Overview of International Lighting Standards

Steve Coyne

Director, Light Naturally

UNEP Consultant

UNEP Collaborating Centre for Energy Efficient Lighting

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International Standards Bodies: Relevant to Lighting

International Organisation for Standardisation

International Commission on Illumination

International Electrotechnical Commission

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CIE: Activity

- Devoted to the international cooperation and exchange of information among its member countries on all matters relating to the science and art of lighting

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CIE: Outputs

Produces International Standards that are:

- On aspects of light and lighting that require a unique definition (eg lumen) or understanding (eg glare)
- A primary source of internationally accepted and agreed data which can be taken, essentially unaltered, into universal standard systems. (eg relative photopic response)
- The requirements to perform reproducible photometric and colorimetric measurements
- specifies lighting requirements for situations so that people can perform the visual tasks efficiently, in comfort and safety

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CIE: Structure

- International Divisions

	Division 1: Vision and Colour
	Division 2: Physical Measurement of Light and Radiation
	Division 3: Interior Environment and Lighting Design
	Division 4: Lighting and Signaling for Transport
	Division 5: Exterior Lighting and Other Applications
	Division 6: Photobiology and Photochemistry
	Division 8: Image Technology

- National Committees with mirror Divisions

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IEC: Activity

- Promotes international co-operation on all questions concerning standardization in the electrical and electronic fields

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IEC: Output

- Prepares and publishes International Standards for all electrical, electronic and related technologies.

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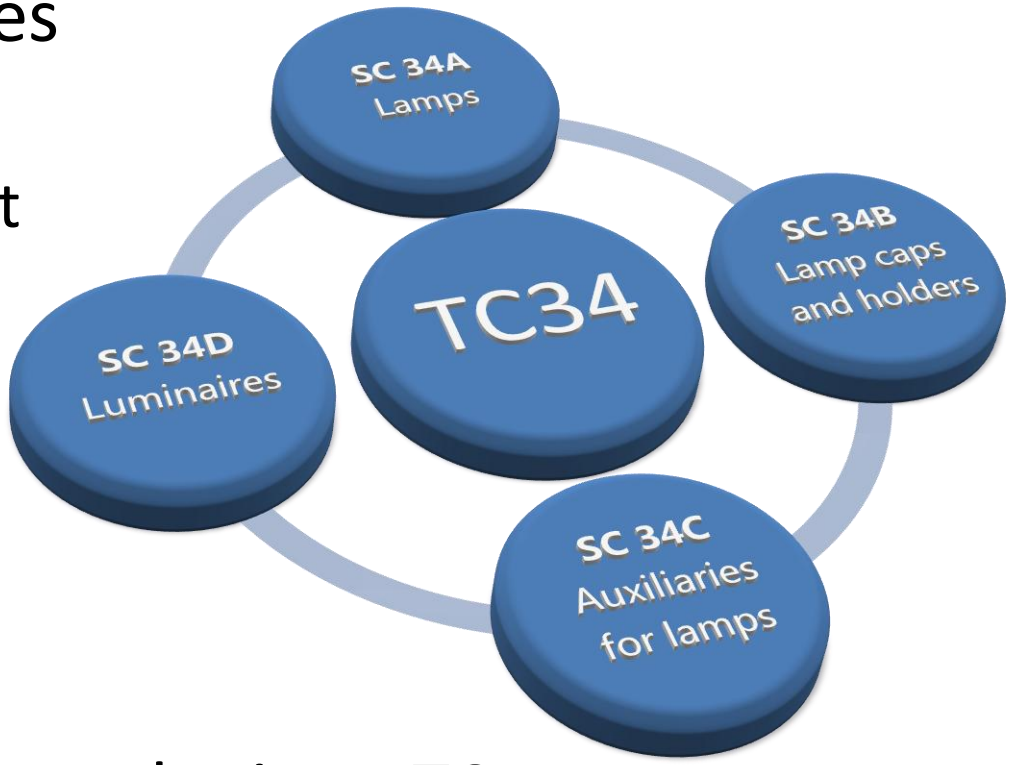
IEC: Structure

- Technical Committees
  - TC34 Lamps
    & related equipment



- National committees and mirror TCs

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ISO: Activity

- Worldwide federation of national standards bodies for preparing International Standards.
- Covering almost every industry, from technology, to food safety, to agriculture and healthcare.

