenance) prediction;
5) IEC xxxxx: LED double ended retrofit / conversion fluorescent lamps;
6) IEC 62471 / 62471-2: Photobiological Safety.

new work

- binning (lumens and forward voltage);
- translation of IEC to other colour grids (e.g. ANSI);
- self ballasted LED lamps < 50V;
- OLED proposals from Korea.

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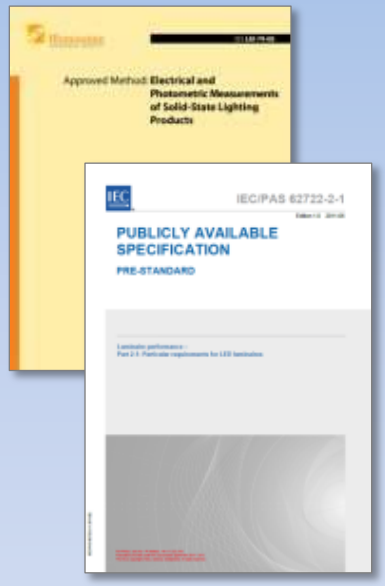
Compare Performance Claims?

Made-in-China.com™
Connecting Buyers with China Suppliers



DER BLAUE ENGEL
JURY UMWELTZEICHEN

energy
ENERGY STAR

DEKRA

MIND THE GAP

LONGLIFE
L.E.D
TECHNOLOGY

energy saving trust

Compare Performance Claims?

efficacy





LED Die	LED Array		Optics		Control Gear	LED Luminaire
90 lm/W	90%	81 lm/W	90%	73 lm/W	90%	66 lm/W
	85%	77 lm/W	50%	39 lm/W	70%	27 lm/W

performance

- technical definitions;
- product design.

Standardised Quality Criteria

Evaluate performance claims from different manufacturers it is important:

- to compare a standardised set of quality criteria;
- that are measured in compliance with the appropriate standard.

IEC/PAS Performance Requirements

	Product Type	Safety Standard	Performance Standard
	LED drivers	IEC 61347-2-13 Publication 2006	IEC 62384 Publication 2006
	LED lamps	IEC 62560 Edition 1 Publication 2010	IEC 62612/PAS Public Available Specification
	LED modules	IEC 62031 Edition 1 Publication 2008	IEC 62717/PAS Public Available Specification
	LED luminaires	IEC 60598 Edition 1 & 2 Publication 2008	IEC 62722/PAS Public Available Specification

recently published

- IEC/PAS 62717 – LED modules for general lighting;
- IEC/PAS 62722 – LED luminaires for general lighting.

Apples & Pears

manufacturers
&
certification bodies

IEC/PAS Performance Requirements

lighting designers
technical engineers
policy makers

CELMA Guide Apples & Pears

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Quality Criteria Initial & Maintained

limiting values

measurement methods

technical definitions

scope

- initial & maintained claims of LED luminaires;
- to establish confidence in the product data provided;
- acceptance or rejection of quality over life is out of the scope!

(maintained values are measured at 25% of rated life time up to a max. of 6.000 hours)

Quality Criteria Mentioned In The IEC/PAS

1) Rated input power (*in W*);
2) Rated luminous flux (*in lm*);
3) LED luminaire efficacy (*in lm/W*);
4) Luminous intensity distribution;
5) Photometric code;
   - Correlated Colour Temperature (CCT in K);
   - Rated Colour Rendering Index (CRI);
   - Rated chromaticity co-ordinate values (initial and maintained);
   - Maintained luminous flux.

- *performance claims are always measured at a specific ambient temperature (t_q);*
- *maintained values are measured at 25% of rated life time up to a max. of 6.000 hours.*

Photometric Code

six digit photometric code displays important ‘quality of light’ parameters

8	3	0	/	3	5	9

- initial CRI value of 84 – code 8;
- initial CCT value of 3000K – code 30;
- initial spread of chromaticity co-ordinates within a 3-step MacAdam ellipse – code 3;
- maintained spread of chromaticity co-ordinates within a 5-step MacAdam ellipse – code 5;
- maintained luminous flux of 91% – code 9.

(maintained values are measured at 25% of rated life time up to a max. of 6.000 hours)

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Quality Criteria Over Time

> 6000hrs – lifetime claims

- lumen maintenance;
- luminaire life.

