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for Ecodesign and/or Energy Labelling Requirements
('Lot 8/9/19').

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Scope, Standards, Legislation

Energy

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Annex A. STATEMENT OF CONTRACTOR ON RIGHT TO DELIVERED RESULT

I, Dirk Fransaer, representing the "Consortium of VITO NV, VHK BV, Viegand & MaagØe ApS, Wuppertal Institute for Climate, Environment and Energy GmbH, and ARMINES", party to the contract 'Preparatory Study on Lighting Systems for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19'), specific contract No. ENER/C3/2012-418 LOT1/07/SI2.668526 implementing framework contract No. ENER/C3/2012-418-Lot 1', warrant that the Contractor holds full right to the delivered Task 1 report and accompanying Task 1 Annexes of the 'Preparatory Study on Lighting Systems for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19')', which is free of any claims, including claim of the creators who transferred all their rights and will be paid as agreed within 30 days from the receipt of confirmation of acceptance of work.

Mol, Belgium,

Date:

Signature:

Dirk Fransaer

Managing Director VITO NV

Annex B. DEFINITIONS

Most definitions that follow have been taken from the existing regulations on lighting: 244/2009 (non-directional household lighting), 245/900 (tertiary lighting), 874/2012 (energy labelling) and 1194/2012 (directional lamps). Additional definitions or term descriptions have been taken from previous lighting studies [1] and from the ILV [2]. The source(s) from which a definition has been taken is (are) usually indicated between parentheses, following the definition itself.

Where the definition for the same term is not identical for all sources, usually the definition from the most recent regulations 874/2012 and 1194/2012 has been used.

B.1 Definitions for types of lighting

'*Lighting*' means the application of light to a scene, objects or their surroundings so that they may be seen by humans; (1194/2012) (874/2012)

'*General lighting*' means substantially uniform lighting of an area without provision for special local requirements; (245/2009)

'*Office lighting*' means a fixed lighting installation for office work intended to enable people to perform visual tasks efficiently and accurately; (245/2009)

'*Public street lighting*' means a fixed lighting installation intended to provide good visibility to users of outdoor public traffic areas during the hours of darkness to support traffic safety, traffic flow and public security; (245/2009)

'*Household room illumination*' means the full or partial illumination of a household room, by replacing or complementing natural light with artificial light, in order to enhance visibility within that space; (244/2009)

'*Accent lighting*' means a form of lighting where light is directed so as to highlight an object or a part of an area; (1194/2012) (874/2012) [3]

'*Light pollution*' means the sum of all adverse impacts of artificial light on the environment, including the impact of obtrusive light. (245/2009)

'*Obtrusive light*' means the part of the light from a lighting installation that does not serve the purpose for which the installation was designed. It includes (245/2009):

- light improperly falling outside the area to be lit,
- diffused light in the neighbourhood of the lighting installation,
- sky glow, which is the brightening of the night sky that results from the direct and indirect reflection of radiation (visible and non-visible), scattered from the constituents of the atmosphere (gas molecules, aerosols and particulate matter) in the direction of observation.

[1] Preparatory Studies for Eco-design requirements of EuPs, Final Reports for Lot 19 Domestic lighting, Lot 9 Public Street lighting and Lot 8 Office lighting, and Exploratory Study on lighting systems, Final Report for Lot 37. See full references in the main text of the Task 0 report.

[2] CIE S 017/E:2011, 'ILV: International lighting vocabulary, new', http://eilv.cie.co.at/.

[3] If the lamp's beam angle is ≥ 90° and its useful luminous flux is thus to be measured in a 120° cone, the lamp is not suitable for accent lighting, Regulation 1194/2012, Annex III, 3.1.2(j).

B.2 Definitions for types of lighting products

'*Electrical lighting product*' means a product designed for use with electricity and intended for use in lighting; (1194/2012)

'*Luminaire*' means an apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes all the parts necessary for supporting, fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply; (1194/2012) (874/2012)[4]

'*Lamp*' means a unit whose performance can be assessed independently and which consists of one or more light sources. It may include additional components necessary for starting, power supply or stable operation of the unit or for distributing, filtering or transforming the optical radiation, in cases where those components cannot be removed without permanently damaging the unit; (1194/2012) (874/2012)

'*Light source*' means a surface or object designed to emit mainly visible optical radiation produced by a transformation of energy. The term 'visible' refers to a wavelength of 380-780 nm; (1194/2012) (874/2012)

'*White light source*' means a light source having chromaticity coordinates that satisfy the following requirement:

- $0.270 < x < 0.530$
- $-2.3172\ x^2 + 2.3653\ x - 0.2199 < y < -2.3172\ x^2 + 2.3653\ x - 0.1595$ (245/2009)

'*Household lamp*' means a lamp intended for household room illumination; it does not include special purpose lamps; (244/2009)

'*Special purpose lamp*' see par. 1.4.1.5 of the main text.

'*Directional lamp*' means a lamp having at least 80 % light output within a solid angle of π sr (corresponding to a cone with angle of 120°); (244/2009) (1194/2012) (874/2012)

'*Non-directional lamp*' means a lamp that is not a directional lamp; (244/2009) (1194/2012) (874/2012)

'*Clear lamp*' is a lamp (excluding compact fluorescent lamps) with a luminance above 25 000 cd/m^2 for lamps having a luminous flux below 2 000 lm and above 100 000 cd/m^2 for lamps having more luminous flux, equipped with only transparent envelopes in which the light producing filament, LED or discharge tube is clearly visible; (244/2009)

'*Non-clear lamp*' is a lamp that does not comply with the specifications for a 'Clear lamp', including compact fluorescent lamps; (244/2009)

B.3 Definitions for types of lamps (other than LED)

'*Filament lamp*' means a lamp in which light is produced by means of a threadlike conductor which is heated to incandescence by the passage of an electric current. The lamp may contain gases influencing the process of incandescence; (244/2009) (1194/2012) (874/2012)

'*Incandescent lamp*' means a filament lamp in which the filament operates in an evacuated bulb or is surrounded by inert gas; (244/2009) (1194/2012) (874/2012)

[4] In an older definition of 'luminaire' (from regulation 245/2009), the term 'light source' was used instead of the term 'lamp'. In addition, in regulation 245/2009, the definition explicitly stated that the light sources themselves are NOT part of the luminaire. This statement is no longer present in the more recent definition.

'(Tungsten) halogen lamp' means a filament lamp in which the filament is made of tungsten and is surrounded by gas containing halogens or halogen compounds; it may be supplied with an integrated power supply; (1194/2012) (874/2012)

'*Discharge lamp*' means a lamp in which the light is produced, directly or indirectly, by an electric discharge through a gas, a metal vapour or a mixture of several gases and vapours; (244/2009) (245/2009) (1194/2012) (874/2012)

'*Fluorescent lamp*' means a discharge lamp of the low-pressure mercury type in which most of the light is emitted by one or more layers of phosphors excited by the ultraviolet radiation from the discharge. Fluorescent lamps may be supplied with an integrated ballast; (1194/2012) (874/2012)

'*Compact fluorescent lamp*' means a fluorescent lamp that includes all the components necessary for starting and stable operation of the lamp; (1194/2012) (874/2012)

'*Fluorescent lamp without integrated ballast*' means a single or double capped fluorescent lamp without integrated ballast; (244/2009) (245/2009) (1194/2012) (874/2012)

'*High intensity discharge lamp*' means an electric discharge lamp in which the light-producing arc is stabilised by wall temperature and the arc has a bulb wall loading in excess of 3 watts per square centimetre; (244/2009) (245/2009) (1194/2012) (874/2012)

'*High-pressure mercury (vapour) lamp*' means a high intensity discharge lamp in which the major portion of light is produced, directly or indirectly, by radiation from mercury operating at a partial pressure in excess of 100 kilopascals. (245/2009)

'*High-pressure sodium (vapour) lamp*' means a high intensity discharge lamp in which the light is produced mainly by radiation from sodium vapour operating at a partial pressure of the order of 10 kilopascals. (245/2009)

'*Metal halide lamp*' means a high intensity discharge lamp in which the light is produced by radiation from a mixture of metallic vapour, metal halides and the products of the dissociation of metal halides. (245/2009)

'*Blended lamp*' is a lamp containing a mercury vapour lamp and an incandescent lamp filament connected in series in the same bulb; (347/2010)

B.4 Definitions for LEDs

'*Light emitting diode (LED)*' means a light source which consists of a solid state device embodying a p-n junction *of inorganic material*. The junction emits optical radiation when excited by an electric current; (1194/2012) (874/2012)[5]

'*LED package*' means an assembly having one or more LED(s). The assembly may include an optical element and thermal, mechanical and electrical interfaces; (1194/2012) (874/2012)

'*LED module*' means an assembly having no cap and incorporating one or more LED packages on a printed circuit board. The assembly may have electrical, optical, mechanical and thermal components, interfaces and control gear; (1194/2012) (874/2012)

'*LED lamp*' means a lamp incorporating one or more LED modules. The lamp may be equipped with a cap; (1194/2012) (874/2012)

[5] In regulation 1194/2012 the definition includes the specification '*of inorganic material*', which is maintained here and excludes OLEDs. In regulation 874/2012 this specification is absent, thus including OLEDs.

B.5 Definitions for lamp parameters

'*Luminous flux*' (Φ) means the quantity derived from radiant flux (radiant power) by evaluating the radiation in accordance with the spectral sensitivity of the human eye. Without further specification it refers to the initial luminous flux [6] (unit: lumen, lm); (1194/2012)

'*Initial luminous flux*' means the luminous flux of a lamp after a short operating period; (1194/2012)

'*Useful luminous flux*' (Φ_{use}) means:

- the entire luminous flux (in all directions) for non-directional lamps,
- the part of the luminous flux of a lamp falling within a cone of 120° ($\Phi_{120°}$) for directional lamps with a beam angle ≥ 90° other than filament lamps,
- the part of the luminous flux of a lamp falling within a cone of 90° ($\Phi_{90°}$) for other directional lamps. [7].

'*Beam angle*' means the angle between two imaginary lines in a plane through the optical beam axis, such that these lines pass through the centre of the front face of the lamp and through points at which the luminous intensity is 50 % of the centre beam intensity, where the centre beam intensity is the value of luminous intensity measured on the optical beam axis; (1194/2012)

'*Luminous intensity*' means the quotient of the luminous flux leaving the source and propagated in the element of solid angle containing the given direction, by the element of solid angle (unit: candela, cd); (1194/2012)

'*Luminance*' means the amount of light, per unit of apparent surface, that is emitted by or reflected by a particular area within a given solid angle (unit: cd/m^2); (244/2009)

'*Luminous efficacy*' (η_x) means the quotient of the useful luminous flux emitted (Φ_{use}) by the power consumed (P_x): $\eta_x = \Phi_{use}/ P_x$. It can be specified for a light source (η_{source}, P_{source}) or for a lamp (η_{lamp}, P_{lamp}). If not specified otherwise, the power dissipated by ballast, control gear, transformers, inverters, control device and power supply is excluded from the power (P_x). (unit: lm/W). [8]

'*Lamp lumen maintenance factor*' (LLMF), means the ratio of the luminous flux emitted by the lamp at a given time in its life to the initial luminous flux; (244/2009) (245/2009) (1194/2012)[9]

'*Lamp survival factor*' (LSF), means the defined fraction of the total number of lamps that continue to operate at a given time under defined conditions and switching frequency; (244/2009) (245/2009) (1194/2012)

'*Light distribution*', used especially for more energy efficient lamp retrofit solutions and directional light sources. The distribution can be given in different forms (flux code, polar intensity curve, Cartesian diagram or illuminance cone diagram) but should at least be available as CEN / CIE flux code (source EN 13032-2). This flux code represents the optical characteristics of the luminaire, and consists of 9 whole numbers separated by spaces defined as in the next list and Figure 1:

[6] Regulations 244/2009 and 245/2009 are more specific: "*measured after 100 hours of lamp running time*"
[7] For directional lamps, see also regulation 1194/2012 Annex III and point 3.1.2(j).
[8] This definition is an adapted version of the definitions in 244/2009 and 245/2009.
[9] In regulation 244/2009 it is specified that 'initial' means 100 hours, but this is not present in later definitions.