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ISO: Output

- Preparing International Standards carried out through ISO technical committees.
- ISO collaborates closely with the IEC on all matters of electrotechnical standardization and CIE on all matters of light and lighting.
- In the area of lighting publishes jointly with CIE and IEC.

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ISO: Structure

- Technical Committees
  - TC 274 Light and lighting
- National Committees
  - (possibly combined with National CIE committees)

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Other Regional Bodies: Relevant to Lighting Standards

Regional Organisations

Institute of Electrical and Electronics Engineers

European Commission

Illuminating Engineering Society of North America

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National Standards Associations

- Technical committees within National Standards associations generally review international standards for their relevance and applicability to local conditions and regulations (eg climate – ambient temperature, electrical supply, existing wiring laws).
- If changes are required to the international standard, it is published as a “Modified” international standard with the changes clearly marked in the publication.

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Transparency of Modifications to international Standards

AS/NZS 60598.1:2003

AS/NZS variations to draft Edition 6 of IEC 60598.1:2003 are identified separately. Strikethrough (~~example~~) identifies IEC text, tables and figures which, for the purposes of this Australian/New Zealand Standard, are deleted. Where text, tables or figures are added, each is set in its proper place and identified by shading (example). Added figures are not themselves shaded, but are identified by a shaded border. These changes are also included in a new Annex ZZ for easy reference.

~~Luminaires with non-detachable flexible cables or cords which are not fitted include with the manufacturers instructions any information necessary connection, e.g. deviations from the national standardised colour coding of this does not create the possibility of an unsafe situation during ins maintenance.~~

~~NOTE – In some countries, luminaires with non-detachable flexible cables or cords which connected to the supply via a socket-outlet and which are not fitted with a plug are not permitt~~

In Australia, luminaires with non-detachable flexible cables or cords which a connected to the supply via a socket-outlet and which are not fitted wit permitted.

Australian/New Zealand Standard™

Luminaires

Part 1: General requirements and tests (IEC 60598-1:2003, MOD)

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Lighting Standards Types and relevant standards bodies

- Product and connector form and dimensions……
- Product safety requirements
  - Electrical……
  - Mechanical……
  - Photobiological……
  - Flicker & stroboscopic effects……

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Lighting Standards Types

- Product performance requirements
  - Photometric..... IEC
  - Electrical ..... IEC
  - Lifetime ..... IEC
  - Emissions ..... IEC
  - Energy Efficiency ..... Gov't

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Lighting Standards Types

- Product Test methods ..... IES CIE
- Lighting application design requirements..... IES CIE
- Lighting design methods..... IES CIE
- Lighting audit methodologies..... IES CIE

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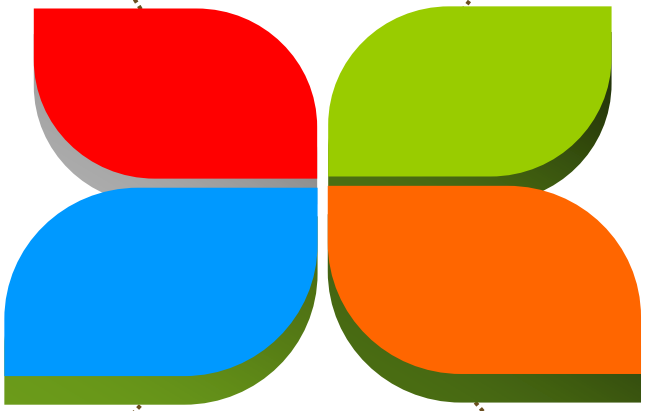
General classification of lighting standards and relevant standards bodies for lighting products

Product safety standard

IEC

Test method standard

CIE



Technical performance requirement

IEC

Energy efficiency regulation

Gov't

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Typical hierarchy of standards