Lumen Maintenance Claims

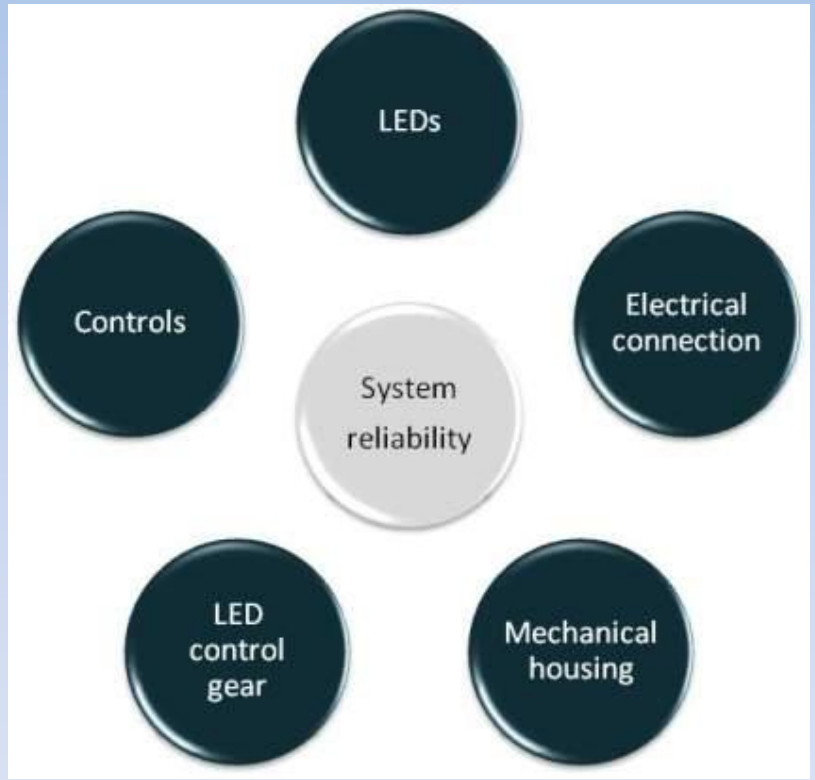
LM-80: 6-10K hrs real measurement.

TM-21: extrapolation 6x measurement .

lumen maintenance LED's used in a LED luminaire

- catastrophic failures of individual LED's are not taken into account;
- no validated way to translate maintenance curve LED's into luminaire.

Luminaire Life Claims



IEC Recommended Lifetime Metrics

LED luminaire life ($L_x F_y$)

lumen maintenance at rated life (L_x)

failure fraction (F_y) (gradual & abrupt)

combination of

- rated life (in h) of the LED module used in the luminaire and the associated rated lumen maintenance (L_x);
- failure fraction (F_y) corresponding to the rated life of the LED module used in the luminaire.

IEC Recommended Lifetime Metrics

gradual light degradation

$L_{70}B_{50}$

life time (hrs) where light output ≥70% for 50% of the population.

abrupt light degradation

L_0C_{10}

life time (hrs) where light output is 0% for 10% of the population.

IEC Recommended Lifetime Metrics

LED luminaire life ($L_x F_y$)

lumen maintenance at rated life (L_x)

failure fraction (F_y) (gradual & abrupt)

	L_xB_y						L_xC_y		L_xF_y					
X	70		80		90		0		70		80		90	
Y	10	50	10	50	10	50	10	50	10	50	10	50	10	50

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Take Away

Remember not to mix up 'Apples & Pears'

1. It is important to compare against a standardised set of quality criteria;
2. Ask for spec's measured in compliance with appropriate standards;
3. Lifetime claims based on 'lumen maintenance' and 'luminaire life' are two different things both taken into consideration;
4. Reputable LED luminaire manufacturers will publish product spec's measured in compliance with IEC/PAS performance requirements.

Take Away

IEC/PAS 62717 – *LED modules for general lighting*;
IEC/PAS 62722 – *LED luminaires for general lighting*.

FOR SALE via http://webstore.iec.ch/

CELMA Guide Apples & Pears: *Why standardisation of performance criteria for LED luminaires is important.*

FOR FREE via http://www.celma.org/

Apples & Pears: *why standardisation of performance requirements for LED luminaires is important.*

Thank You!

PAPER FROM:

APEC LED WORKSHOP: *POLICIES TO PROTECT AND EDUCATE CONSUMERS*

APEC#212-RE-04.1