FCL1/FCL4	= N1
FCL2/FCL4	= N2
FCL3/FCL4	= N3
DFF	= N4
LOR	= N5
FCU1/FCU4	= N6
FCU2/FCU4	= N7
FCU3/FCU4	= N8
UFF	= N9

- UFF is upward flux fraction (= ULOR/LOR= 1-DFF)
- DFF is downward flux fraction (=DLOR/LOR)
- LOR is light output ratio.
- FCL1-4 are accumulated luminous fluxes in lower hemisphere for the four zones from 0° to 41.4° (FCL1), 60° (FCL2), 75.5° (FCL3) and 90° (FCL4).
- FCU1-4 are accumulated luminous fluxes in upper hemisphere for the four zones from 180° to 138.6° (FCU1), 120° (FCU2), 104.5° (FCU3) and 90° (FCU4).

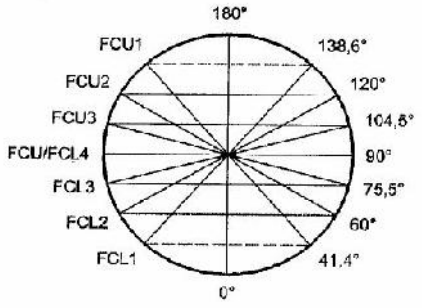


Figure 1: Zones for the calculation of accumulated luminous fluxes according to the CEN flux-code.

'*Lamp lifetime*' means the period of operating time after which the fraction of the total number of lamps which continue to operate corresponds to the lamp survival factor of the lamp under defined conditions and switching frequency. For LED lamps, lamp lifetime means the operating time between the start of their use and the moment when only 50 % of the total number of lamps survive or when the average lumen maintenance of the batch falls below 70 %, whichever occurs first; (1194/2012)

'*Chromaticity*', means the property of a colour stimulus defined by its chromaticity coordinates, or by its dominant or complementary wavelength and purity taken together; (244/2009) (245/2009) (1194/2012)

'*Correlated colour temperature*' (Tc [K]), means temperature of a Planckian (black body) radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions; (244/2009) (245/2009) (1194/2012)

'*Colour rendering*' (Ra), means the effect of an illuminant on the colour appearance of objects by conscious or subconscious comparison with their colour appearance under a reference illuminant; (244/2009) (245/2009) (1194/2012)

'*Colour consistency*' means the maximum deviation of chromaticity coordinates (x and y) of a single lamp from a chromaticity centre point (cx and cy), expressed as the size (in steps) of the MacAdam ellipse formed around the chromaticity centre point (cx and cy); (1194/2012)

'*White light source*' means a light source having chromaticity coordinates that satisfy the following requirement:

- $0.270 < x < 0.530$
- $-2.3172\ x^2 + 2.3653\ x - 0.2199 < y < -2.3172\ x^2 + 2.3653\ x - 0.1595$ (245/2009)

'*MacAdam ellipse*': region on a chromaticity diagram which contains all colours which are indistinguishable, to the average human eye, from the colour at the centre of the ellipse. MacAdam ellipses are described as having 'steps' which really means 'standard deviations'. If a large sample of the population were used and if a trained observer could reliably repeat his observations, then the steps would translate to probabilities for the general population as follows:1 sd = 68.26 % of the general, colour-normal population 2 sd = 95.44 % "3 sd = 99.44 %. Any point on the boundary of a '1-step' ellipse, drawn around a target, represents 1 standard deviation from the target. For a '3-step'ellipse, the boundary represents 3 standard deviations from the target, and so on. (Lot 8)

'*Specific effective radiant ultraviolet power*', means the effective power of the ultraviolet radiation of a lamp weighted according to the spectral correction factors and related to its luminous flux (unit: mW/klm); (244/2009)

'*Lamp start time*', the time needed, after the supply voltage is switched on, for the lamp to start fully and remain alight; (244/2009) (1194/2012)

'*Lamp warm-up time*' the time needed after start-up, for the lamp to emit a defined proportion of its stabilised luminous flux; (1194/2012) (244/2009)

'*Lamp mercury content*', means the amount of mercury contained in the lamp. (245/2009) (1194/2012)

B.6 Definitions for ballasts / control gears

'*Ballast*' means lamp control gear inserted between the supply and one or more discharge lamps which, by means of inductance, capacitance or a combination of inductance and capacitance, serves mainly to limit the current of the lamp(s) to the required value; (1194/2012) (874/2012)[10]

'*Lamp control gear*' means a device located between the electrical supply and one or more lamps, which provides a functionality related to the operation of the lamp(s), such as transforming the supply voltage, limiting the current of the lamp(s) to the required value, providing starting voltage and preheating current, preventing cold starting, correcting the power factor or reducing radio interference. The device may be designed to connect to other lamp control gear to perform these functions. The term does not include (1194/2012):

- control devices
- *power supplies within the scope of Commission Regulation (EC) No 278/2009* [11] [12];

[10] In regulations 244/2009 and 245/2009 it was explicitly stated that a ballast might also include means for dimming the lamp. In regulations 874/2012 and 1194/2012 dimming is not explicitly mentioned but it is also not excluded, because 'ballast' refers to 'control gear' and the latter can include a 'functionality related to the operation of the lamp' (and dimming seems to be such a functionality). However, in the more recent regulations 'dimming' is more closely related to a 'Control Device' than to a 'Ballast/Control Gear'.

[11] COMMISSION REGULATION (EC) No 278/2009 of 6 April 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies, OJ L 93/3 7.4.2009, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:093:0003:0010:EN:PDF

[12] In regulation 874/2012 the last line reads: "power supplies converting the mains voltage to another supply voltage that are designed to supply in the same installation both lighting products and products whose primary purpose is not lighting"

'*External lamp control gear*' means non-integrated lamp control gear designed to be installed outside the enclosure of a lamp or luminaire, or to be removed from the enclosure without permanently damaging the lamp or the luminaire; (1194/2012) (874/2012)

'*Halogen lamp control gear*' means lamp control gear that transforms mains voltage to extra low voltage for halogen lamps; (1194/2012) (874/2012)

'Magnetic ballast', generally containing up to 3 parts: ballast coil, igniters (optional), power factor capacitor. 'Magnetic ballasts are also called 'electromagnetic ballast' or 'conventional ballast' and operate the lamp at grid frequency 50 Hz (60 Hz). (Lot 8)

'Electronic ballasts' operate the lamp at high Frequency (HF). These ballasts require a lower system power, mainly due to the 10% efficacy gain of the lamp, when it is operated at high frequencies. Also called 'ballast for lamp at HF (High Frequency)' or 'electronic control gear'.

'*Ballast efficiency*' ($\eta_{ballast}$), means the ratio between the lamp power (ballast output) and the input power of the lamp-ballast circuit with possible sensors, network connections and other auxiliary loads disconnected. (245/2009)

'*Efficiency Base ballast*' (EBb) means the relationship between the rated lamp power (P_{lamp}) and the ballast efficiency. For ballasts for single and double capped fluorescent lamps, the EBb_{FL} is calculated as follows:

When $P_{lamp} \leq 5$ W : $EBb_{FL} = 0.71$

When 5 W < P_{lamp} < 100 W : $EBb_{FL} = P_{lamp}/(2*sqrt(P_{lamp}/36)+38/36*P_{lamp}+1)$

When $P_{lamp} \geq 100$ W : $EBb_{FL} = 0.91$

'*Ballast Lumen Factor (BLF)*': ratio of the luminous flux emitted by a reference lamp when operated with a particular production ballast (at the rated voltage of the ballast) to the luminous flux emitted by the same lamp when operated with its reference ballast. (Lot 8)

'*Ballast Maintenance Factor (BMF)*': the ratio of the worst ballast efficiency at a given time in its life to the initial ballast efficiency in standard conditions at maximum power without lamp dimming (Lot 8)

'*Ballast Gain Factor (BGF)*': the ratio of the average power consumption with lamp dimming to the maximum power consumption without lamp dimming

'*Power factor*', means the ratio of the absolute value of the active power to the apparent power under periodic conditions; (244/2009) (1194/2012)

'*No-load mode*' means the condition of a lamp control gear where it is connected to the supply voltage and where its output is disconnected in normal operation from all the primary loads by the switch intended for this purpose (a faulty or missing lamp, or a disconnection of the load by a safety switch is not normal operation); (1194/2012)

'*No-load power*' means the power consumed by the lamp control gear in no-load mode; (1194/2012)

'Standby mode' means a mode of lamp control gear where the lamps are switched off with the help of a control signal under normal operating conditions. It applies to lamp control gear with a built-in switching function and permanently connected to the supply voltage when in normal use; (1194/2012)

'*Standby power*' means the power consumed by the lamp control gear in standby mode; (1194/2012)

B.7 Definitions for control devices

'*Control device*' means an electronic or mechanical device controlling or monitoring the luminous flux of the lamp by other means than power conversion, such as timer switches, occupancy sensors, light sensors and daylight regulation devices. In addition, phase cut dimmers shall also be considered as control devices; (1194/2012) (874/2012)

'*Control signal*' means an analogue or digital signal transmitted to the control gear wirelessly or wired either via voltage modulation in separate control cables or via modulated signal in the supply voltage; (1194/2012)

'*Dimmer*' means a device that regulates the light output of a light source; (VITO, 2014 [13])

'*Electrical switch*' means a device that switches off the electrical supply, it can be electronic or mechanical and can also include dimming functions, presence detection etc.; (VITO, 2014)

'*Sensor*' means a device that measures the light (light sensor) or that detects the presence of persons (presence detection sensor); (VITO, 2014)

'*Control and management unit*' means a unit that processes the received signals from switches and sensors and that manages the lighting in the installation by dimming or switching on and off; (VITO, 2014)

'*Communication network*' means a network between installation and control unit, wireless or not, that transports the signals to and from the control and management unit; (VITO, 2014)

B.8 Definitions for luminaires

'*Ingress protection grading*', means a coding system to indicate the degree of protection provided by an enclosure against ingress of dust, solid objects and moisture and to give additional information in connection with such protection.