1 Government regulations

Refer to

2 Safety and Performance standards

Refer to

Refer to

3 Test method standards

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International Standards

Body	Lamp/luminaire standard	
IEC	IEC 60081 am6 Ed. 5.0	Amendment 6 - Double-capped fluorescent lamps - Performance specifications ;
	IEC 60969 Ed. 2.0	Self-ballasted compact fluorescent lamps for general lighting services - Performance requirements
	IEC 62031 Ed. 2.0:	LED modules for general lighting - Safety specifications
	IEC 62612 am1 Ed. 1.0	Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements
	IEC 62663-1 Ed. 1.0	Non-ballasted LED-lamps - Part 1: Safety specifications
	IEC 62663-2 Ed. 1.0	Non-integrated LED lamps - Part 2: Performance requirements
	IEC 62717 am1 Ed. 1.0	LED modules for general lighting - Performance requirements
	IEC 62838 Ed. 1.0	Semi-integrated LED-lamps for general lighting services with supply voltages not exceeding 50 V a.c. r.m.s. or 120 V ripple free d.c. - Safety specifications
	IEC 62931 Ed. 1.0	GX16t-5 capped tubular LED lamp - Safety specifications
	IEC/TS 62861 Ed. 1.0	Guide to principal component reliability testing for LED light sources and LED luminaires
	IEC 60598-1:2014	Edition 8.0 Luminaires - Part 1: General requirements and tests
	IEC 60598-2 series	Luminaires. Part 2: Particular requirements
	IEC 62722-1:2014 E1	Luminaire performance - Part 1: General requirements
	IEC 62722-2-1:2014 E1	Luminaire performance - Part 2-1: Particular requirements for LED luminaires

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International Standards

Body	Lamp standard
CIE	**Standards**
	CEI/IEC 62471/CIE S 009/E&F:2006: Photobiological Safety of Lamps and Lamp Systems
	CIE S025/E :2015 Test Method for LED Lamps, LED Luminaires and LED Modules
	Technical Reports, Notes and Guides
	CIE 198:2011: Determination of Measurement Uncertainties in Photometry
	CIE S 021/E:2011: Vehicle Headlighting Systems Photometric Performance - Method of Assessment
	CIE TN 002-2014 Relating photobiological and photochemical quantities to photometry quantities
	CIE TN 001-2014 Chromaticity Difference Specification for Light Sources
	CIE 211:2014 Colour Appearance in Peripheral Vision
	CIE TN 006-2016 Visual Aspects of Modulated Lighting

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International Standards

Body	Lamp standard
ISO	ISO 8995-3:2006(E)/CIE S 016/E:2005: Joint ISO/CIE Standard: Lighting of Work Places - Part 3: Lighting Requirements for Safety and Security of Outdoor Work Places
	ISO 30061:2007(E)/CIE S 020/E:2007: Joint ISO/CIE Standard: Emergency Lighting
	ISO 11664-(1-6) :2007(E)/CIE S 014-2/E:2006: Joint ISO/CIE Standard: Colorimetry
	ISO/CIE 9476 2014: Characterization of the Performance of Illuminance Meters and Luminance Meters

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Standard relat to LED lamp

Standard relat to CFL lamp

LED
CFL

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Summary of key performance and test method standards

Type	Lamp photometric test method standard
Solid -state lighting	CIE S025 EN 13032-4 IES LM-79
Compact fluorescent lamp	CIE 84 IES LM-65 IES LM-66

Type	Lamp Photometric test method standard	Light Source Performance Standard
Others	IES LM-20	IEC 60901
	IES LM-58	IEC 60081
	CIE 13.3	IEC 60969
	CIE 15	IEC 62471
	CIE 43	IEC 62722-2-1
	CIE 63	IEC 62612
	CIE 84	IEC 62717
	CIE 121	IEC 61341
	CIE 127	IEC 62031
	CIE 177	IEC 62560

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Variations between photometric test methods

- Consider carefully the differences between test methods (eg test equipment tolerances and operating conditions)

Document	LM-79 (LED lamps & luminaires)	CIE S025
<Mounting>		
Operating orientation/operating position	Use the operating position recommended by the manufacturer (6.0)	LED lamp: cap up unless otherwise specified by the manufacturer (6.3)
Different position than specified by the manufacturer (or protocol)	Not allowed.	Different burning position allowed with correction (6.3) (This will be elabrated as specified in RR Test Method.)
Ageing/Seasoning	No aging (4.0)	according to appropriate LED device standard

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Example: Regulation Requirements on Test Method Standards: LED products

Attribute	Test methods
* Total luminous flux * Electrical Power * Efficacy * Replacement Lamp Equivalence	CIE S025 LM79 EN 13032-4:2015
* Centre beam luminous intensity * Beam Angle (directional lamps only)	CIE S025 LM79 EN 13032-4 (Refer to IEC 61341)

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Example: Regulation Requirements on Test Method Standards: LED products