'*Luminaire Maintenance Factor*' (LMF), means the ratio of the light output ratio of a luminaire at a given time to the initial light output ratio. (245/2009)

'*Light Output Ratio (LOR)*': ratio of the total flux of the luminaire, measured under specified practical conditions with its own lamps and equipment, to the sum of the individual luminous fluxes of the same lamps when operated outside the luminaire with the same equipment, under specified conditions (Lot 8).

'*Downward Light Output Ratio (DLOR)*': ratio of the downward flux of the luminaire, measured under specified practical conditions with its own lamps and equipment, to the sum of the individual luminous fluxes of the same lamps when operated outside the luminaire with the same equipment, under specified conditions. (Lot 8)

'*Upward Light Output Ratio (ULOR)*': ratio of the upward flux of the luminaire, measured under specified practical conditions with its own lamps and equipment, to the sum of the individual luminous fluxes of the same lamps when operated outside the luminaire with the same equipment, under specified conditions. (Lot 8)

'*Utilance*' (of an installation, for a reference surface)(U)): ratio of the luminous flux received by the reference surface to the sum of the individual total fluxes of the luminaires of the installation. (Lot 8)

[13] "Exploratory study on lighting systems, including lighting schemes, luminaires and lighting controls for intelligent systems, for Ecodesign, Energy labelling, and/or Energy performance of building requirements ('Lot 37'), final report VITO march 2014, not publicly available.

'*Utilisation Factor*' (UF = UxLOR) of an installation for a reference surface, means the ratio of the luminous flux received by the reference surface to the sum of the individual total fluxes of the lamps of the installation. (245/2009) (Lot 8)

'*Luminaire Efficacy Rating (LER)*': is the Light Output Ratio of the luminaire multiplied with the ballast efficiency and the lamp efficacy. LER = LOR x ηballast x ηlamp with LOR in luminaire standard working conditions (ambient temperature 25°) and ηlamp at 25°C. (Lot 8)

B.9 Other definitions

'*Second lamp envelope*' means a second outer lamp envelope which is not required for the production of light, such as an external sleeve for preventing mercury and glass release into the environment in case of lamp breakage, for protecting from ultraviolet radiation or for serving as a light diffuser. In determining the presence of a second lamp envelope, the arc tubes of high intensity discharge lamps shall not count as a lamp envelope. (244/2009) (245/2009) [14]

'*Anti-glare shield*' means a mechanical or optical reflective or non-reflective impervious baffle designed to block direct visible radiation emitted from the light source of a directional lamp, in order to avoid temporary partial blindness (disability glare) if viewed directly by an observer. It does not include surface coating of the light source in the directional lamp; (1194/2012)

'*Lamp cap*' means that part of a lamp which provides connection to the electrical supply by means of a lamp holder or lamp connector and may also serve to retain the lamp in the lamp holder; (874/2012), very similar: (244/2009) (1194/2012)

'*Lamp holder*' or '*socket*' means a device which holds the lamp in position, usually by having the cap inserted in it, in which case it also provides the means of connecting the lamp to the electric supply; (244/2009) (1194/2012) (874/2012)

'*Switching cycle*' means the sequence of switching the lamp on and off at set intervals; (244/2009) (1194/2012)

'*Premature failure*' means when a lamp reaches the end of its life after a period in operation which is less than the rated life time stated in the technical documentation; (1194/2012) (244/2009)

'*End-user*' means a natural person buying or expected to buy a *product* for purposes which are outside his trade, business, craft or profession; (1194/2012)[15]

'*Final owner*' means the person or entity owning a product during the use phase of its life cycle, or any person or entity acting on behalf of such a person or entity. (1194/2012) (874/2012)

'*Point of sale*' means a physical location where the product is displayed or offered for sale, hire or hire-purchase to the end-user; (874/2012)

'*Compatibility*' means that when a product is intended to be installed in an installation, inserted into another product or connected to it through physical contact or wireless connection,

(i) it is possible to perform the installation, insertion or connection; and
(ii) shortly after starting to use them together, end-users are not led to believe that any of the products has a defect; and
(iii) the safety risk of using the products together is not higher than when the same products taken individually are used in combination with other products. (1194/2012)

[14] The definitions in 244/2009 and 245/2009 are not identical. The current definition integrates both.
[15] Regulation 874/2012 specifies '*an electrical lamp or luminaire*' instead of the more generic '*product*'.

'*Rated value*' is/means the value of a quantity used for specification purposes, established for a specified set of operating conditions of a product. Unless stated otherwise, all requirements are set in rated values; (244/2009) (1194/2012)

'*Nominal value*' means the value of a quantity used to designate and identify a product; (244/2009) (1194/2012)

Annex C. SELECTED LAMP CAP/SOCKET TYPES

This annex contains figures of most of the socket and cap types mentioned in the lighting regulations. The intention of this annex is not to provide a full survey of all existing socket and cap types, nor to present the exact formal definitions of these types. For more detailed official information, see standard IEC 60061.

Figure 2: Example of lamps with socket type E14

(14 mm Small Edison Screw, IEC 60061-1 standard sheet 7004-23).

Figure 3: Example of lamps with socket type E27

(27 mm [Medium] Edison Screw, IEC 60061-1 standard sheet 7004-21).

Figure 4: Example of lamps with socket type E40, typically used for lamps > 500 W

(40 mm Mogul or Goliath Edison Screw, IEC 60061-1 standard sheet 7004-24).

Figure 5: Example of lamps with socket type B15d

(15 mm Small Bayonet Cap, IEC 60061-1 standard sheet 7004-11).

Figure 6: Example of lamps with socket type B22d

(22 mm Bayonet Cap, IEC 60061-1 standard sheet 7004-10).

Figure 7: Example of (incandescent) lamps with cap type S15s or S19

(these lamps are also referred to as striplights).

Figure 8: Example of lamps with cap type S14s or S14d, placed on the side of a linear lamp.

Figure 9: Linear halogen capsule with R7s type socket.

Figure 10: Miniature halogen capsule (left) and LED lamp (right) with G9 type socket (mains voltage use; 9 mm is pin distance).

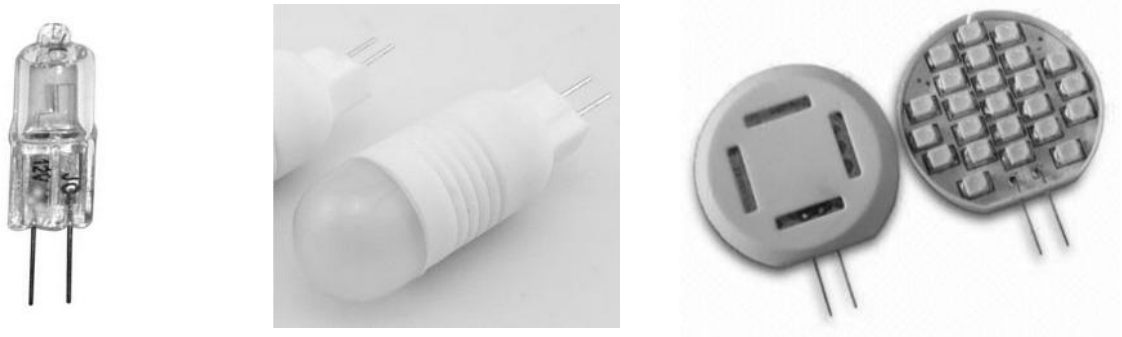


Figure 11: Miniature halogen capsule (left) and LED lamp (centre, right) with G4 type socket (low voltage use; 4 mm is pin distance).

Figure 12: Miniature halogen capsule (left) and LED replacement (right) with GY6.35 type socket (low voltage use; 6.35 mm is pin distance).

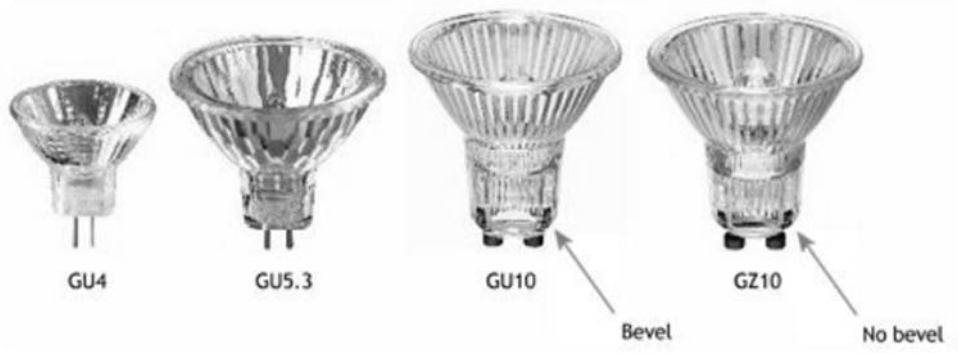


Figure 13: The most common halogen spots are either push fit (GU4 or GU5.3), low voltage type, or twist and lock (GU10 or GZ10) mains versions. The GU10 has a bevel around the base but the GZ10 has a square corner. This stops the GZ10 being used in a fitting designed for a GU10 but allows the GU10 to be used in either. (courtesy of: http://www.lightbulbs-direct.com/article/fittings-caps-and-bases/)

Figure 14: LED lamp with GU4 base (left) and GU10 base (right)/

Figure 15: Fluorescent strips (LFL) generally have a two-pin fitting at both ends of the tube. Standard size T8 (25mm) and the larger T12 (38mm) tubes both use the G13 fitting. The smaller T5 (16mm) tubes use the G5 fitting with 5mm between the two pins. (courtesy of: http://www.lightbulbs-direct.com/article/fittings-caps-and-bases/)

Figure 16: T5 fluorescent lamp with cap type 2G11 and 4 pin base.

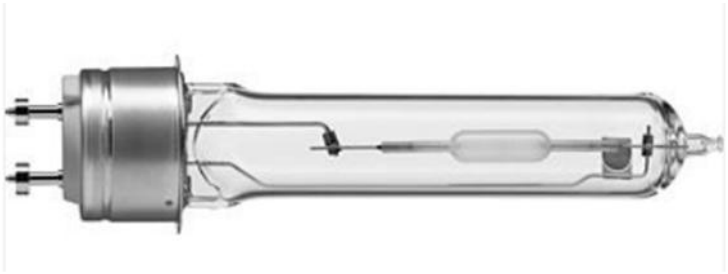


Figure 17: Ceramic Metal Halide lamp with PGZ12 base.

Figure 18: Disk type lamp with GX53 type base.

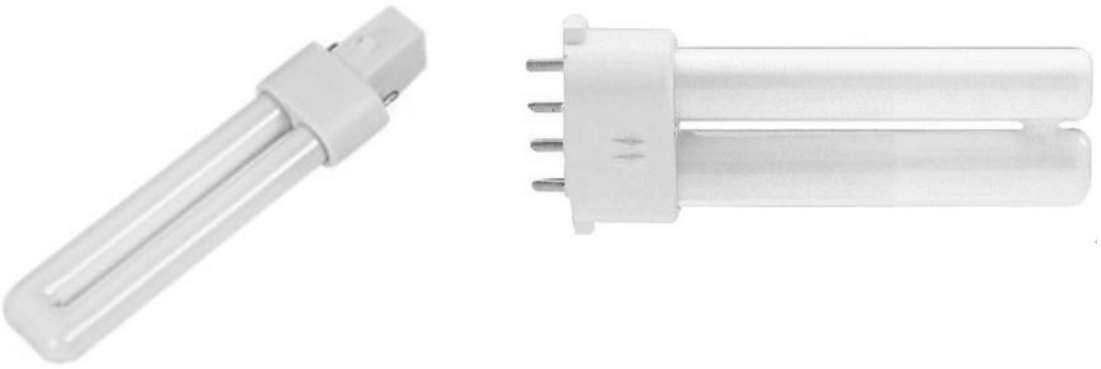


Figure 19: CFL lamp with G23 2 pin base (left) and 2G7 4pin base (right).