Attribute	Test methods
* Colour Appearance	CIE S025 LM79 EN 13032-4:2015 (All refer to CIE S015)
* Colour Rendering	CIE S025 LM79 EN 13032-4:2015 (All refer to CIE 13.3)
* Endurance	
Lamps	IEC 62612: 2013
Modules/packages	IEC 62717: 2014
Luminaires	IEC 62722.2.1: 2011

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Example: Regulation Requirements on Test Method Standards: LED products

Attribute	Test methods
* Power Factor	IEC 61000-3-2 (2014)
* Harmonics	IEC 61000-4-7
* Standby Power (smart lamps only)	IEC 62301 (or IEA 4E SSL Task 7 2016 publication) New proposal in IEC
* Smart Lighting – controlled variations in power consumption (smart lamps only)	Energy Star Lamps v2 Section 12.9

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Example: Regulation Requirements on Test Method Standards: LED products

Attribute	Test methods
* Lumen maintenance	IESNA LM80/TM21 & ISTMT (IEC 60598.1 Section 12.4.1) Or IESNA LM84/TM28
* Colour maintenance	ISTMT (IEC 60598.1 Section 12.4.1) & IESNA LM80 Or IESNA LM84

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Example: Regulation Requirements on Test Method Standards: LED products

Attribute	Test methods
* Photo biological Safety	IEC 62471/CIE S009
* Flicker	IEEE 1789 See CIE TN 006-2016 Visual Aspects of Modulated Lighting

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Example: Regulation Requirements on Test Method Standards: LED products

Attribute	Test methods
* Dimmer compatibility	To be developed See IEC TR 63036 Electrical interface specification for phase-cut dimmer in phase-cut dimmed lighting systems Draft IEC DTR 63037 Electrical interface specification for self-ballasted lamps and controlgear in phase-cut dimmed lighting systems
* ELV converter compatibility	To be developed

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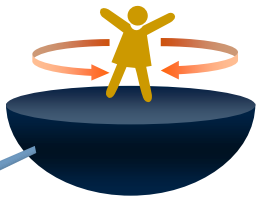
4. *Trend of International standards*

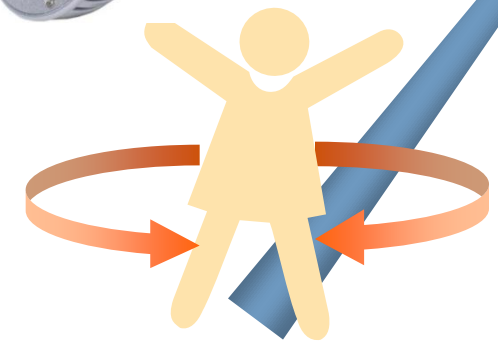
Incandescent lamp

CFL



LED

lighting system



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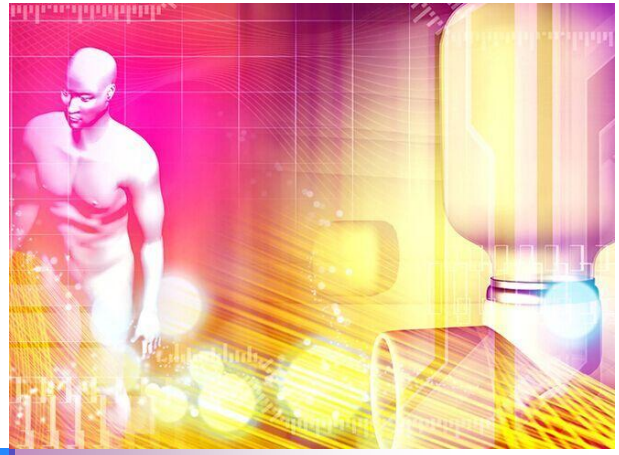
Trends in lighting and international standards

smart lighting



intelligent lighting

human centric lighting

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LED Integrated Luminaires

LED products


LED Bulb lamp

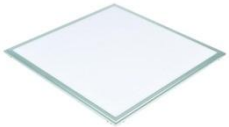

LED directional l amp


LED road luminaire


LED Downlight luminaire


LED tunnel luminaire


LED tubular lamp


LED panel luminaire

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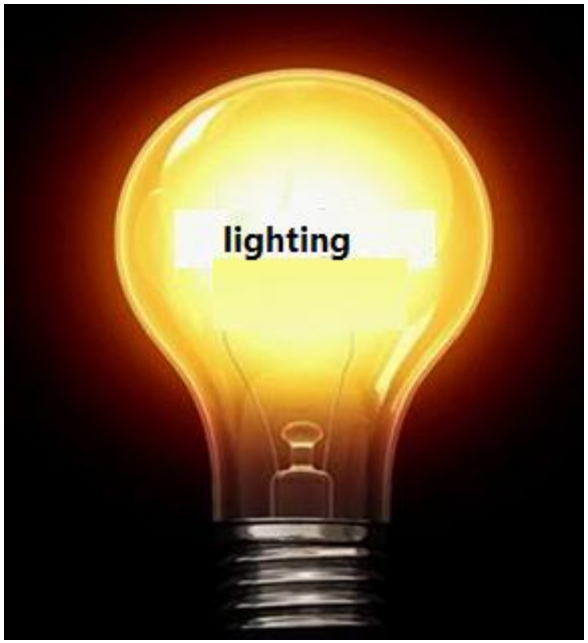
Product classification

W

lm



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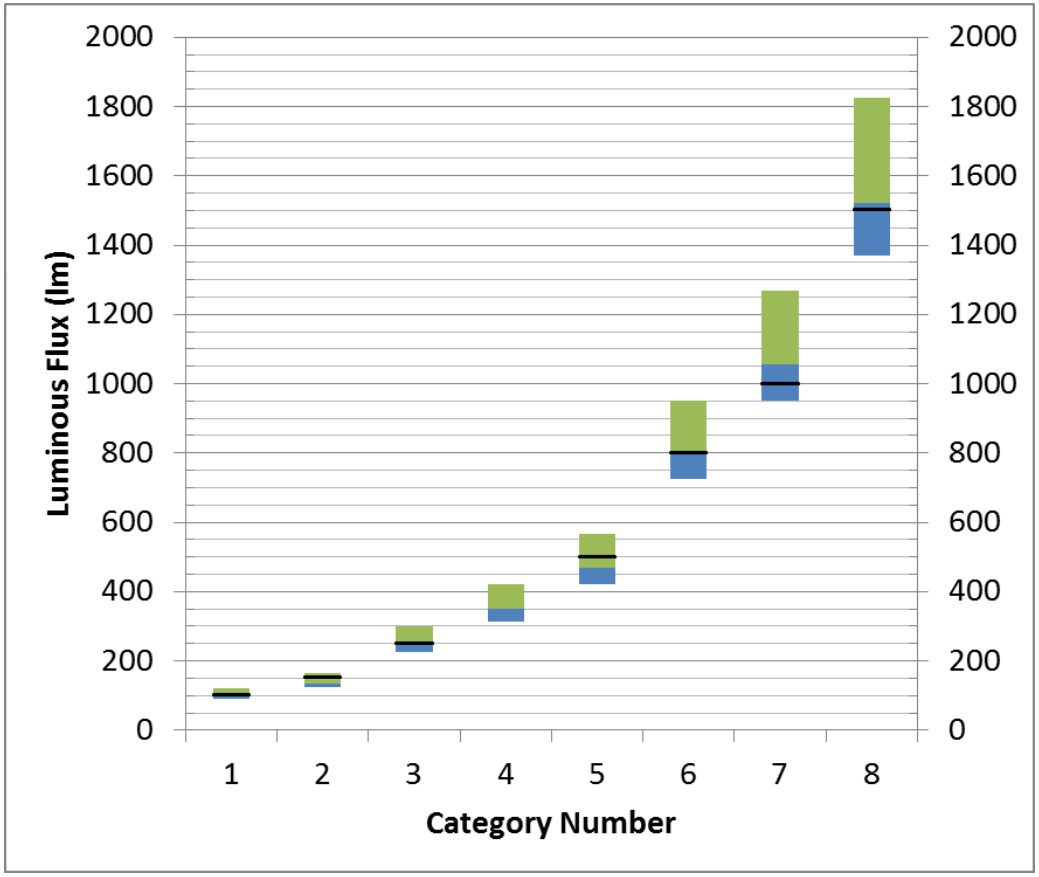
Lumen Grouping

Classification Self-ballast LED lamp (IEC 62612)
150 lm
250 lm
500 lm
800 lm
1000 lm
1500 lm
2000 lm
3000 lm



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Smart Lamps and Power Consumption

Report: IEA 4E Solid State Lighting Annex: Task 7: Smart Lighting – New Features Impacting Energy Consumption

http://ssl.iea-4e.org/news/smart-lighting

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Smart lamps and Power Consumption