Figure 20: Compact fluorescent lamps (CFLs) without integrated control gear generally use push-fit square or rectangular fittings. Those with integral starters use 2-pin fittings; those for use with electronic control gear and/or dimmers have 4-pin connectors. Two-pin Triple turn CFLs use the GX24d-1/2/3 fitting (not shown). Four-pin Triple-turn CFLs use the GX24q-1/2/3/4 (not shown). 2D lamps use either the GR8 (2-pin) or GR10q (4-pin) connector. (courtesy of: http://www.lightbulbs-direct.com/article/fittings-caps-and-bases/)

Annex D. SPECIAL PURPOSE LAMPS

D.1 Why special purpose

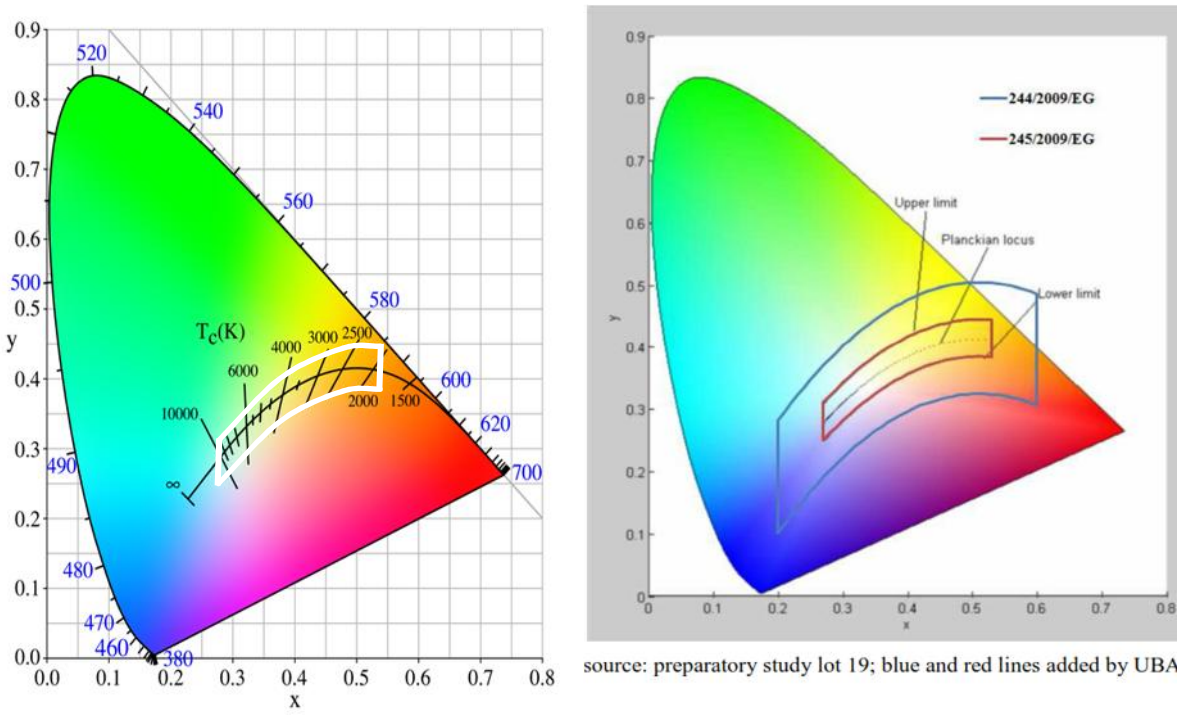
This Annex first looks at the technical parameters that make special purpose lamps special enough to be exempted from the current light source regulations. Next, a survey is provided of the different groups of special purpose lamps with a first rough estimate of their impact on EU energy consumption.

D.1.1 Spectrum

All three lamp regulations specify that the light source should have the chromaticity of 'white light' to be suitable for general lighting services. Lamps emitting a spectrum that does not comply are exempt from the regulation and can be regarded as 'special purpose'.

However, the definition of 'white light' in Regulation (EC) No 244/2009 is different from that in Regulations (EC) No 245/2009 and (EU) No 1194/2012 (

Figure 21).



source: preparatory study lot 19; blue and red lines added by UBA

Figure 21 Chromaticity diagram and definitions for 'white light' as used in the existing regulations

In Regulations 1194/2012 and 245/2009 'white light' is defined as having the following chromaticity coordinates x and y:

$0.270 < x < 0.530$

$-2.3172\ x^2 + 2.3653\ x - 0.2199 < y < -2.3172\ x^2 + 2.3653\ x - 0.1595$;

This implies a colour temperature between 2000 and 10000 K (inside the white or red demarcation lines in the chromaticity diagram of Figure 21).

In Regulation 244/2009 the definition is significantly wider (blue demarcation line in right figure):

$0.200 < x < 0.600$

$-2.3172\ x^2 + 2.3653\ x - 0.2800 < y < -2.3172\ x^2 + 2.3653\ x - 0.1000$;

Apart from this generic requirement, also within the group of lamps that stay within these chromaticity boundaries, there are specific features of light sources that could make them 'special purpose'.

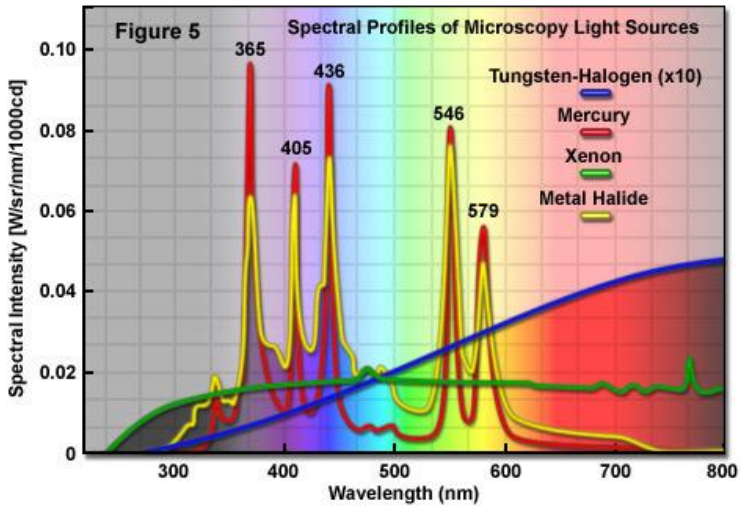


Figure 22 Original spectrum of several lamp types (source Zeiss, microscopy)

The visible light spectrum is in the range of 380 to 720 nm. Tungsten-halogen lamps and – even better — discharge lamps using Xenon have a fairly even distribution in the visible spectrum, making them very suitable for photo/film/projection applications. But tungsten-halogen lamps, as traditional incandescent bulbs, also emit a considerable part in the non-visible infra-red (IR) spectrum. For general lighting service applications, this is not efficient but as a 'heat lamp' the tungsten-halogens are a good source converting up to 90% of the energy input in heat. Also Xenon lamps have several peaks (not all shown in the graph) in the IR range, mainly deteriorating their efficiency. In contrast, the mercury (e.g. Hg-arc) and metal halide (MH) lamps show distinct peaks in the spectrum at the wavelengths indicated in the graph. For pure visible light applications, they lose a part of their efficacy in the ultra-violet (UV) range with a peak at 365 nm (note that for UV applications in microscopes and tanning this 365 nm peak can be very helpful). The spectral difference between MH and Hg-arc lamps is that the MH lamp fills in the gaps between the peaks much better than the Hg-arc lamps, so it relatively gives a better distribution in the visible range.

The above figure is typical for lamps used in (fluorescence) optical microscopes, where some share of UV may be needed. In contrast, the sodium lamps almost emit no light in the UV range, but distinct peaks in the yellow-orange visible spectrum (Figure 23). In terms of visible light efficacy (lm/W) this makes them the most efficient lamps around, reaching values of 140 lm/W, i.e. comparable to current commercial LED packages. The spectrum misses out on blue and green. The fact that the green colour is largely missing from the spectrum makes the sodium lamps very efficient as grow lights in certain stages of plant growth (plants are insensitive to green light). On the other hand, at some stages of growth also the blue light is helpful and –using the right phosphors— the lamp manufacturer will try to enhance the blue side of the spectrum in a growth light.

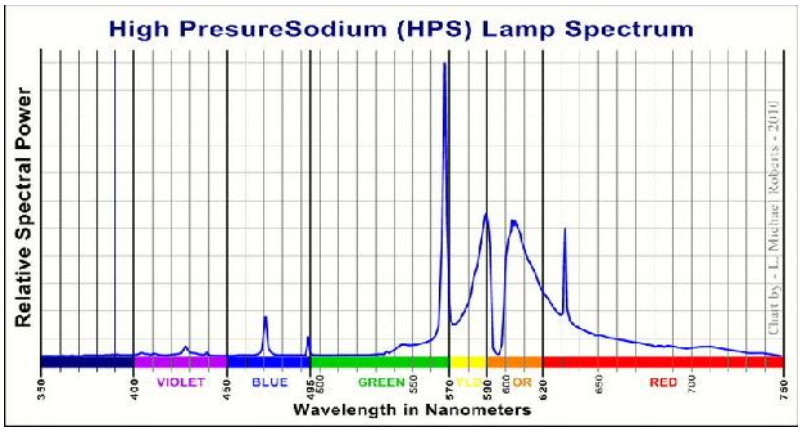


Figure 23 High pressure sodium lamp spectrum (source: L. Michael Roberts, 2010)

In this context, it should be mentioned that with phosphors and other coatings on the bulb/tube, the manufacturers can influence the spectrum of light output considerably. In fact, all LFL and CFL lamps originally show the mercury spectrum with its distinct peaks, but once the light has passed the (fluorescing) phosphors a much more evenly distributed light spectrum comes out.

The same goes for the so-called 'white LED' that is used in most lamps, which originally emits in the 300-400 nm range (UVA and visible blue), but is then turned into 'white' by using phosphors in the LED-package.[16] Not all LED's use phosphor. RGB LEDS use a mix of blue, red and green to obtain white light.

But the use of fluorescence/phosphors to influence the lamp spectrum comes at a cost in terms of lower efficacy (less lm/W) and in terms of lower radiance (see next section).

In terms of possible loopholes and weaknesses for ecodesign legislation, the phosphor formula that is applied to the bulb/tube may be the only feature to distinguish a 'special purpose lamp' from a 'general lighting purpose' lamp. This difference is often – unless a colour is added on purpose – not visible to the naked eye, sometimes not even when the lamp is switched on.

Spectrography and 'neon' advertising very much depend on the fact that certain gases, when used in a hot cathode or cold cathode gas discharge lamp, emit a very specific colour. This is particularly well known for Neon and other gases in neon signs (see Figure 24).