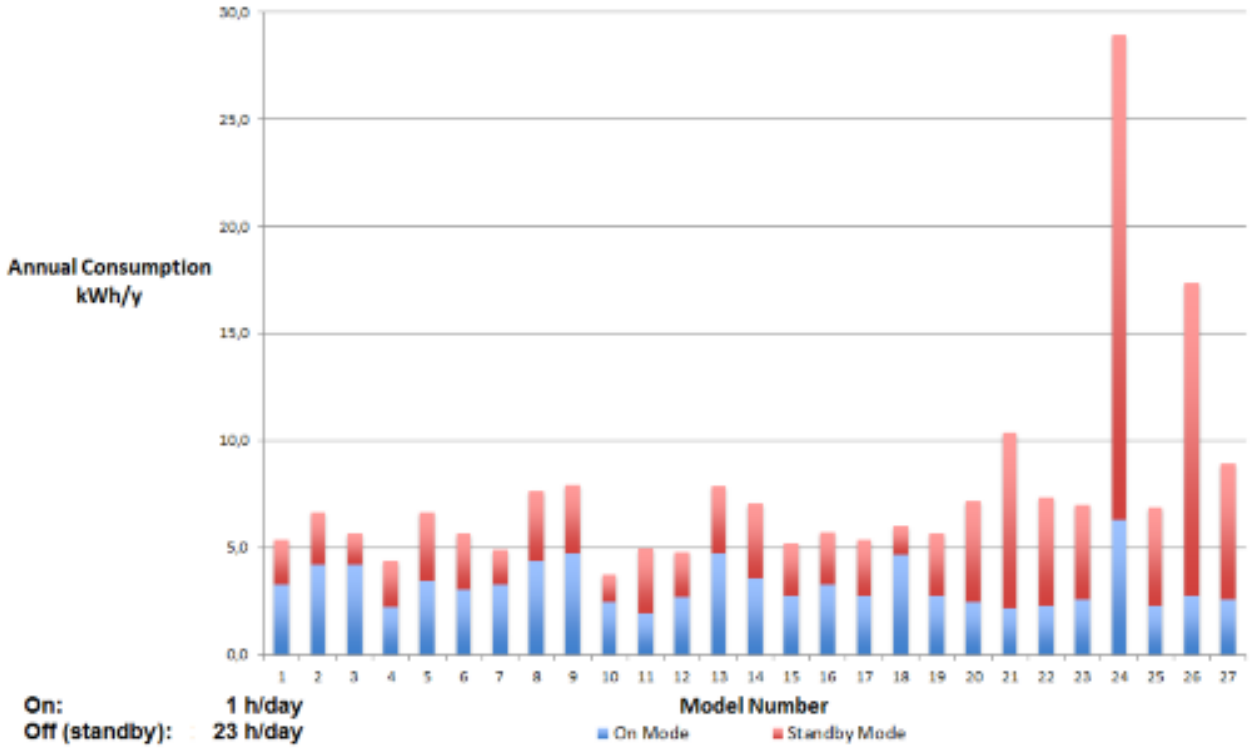

Figure 13. Annual energy consumption for 27 smart lamps models in operation 1 hour/day

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Flicker measurement & metrics