Figure 24 Originals colours produced by a cold cathode discharge tube ('neon tube') charged with respectively neon, helium, argon, xenon and krypton.

[16] Historically, LEDs first came in 'red', then in 'green' and then –about 15 years ago-- in 'blue'. White light can be created, e.g. in certain TVs and other displays, by combining red, green and blue emitting LEDs .

D.1.2 Radiance

Radiance is the capacity of a light source to emit light from the smallest possible point source. This is very important for all applications where the light will be directed by lenses, such as in projectors, microscopes, certain spot lights but also e.g. marine signalling lamps that need to be seen from very far.

Arc-lamps, where the light-arc is created between a cathode (minus) and an anode (plus) in a gas vapour filled ambient, are the best. Strictly in terms of radiance, the mercury arc lamps (Hg-arc) are the best, but –given the deficiencies in optimal spectrum and thus colour rendering—usually Xenon arc lamps (Xe-arc) are used. The 'hot spot' in a Xe-arc lamp is as small as 0.5 x 0.8 mm.

A cheaper alternative to Xe-arc lamps, e.g. in portable projectors, is a halogen lamp. This still has a good colour spectrum, but the filament 'hot spot' is larger.

In legacy applications, such as 8mm film projectors, even a small incandescence lamp will do. Miniature incandescent bulbs are also still used, with a vertically positioned filament instead of the usual horizontal filament in order to reduce the relevant size of the hot spot, in marine applications.

LEDs are only now starting to come into focus for this application, because thus far the 'hot spot' of a single LED, which is the parameter that counts, was too big. Only with the most recent and most powerful LEDs the microscope manufacturers are now bringing LEDs in popular products. But for specific applications, the high-pressure (arc) gas discharge lamps are still needed, e.g. in case there is a very weak fluorescence the Hg-arc lamp is still indispensable.

The latest invention in (home) video projection lamps is the combination of LED and laser technology ('Phaser'), where the monochromatic laser shines its light beam through a fast rotating colour-filter disc producing the red, green, blue components that result in white light.

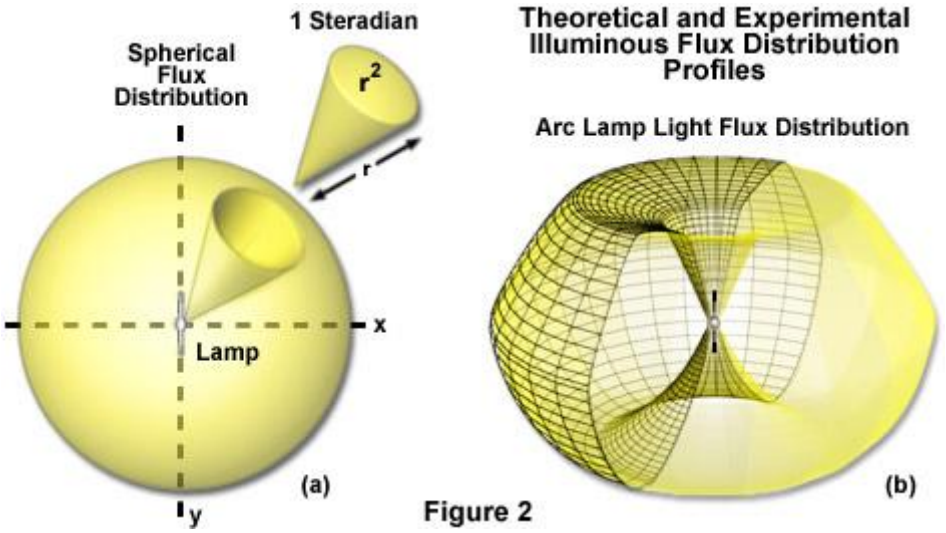


Figure 25 Definition of radiance.

Note: Radiance is a measure of the light flux density per unit of solid viewing angle. Radiance (a.k.a. 'brightness' in older literature) are quantities of optical radiation that describe the amount of light that is emitted from a defined unit area and encompassed within a **solid angle** in a specific orientation. The quantity is expressed in watts per square centimeter per steradian (W/cm²/sr) and takes into account the radiant flux from the source, its size, and the angular distribution. A **steradian** is the basic unit of a solid angle cut from a sphere that is used to describe two-dimensional angular trajectories in three-dimensional space (as illustrated in Figure 2(a)). Thus, a single steradian unit is defined as the solid angle subtended from the center of a sphere having a radius of **r** by a portion of the sphere's surface having an area of **r²**, into which light

projects. The term **flux** refers to the amount of energy (in photons) per steradian per second at a defined distance from the illumination source. The actual (measured) luminous flux distribution pattern generated by a typical xenon XBO arc lamp is illustrated in Figure 2(b), and obviously deviates significantly from that of the theoretical perfect sphere shown in Figure 2(a). Another important point in optical terminology is that **radiometric** quantities encompass the measurements of the entire electromagnetic spectrum emitted by a light source, whereas **photometric** quantities are limited only to those wavelengths that are visible to the human eye. Radiance is independent of the distance from the source because the sampled area increases in proportion with distance. The photometric equivalent measure is the mean or average **luminance**, often expressed in units of **candelas** per square meter. (source: Zeiss)

D.1.3 Safety

In certain applications, like traffic and other signalling lights, tunnel lights, exit signs etc., reliability and a long product life is very important for safety and for low maintenance costs. For filament lamps that were traditionally used in traffic lights it means that the filament is made thicker, to be able to secure at least 2000 h service life (instead of the 1000h that is normal for general lighting services). The thicker filament also means a lower efficacy and these lamps often reach no more than 6-7 lm/W.

D.1.4 Integrated, primarily lighting products

These are light sources that are integrated in products that derive their primary function from the light source. In other words, without a lamp they don't work. There is often a strong 'lock-in' effect because of the use of special caps, form factors and –where applicable—specific drivers.

Technically and energetically there are often (better) alternatives available for the light source, but the lock-in effect means that phasing out specific lamps very often implies phasing out a complete piece of equipment at considerable cost.

Examples are Video- and filmprojectors, microscopes, surgical lights, etc.. The diversity of available caps and lamp types is illustrated in the following two figures.

Figure 26 Medical filament (halogen and incandescent) lamps with form factors and caps to fit various medical instruments ('lock-in' effect.

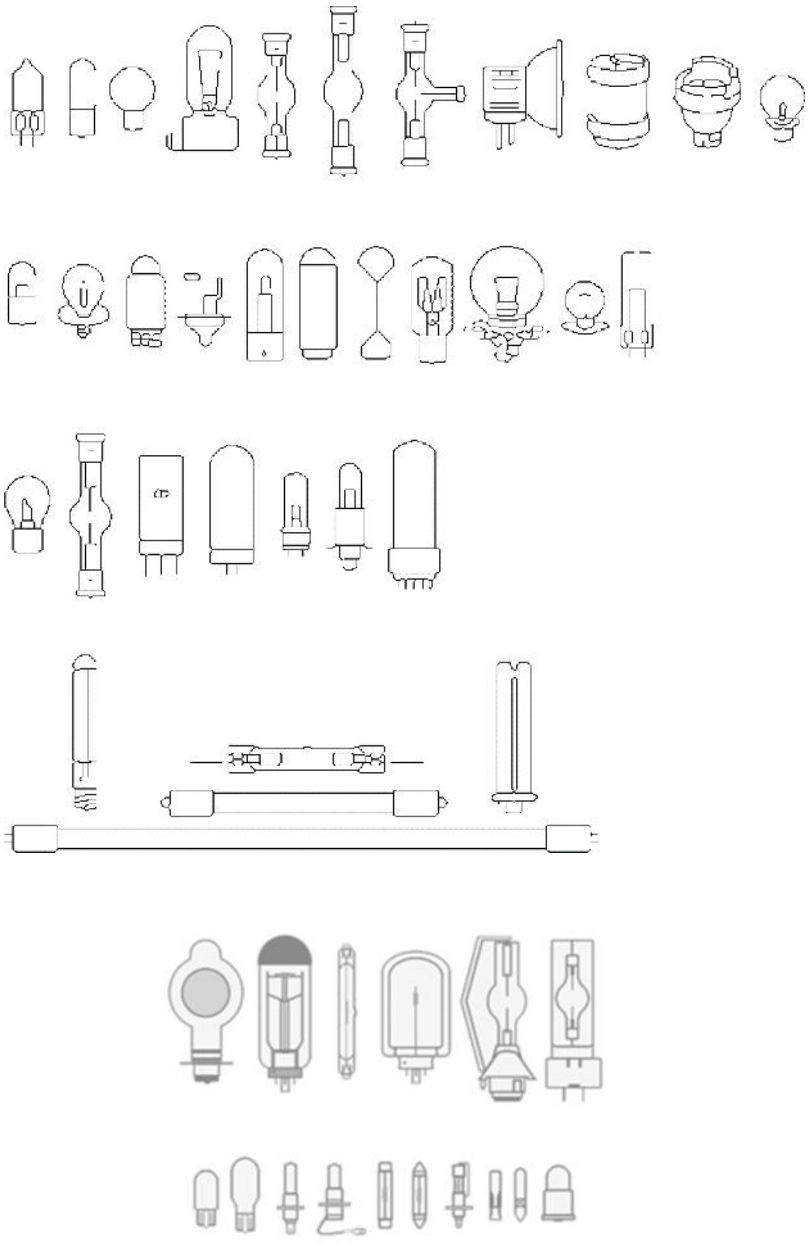


Figure 27 Overview of some form factors in special purpose lamps

D.1.5 Integrated, non-primarily lighting products

These are light sources that are integrated in products where the primary function does not depend on the light source, but lighting is a secondary function typically as a task light. Examples are lamps in refrigerators, ovens, sewing machines, etc. There is a 'lock in' effect because of the form factor, but these lamps often use standard caps, making replacement by more efficient alternatives possible.

D.2 Signalling lamps

D.2.1 Overview

row	SPECIAL PURPOSE LAMPS	units stock	lamp power	opera-tion	energy/yr	lamp life	total lamp sales/yr	o/w new sales	o/w in-candes-cents
nr		m #	W	h/yr	TWh	h	m #/yr	m #/yr	m #/yr
	Signalling and signage lamps								
4	traffic signalling lights (incand. 45% (LV/MV 50/50), HL 5%)	5.00	60	3000	0.900	2000	7.5	0.5	6.7
5	traffic signalling lights (LED 50%)	5.00	5	3000	0.075	20000	0.8	0.5	
6	railway lights (crossings and signals)	0.98	16	3650	0.057	2000	1.88	0.1	0.8
7	marine signalling lights (buoys, light houses)	0.10	10	8760	0.009	10000	0.10	0.01	0.05
8	airfield signalling (current controlled, in series)	1.20	71	4300	0.366	2000	2.7	0.12	
9	neon and (static) billboards (LFL, MH)	0.52	394	4380	0.896	10000	0.3	0.05	
10	exit signs, commercial and industrial buildings	50.00	11	7500	4.125	20000	5.0	5	
		62.80			***6.43***		***18.21***	***6.28***	***7.55***

4: Compare: US 2010 --> 15.9 m traffic signals (95% LED)

6: US data: 0.976 m total stock, of which 0.549 incandescent, rest LED. Average 16W

7: Legacy buoy light bulbs have vertical filament for better horizontal radiance. Lighthouses are almost extinct

8: 3300 airfields of which 150 bigger ones with multiple (say 3) strips --> 4 k airstrips of 3000 m with light every 10 m--> 300 lights x 4 k=1.2 m lights

9: 'neon' is a cold cathode discharge tubular lamp, filled with Ne (red) or other gases. It is custom made. No market data are available. Other advertising signs rely usually on LFL or more recently LED back- or edge-lit billboards. Other data from US 2010 study

10: US 2010: 38 m LED exit signs for 5.4 m buildings. EU has 7.05 m industrial and commercial buildings (MEErP) and also a higher share of CFLs (11W?) besides LEDs. So estimate 50 m exit signs. An exit sign is a battery backed-up device (on mains voltage). In the US an exit sign works 23 h/d. In the EU assumed as well. Energy-efficient alternative (but requires proper handling in production and disposal) are 'self-luminous' exit signs using tritium (H3) gas, where the radioactive isotope makes the signs light up (no electricity, works reportedly for 15 years, 130 000 hours). In the US, they are allowed by the US Nuclear Regulatory Commission and also sold (at least as imports) in the EU. www.michigan.gov: More than two million tritium EXIT signs are estimated to be in use in the United States. Wattage: LED signs of 7W (incl. some emergency lighting facility) found in NL.

Table 1 Signalling Lamps

D.2.2 Additional market data

According to the Ecodesign Working Plan 2 (VHK 2011) there are around 8-10 million traffic signal lamps installed in the EU27. This comes down to a density of around one traffic lamp per 50-60 EU inhabitants.

As there is no specific market research data available, this number has been checked against anecdotal data from city councils and other sources in recent years. The main problem with interpreting these usually incomplete data, is that a "traffic light" (D. *Ampel*; F. *feu rouge*; IT. *semaforo*; NL *verkeerslicht*) can be a traffic light installation for a whole intersection, it can be a 3 or 2 bulb red-(orange)-green package or sometimes it is used to mean just a single traffic light bulb.

This is shown in Table 2, which also gives the number of inhabitants per city, in order to be able to calculate the density.

The table shows that for certain Southern European cities like Torino (IT) and Paris (FR) the density is around 1 lamp per 30-35 inhabitants. In more Nordic cities like Berlin, Amsterdam, London lamp density is roughly 40-50% less at 1 lamp per 40-70 inhabitants. Outside the big cities, like e.g. in the Italian town of Capannori with 45 000 inhabitants there are relatively less traffic lights (e.g. 1 lamp per 120-130 inhabitants). For the Netherlands and Belgium as a total there is 1 lamp per 70(NL)-95(BE) inhabitants. For Southern countries it will be 50% less inhabitants, so on average for the EU27 a number of 1 lamp per 60 inhabitants is plausible. This means, at an EU27 population of around 500 million, that around 8 million fixed traffic bulbs are installed. To this, the signalling lamps for mobile (road) installations have to be added. For railways and airfields (landing-lights) the estimates from the 2012 Navigant study for the US were taken.

	Intersections with traffic lights	traffic lights (3 bulb)	pedestrian lights (2bulb)	red light total	bulbs in traffic lights	inhabi-tants (in million)	inhabitants/bulb	note
Paris (City), FR	**1792**	**13993**	**18441**	**32434**	*78861*	**2.2**	***28***	city council website
Torino (City), IT	*1273*	*9937*	*13095*	*23032*	**56000**	**1.7**	***30***	city council website
Capannori(TO), IT	**15**	*117*	*154*	*271*	**350**	**0.045**	***129***	city council website
Berlin, DE	**2000**	*15617*	*20581*	*36199*	*88015*	**3.4**	***39***	city council website
Brussels, BE	**400**	**3800**	*4116*	*7240*	*19633*	**0.9**	***46***	Leefmilieu Brussels
Amsterdam, NL	**370**	*2889*	*3808*	*6697*	**21480**	**0.8**	***37***	city council website
München, DE	**1100**	*8589*	*11320*	*19909*	*48408*	**1.3**	***27***	city council website
London, UK	**2532**	*19771*	*26056*	*45828*	*111426*	**8.3**	***74***	estimate
Belgium total	**2620**	*20459*	*26962*	*47420*	*115299*	**11**	***95***	source: Touring
Netherlands total	**5500**	*42947*	*56599*	*99546*	*242040*	**17**	***70***	source: Rijkswaterstaat 2009
Sweden total	**2112**	*16492*	*21734*	*38226*	*92943*	**9.5**	***102***	source: SRA 2009
compare:								
United States total	*357536*	*3392857*	*410714*	*3803571*	**11000000**	**311**	***28***	eceee estimate, 2000
New York City, US	**12460**	*118240*	*14313*	*132553*	*383346*	**8.3**	***22***	city council website
Manhattan, NYC, US	**2820**	*26761*	*3239*	**30000**	*96479*	**1.6**	***17***	source: US Energy Star 2011
Boston, US	*235*	**3800**	**460**	*4260*	*12320*	**0.62**	***50***	source: Energy Star 2011
Johannesburg, SA	**1561**	*12189*	*16064*	*28253*	*68695*	**4.4**	***64***	city council website
Singapore	**2150**	*16788*	*22125*	*38914*	*94616*	**5.2**	***55***	statistics city council
Tokyo, JP	**15000**	*117129*	*154361*	*271490*	*350000*	**13**	***37***	article city council

Data in black are original data. Data in blue italic are derived/calculated

Table 2 Traffic lights (source: city council websites)

Incandescents are increasingly being replaced by LEDs. Some cities have completely made the transition to LED, whereas others –e.g. Amsterdam—have converted only 10% of installations. Industry statistics on LED signalling lamps are not available, but a company Renesas that makes LED drivers that are very specific for traffic signals shows the graph below for the EMEA market.

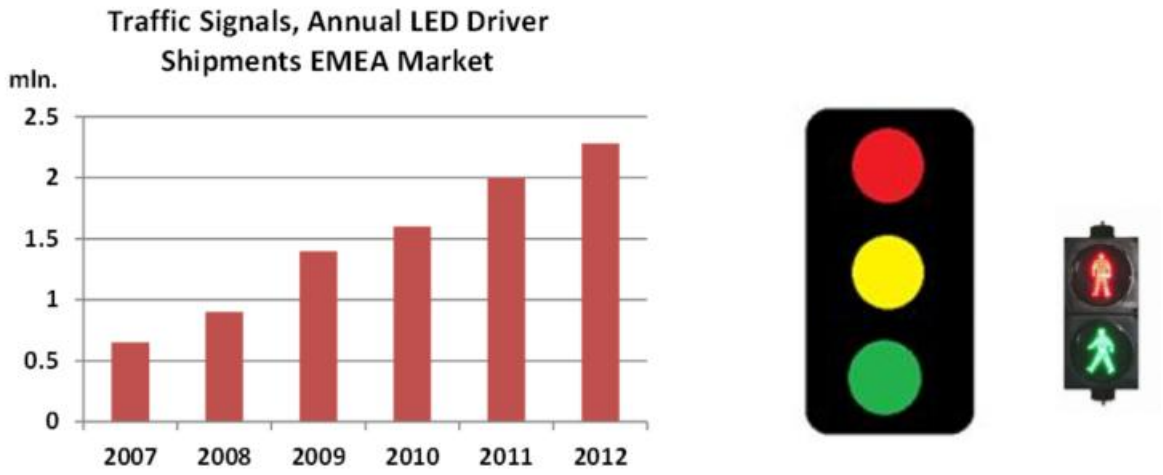


Figure 28 Left: Traffic Signals, Annual LED Driver Shipments EMEA (Europe, Middle East, Africa) market (Source: Hammerschmidt, C., Traffic lights and signage need intelligence, www.ledlighting-eetimes.com , Sept. 27, 2011.). Right: Traffic and pedestrian lights, examples

D.2.3 Products

The following figures and texts give examples and descriptions of signalling lamps and signs that are currently on the market.

Figure 29 Traffic signalling lamps. Left: With B22 or E27 base. Range 40-60W, life 2000h, 230V or low voltage (12V, 24V, 48 V);

Central: 230V krypton-filled incandescent signal lamps. With increased lifetime of 14 000h (premature failure rate 2% up to 6000h). Retrofit lamp for existing high-voltage road traffic signal installations Range: 60W (380 lm) up to 100W (780 lm), 6 – 8 lm/W;

Right: Halogen traffic signalling lamp, 10-12 V. Rated power 20-50 W, 120-150 lm, 2000-6000 h

Figure 30 Train signalling lamps. Left: standard 12V, 6-20W, 600- 2000 – 6000h, B20d. Right: double filament (if 1st filament breaks the 2nd filament takes over), B15s (12V, 24V, 48 V);

Figure 31 Current-controlled halogen lamps for airports. (30-45W, 430 lm, 6.6A, GY6.36, 1000-2000h) to (150W, 4000 lm, 6.6A, G9.5) for air-fields. Dimmable. Infrared radiation output that provides light in the worst of conditions. Halogen low-voltage lamps (double-ended, 100W, R7s, 6.6A, 2170 lm, 1000h) for current-controlled operation are used mainly in series-connected systems for airfield lighting.

Figure 32 Airport and Marine LED alternatives. Left: LED module for airfield applications. More and more airports switch to LED landing lights, reportedly saving up to 70%. Recent example: Amsterdam Airport Schiphol (July 2013). Right: LED marine navigation lamp, 3.2W

LED exit signs (picture left: 7 W, using acrylic plate). Depending on design LED exit signs may save 50% or more with respect to the CFL-equipped exit signs (and much more with respect to legacy incandescent-lit exit signs). Exit signs are plentiful and required to be lit 24h per day and thus the energy consumption is significant. Alternatives may be photoluminescent and tritium exit signs, which consume no power at all, but there are some possible drawbacks. Photoluminescent exit signs (picture middle) need to be exposed to light each day to charge. If placed in an area that does not receive adequate quantities of light, or is vacant for multiple days, these signs may not produce enough light to be discernable in an emergency. In the EU they are usually welcomed as additional emergency aid, but are not a substitute for actively lit exit signs at main doors. Trition exit signs (picture right) use a mildly radioactive form of hydrogen (H3, 'Tritium') and require no electricity, but the amount of light they emit will dissipate over time and, because of the radioactivity, disposal is subject to strict rules and higher disposal costs. Navigant 2012 reports that in the US there are around 38 m LED exit signs installed. US nuclear authorities estimate that there are 2 m tritium exit signs in the US

Figure 33 LED exit signs

D.3 Appliance lamps

Figure 34 Refrigerator replacement lamps. Left: Two incandescent refrigerator lamps, E14, 15W, 110 lm, 230V, 1000h. Right: Two LED lamps for refrigerator, 0.8-1W E14.