IEEE Std 1789-2015
IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers

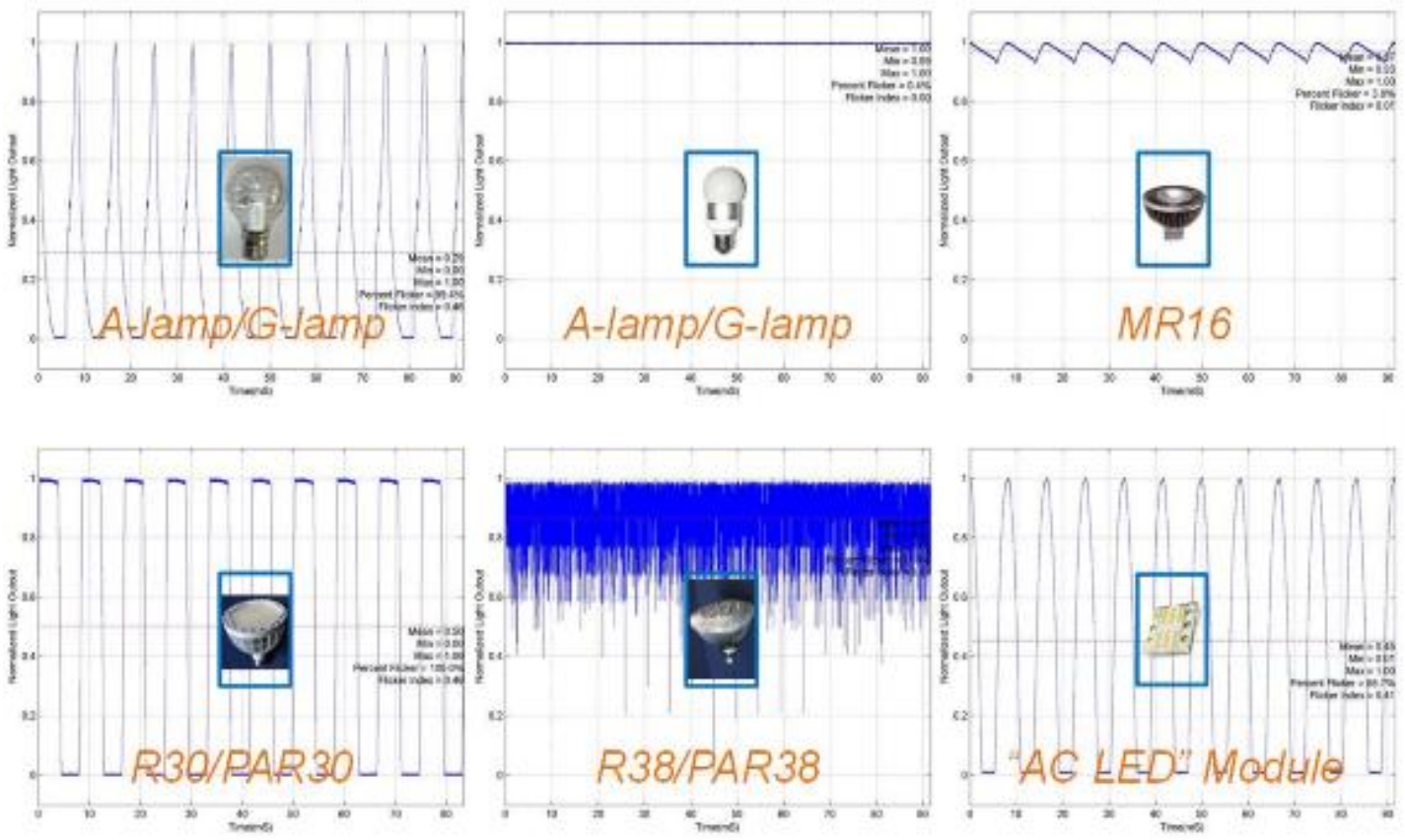

Figure 13—Experimental data of flicker in LED lighting sources (Lehman et al. [B71])

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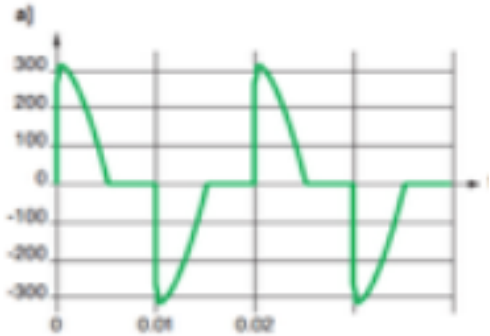
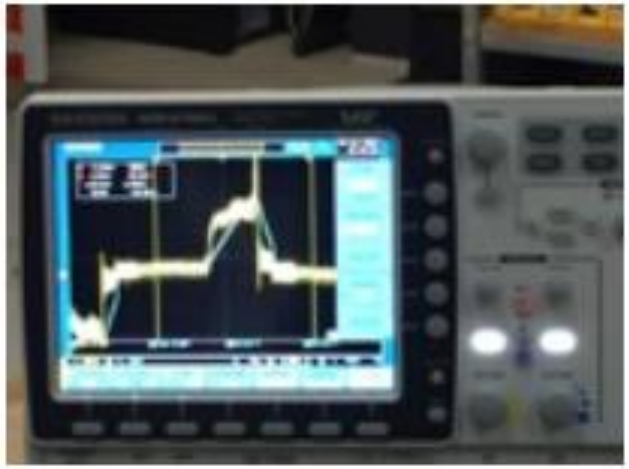
Lighting product compatibility

- Phasecut dimmers and LED control gear
  - Test methods
  - Metrics of compatibility





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