Figure 35 Oven and laundry drier replacement lamps. From left to right: 1) Incandescent microwave oven lamp, E14, 25 W, 230V. 2) Mains voltage halogen oven lamp, 25W, 260 lm, 2000h or 40W, 490 lm, 2000h (Class D). 3) Low voltage halogen oven lamp, 5-10-20W, G4, 12V, 60-140-320 lm/W. 4) Incandescent laundry drier lamp, 10W, 230V, E14

Figure 36 Range hood replacement lamps. Left: Range hood incandescent lamp (AEG/Miele spare part), 25 W, 230V, special base. Middle: Range hood, tubular lamp (WPRO), 25-40W. Right: Mini bulb B15d, 7W

Refrigerators	ca. 20-30 times per day, 20s per time, 600s=10 min/day, ca. 60h/yr, at 1000h/lamp => 16.6 years, normal distribution at 12yrs --> 10-20% lamp replacements over fridge lifetime.
Range hoods	40 minutes per day --> 240h/yr--> product life 12 --> 2880h --> 80% in a life time replacement
Ovens	150 cycles x 1 h/cycle per year => 150h/yr --> 17yr oven life--> 2550 h--> 80% of lamps need replacement
Microwave	3 minutes per day --> no lamp replacement

Table 3 Domestic Appliances, estimated operating times

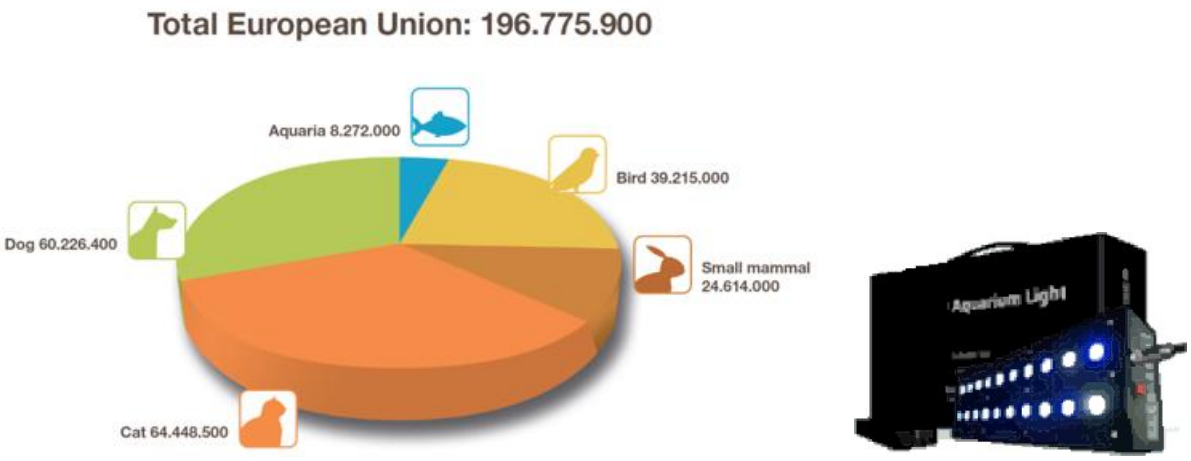


Figure 37 EU pet population (source: European Petfood Association 2012). The graph is showing the ownership of 8.3 million aquariums. Normally an aquarium would be lit by LFL-type lamps with a higher than average UV share to help fight algae. The insert shows an LED luminaire especially developed for aquariums.

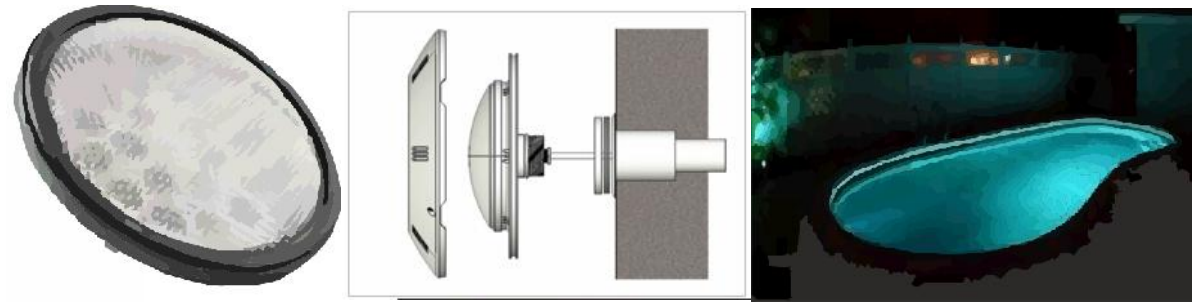


Figure 38 Swimming Pool lamp. Left: form factor (including integrated seal). Middle: section of mounting assembly. Right: application in private pool. E.g. PAR56 lamp, halogen, 12 V, 300 W, 2850 K, 1000h versus LED retrofit ca. 15-30W, LV, 20000h.

Market: In the EU-27 around 4 to 5 million swimming pools are installed, of which 70% in ground and 30% above ground. Countries with most swimming pool owners are France (1,4 million. installed) and Spain (1,1 million. installed). Annual sales are estimated in the order of 250.000 swimming pools, with 50-60% in concrete, 30-35% pre-fabricated and 15-20% in polyester (data 2008).

Sources for market data: Trade Association for Swimming Pool Manufacturers, *FRENCH SWIMMING POOL MARKET*, paper 2009 (data 2004). M Nickmilder, A Bernard, *Ecological association between childhood asthma and availability of indoor chlorinated swimming pools in Europe*, Occup Environ Med 2006:1–10.

D.4 Decorative lamps

Figure 39 Incandescent (coloured) reflector lamps, 40 W, 230 V, E14, 1000 h

Figure 40 Low wattage decorative incandescent lamps. Left: Flicker-effect decorative swan-neck lamp, 3W, E14, 1000h, 230V. Middle: Two decorative incandescent lamps <11W. Right: Night light lamp, 11W, 230V, E27

Figure 41 Classic and decorative incandescent lamps. From left to right: 1) Classic A-shape incandescent lamp, 230V, E27. Manufacturer website: Only 15W version can be supplied in the EU, the higher wattages are marked 'non EU'. 2) Decorative Colour A-shaped incandescent lamp, 11W, 27 lm, 230V, E27. Application: party lights, fair and amusement parks (merry-go-round, etc.). 3) Two decorative ant-glare incandescent lamps, 40-60W, 570lm, 230V, E27/E14. Applications: Mirror-lamps, theatre and barber shop mirrors

Figure 42 Linear/tubular incandescent lamp. Single ended (left) or double ended (right), 35-40 W, 1000h, ca. 7-8 euros, typically used above a mirror (bathroom) or under a (kitchen) cabinet. These lamps are not 'special purpose' and ought to be phased out according regulation 244 from Sept 1st 2013. They are mentioned explicitly in 244/2009 Annex I, 1 :Incandescent lamps with S14, S15 or S19 caps shall be exempted from the efficacy requirements of Stages 1 to 4 as defined in Article 3 of this Regulation, but not from Stages 5 and 6.

Figure 43 Mini-bulb lights (decorative). Left: Mini-bulb incandescent, 3.36W, 14V, incandescent, Miniature Bayonet (BA9s). Right: Mini string lights, incandescent mini-bulbs 50 or 100 lamps of 0.4W (20 or 40 W per string, no transformer needed) or LEDs 50 or 100 lamps of 0.1W (5 or 10 W per string, incl. LED driver/transformer).

D.5 Shockproof lamps

Figure 44 Examples of shock-proof lamps in mobile applications (left) and stationary applications (right)

Lamp type 	Forecast (DoE)	Actual (NEMA)	%	Regulatory action
Rough service lamps,	5.78	6.05	104.6%	No
Vibration service lamps	3.02	1.08	35.7%	No
3-way incandescent lamps	50.13	28.85	57.6%	No
2,601-3,300 lumen general service incandescent lamps	33.98	12.37	36.4%	No
Shatter-resistant lamps,	1.66	1.46	87.5%	No

Table 4 Forecast and sales of some special purpose incandescent lamps in the US (US DoE, 2013)

Table 4 shows that the actual sales of shockproof and similar lamps, provided by the manufacturer's association NEMA, did not exceed the US Department of Energy predictions. The table also provides an indirect indication of how many shockproof lamps could have been sold in the EU27, i.e. a group of countries with 1.5 times the US population and with a similar use of shockproof lamps.

D.6 Projector lamps

The table below gives Eurostat figures for sales and extra-EU trade of arc-lamps, ultraviolet lamps and infrared lamps. The trade figures exclude tanning lamps.

PRODUCTION (in million. Units)

	PRODUCT	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
27401570	Ultraviolet or infrared lamps, arc lamps	22	26	38	48	54	53	57	54	25	25

IMPORT (in million. Units) LAMPS

NC code	PRODUCT	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
85394100	Arc lamps	5	2	1	1	1	1	1	5	3	1
85394910	Ultraviolet lamps	2	3	3	3	3	3	3	5	5	4
85394930	Infra-red lamps	1	1	1	1	2	2	2	2	3	3

EXPORTS (in million. Units) LAMPS

NC code	**PRODUCT**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
85394100	Arc lamps	0	1	0	0	0	0	0	0	1	4
85394910	Ultraviolet lamps	2	3	3	4	6	9	10	9	13	11
85394930	Infra-red lamps	2	2	3	3	3	2	2	1	3	2

Table 5 Eurostat production and trade data arc, UV and IR lamps 2000-2009

Short-arc lamps draw a short arc (<3mm) in a high-pressure mercury or xenon atmosphere to produce a high output (radiance) of white light in a point source. They are used in the electronics industry for the production of Integrated Circuits (microlithography) and etching of Printed Circuit Boards (PCBs). Also, they are used in surgical operating theatres, for cinema projectors and light shows.

The largest arc-lamps are used in IMAC theatres, i.e. 15 kW. Mid-range cinema wattages range from 1000 to 3500W and lumen outputs from 100 000 to 350 000 lumen. Smaller wattage (70-100W) applications involve the combination of high radiance in both the UV and visible range, e.g. for medical applications in fluorescence microscopy and a variety of light guide applications (endoscopy, ophthalmology). The life span of arc-lamps is typically not very long (e.g. as low as 200h for medical applications, 1500h for electronics industry, 2400h for cinema projectors).

For high radiance projection systems (cinema, video) laser based light sources (3 monochrome lasers or single laser with phosphor disc, 'Phaser') are becoming a serious competitor. For smaller wattages, where arc-lamps of 70 – 100W were used, the LED lamps have recently become a serious competitor, because the radiance of individual LED packages has increased to acceptable levels. Having said this, for e.g. weak fluorescents Hg-arc lamp are still indispensable. Furthermore, there are many millions of microscope systems that require a specific geometry and other features of the light source, for which the arc-lamps are indispensable as spare parts (lock-in effect).

Figure 45 Arc lamps. Left-to-right: Two microlithography lamps (Hg), operating theatre lamp (Xe), cinema projector lamp (Xenon-arc, 1600W, 24V, 2400). H

Figure 46 The full range of traditional projector lamps. Left: 15 kW xenon short-arc lamp used in IMAX projectors (source: Atlant at wikipedia.en). Diameter of the reactor bulb around 20cm. Middle: Xenon-arc reflector lamp 100-150W for video/ TV projection. Right: Low voltage, incandescent film projector lamp.

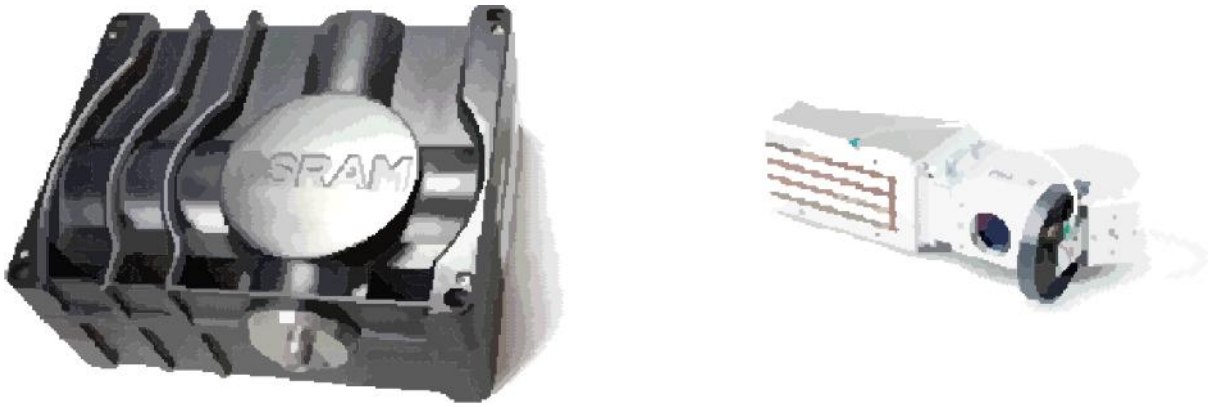


Figure 47 New Phosphor/laser ('Phaser') technology. Left: for medical applications like endoscopy. Right: General video projection. In both applications it will be replacing Xe-arc lamps.

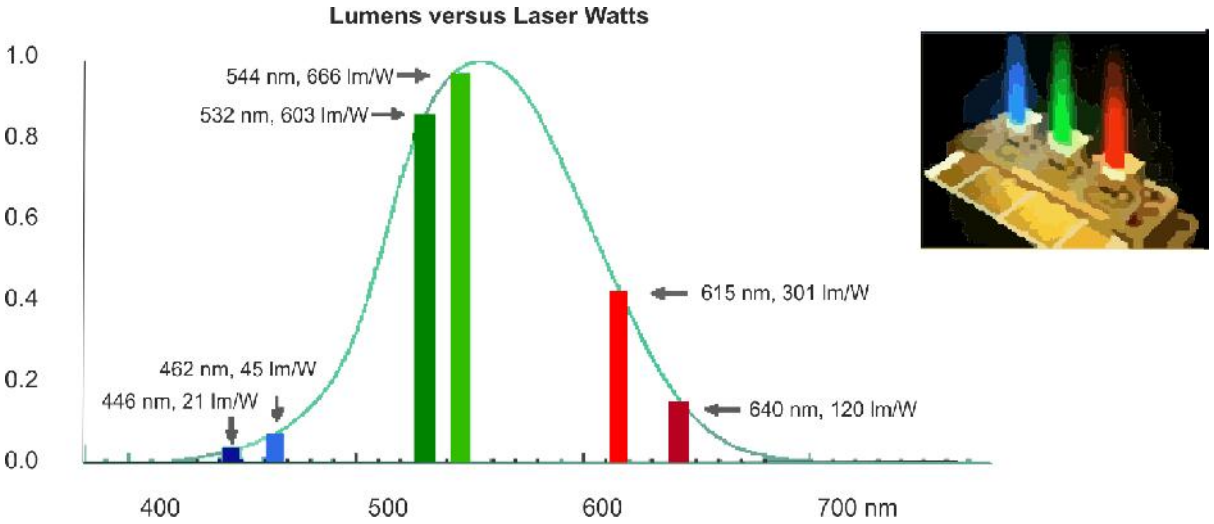


Figure 48 Laser-systems for (3D) cinema projection. Promises laser lifetimes of 25-50,000 hours (instead of ~2000h for Xe-arc), cost-saving on (installation of) replacement lamps, 30-50% lower direct power consumption, reduced HVAC make up air (also energy saving). The cinema systems use three lasers, Red, Green and Blue (RGB), to project the picture. The graph on the left (Lumens versus Laser Watts) shows the lumen efficacy (lm/W) at the distinct laser wavelengths. The picture on the left shows a double diode or array laser configuration, which is just one of the options. (source: Bill Beck, Laser Illumination Systems for 2D and 3D Digital Cinema.
(ppt presentation), Laser Light Engines, Inc., Salem, New Hampshire).

Figure 49 Optical fluorescence microscope with lighting systems.(Source: Zeiss)

Figure 50 Replacement lamps for simple microscopes: Incandescent (3V/3W), LED, Halogen (6V/20W or 12V/10W). Price range 5.95 - 13.50 euros. Extreme right: LED module for medical applications.

According to MEErP 2011, there were 5949 primary hospitals (NACE 85.111), 2732 specialist hospitals (NACE 85.112) in the EU-25 in 2007. Translated to the EU27 in 2013 this comes down to around 10 000 hospitals. A hospital has 5-8 operating rooms ('ORs'), with the biggest featuring 20-25 ORs. Assuming an average of 7 ORs per hospital, the EU27 features an estimated 70 000 ORs. Every OR has 2 -4 directional operating lighting fixtures, presumably with arc-lamps. Every lighting fixture is estimated to hold 5 arc-lamps. This makes on average 10-20 (say 15) arc-lamps per OR and thus for the whole of the EU27 around 1 million lamps are installed. Assuming that the OR-lamps are used 3500h per year and the average lamp-life is 2000h, the replacement market is around 1.75 million per year.

Fluorescence microscopes are another application of (mercury based) arc-lamps, usually mercury based. Although the total market for light microscopes is considerable (10-20 million installed in the EU[17]), the fluorescence microscopes are usually limited to labs in health care and biological research. MEErP 2011 mentions around 13 000 medical laboratories in 2007. When accounting also the other labs and those in educational facilities, the total number of fluorescence microscopes is 30-50 000. The number of replacement and new lamps for these microscopes will not exceed 50 000 per year.

Another market segment for arc-lamps are cinema projectors. According to MEErP 2011 there are around 5585 companies active in 'motion picture projection' in the EU-25 in 2007. Translated to the EU27 in 2013 and assuming around 4 projection rooms per cinema company, this comes down to around 25 000 cinema projectors, operating at least 2000 h/year and presumably all using arc lamps with a product life of on average a product-life of 2000h then the total cinema projector lamps sold is 25 000 units per year. Even if this is only a rough estimate, it must be concluded that this is a modest market.

Event lighting of the type that is using arc lamps for light shows, is even smaller (perhaps 10 000 units per year) and the smallest segment in volume is probably microlithography and PCB etching (maximum a few thousand per year).

All in all, the total EU27 market for arc-lamps is estimated at a maximum of 2 million units a year. For projector lamps substitution by LEDs will be difficult because of the high lumen output from a point source. For fluorescence microscopes substitution by LEDs is definitely an alternative with extra benefits. One prominent manufacturer uses LEDs and raves that 'The age of expensive mercury burners, which were awkward to center and always failed at the wrong moment, is finally over. Also the compromises that had to be made in image quality…'

[17] Structural market information on optical microscopes in the public domain is scarce, but Japanese market researchers from JMAR mention that in 2008 the Japanese market was 650.000 units (750.000 in 2007, so declining) at 25bn Yen (0.2 billion euros). The EU, according to market researchers from Frost 22% of the global microscope market, has more inhabitants than Japan (500 versus 110 million) but less electronics industry, an important customer for microscopes. Anyway, on average EU sales in the region of 1-2 million units per year seem plausible. At an estimated average service life of 10 years this means a stock of 10-20 million microscopes, each equipped with a lamp. Operating time may be between 1-2h for a hobby microscope, 500h for a classroom version and 2000h for a professional lab unit.

Figure 51 Medical applications of light guide projection lamps. Left: endoscopy. Right: ophtamology.

Figure 52 Surgical lamps. Left: Example of surgical operating theatre lamp with LEDs (source: LedItLightForYou). LED operating lamp for dental practice. The use of LEDs is still relatively new in this application and LEDs are still struggling to meet the required radiance levels. Surgery is probably the most demanding manually performed precision task around, requiring not only high light outputs, but also avoiding shading by the surgeon's hands and tools as much as possible. Colour rendering has to be excellent. The work with life tissue also makes high demands on the light spectrum which should be low in UV and IR.

D.7 TV/movie/photo/theatre/event/stadium lighting

Table 6 TV/movie pro halogen bulbs with quartz pinch technology (OSRAM)

W	colour K	lm	life in h	d in mm	base	lm/W[1]
150	3400	4000	-	12	GX6.35	-
200	3200	5150	-	18.5	GX6.35	-
300	3300	9600	15	18.5	GX6.35	-
300	3100	7400	75	18.5	GX6.35	-
650	3400	20000	15	24	GX6.35	-
1000	3400	33000	15	24	GX6.35	-
300	2900	5000	2000	15	GY9.5	16.7
500	2900	8500	2000	22	GY9.5	17.0

[1] = at 2000h life

Figure 53 Halogen lamp for TV/movie work with 'quartz pinch technology', 150-1000W, 230..240V, 27 lm/W at 3400K, 4000-30 000 lumen, 2900..3000K (long-life), 3200K (TV/movie work), 3400K (max. efficacy), GX6.35, l=55, d=12, 11 euros incl. VAT & shipping.

Table 7 TV/movie/theatre/event pro halogen bulbs 230V[2] (examples OSRAM)

W	colour K	lm	life in h	d in mm	base	lm/W[1]
300	3200	7500	200	18	GY9.5	25
500	3200	13500	200	18	GY9.5	27
800	3200	20000	250	19	GY9.5	25
600	3200	14000	250	19	GY9.5	23
650	3200	16250	150	23	GY9.5	25
650	3200	16800	100	26	GY9.5	26
1000	3200	20500	750	26	GX9.5	21
1000	3200	26000	200	26	GX9.5	26
1200	3000	28600	400	27	GX9.5	24
1200	3200	30000	200	27	GX9.5	25
2000	3200	52000	400	35	G22	26
2500	3200	65000	400	35	G22	26
5000	3200	135000	400	60	G38	27
10000	3200	285000	350	80	G38	29
20000	3200	580000	350	100	G38	29
1200 (80V)	3200	37500	300	22	2-pin	31

[1] = note that product life is 100-750h and would not meet Ecodesign NDLS stage 5 limit (2000h)

[2] = unless indicated differently (last row).

Figure 54 Halogen lamp for TV/movie work with 'quartz pinch technology', 300-20000W, 230..240V (special 80V), 25-29 lm/W at 3200K, 7500-580 000 lumen, 100-750h, GY9.5/ GX9.5/ G22/ G38, d=18..100, 15 - 2450 euros incl. VAT & shipping..

Table 8 High Performance Lamp HPL halogen, (examples OSRAM)

W	colour K	lm	life in h	d in mm	base	lm/W[1]
575	3200	14900	400	19	2pin	26
575	3050	11780	1500	19	2pin	20
750	3200	19750	400	19	2pin	26
750	3050	15600	1500	19	2pin	21

[1] = note that product life is 400-1500h and would not meet Ecodesign NDLS stage 5 limit (2000h). Stage 6 limit for these power ranges is 23 lm/W

Figure 55 High Performance Lamp HPL halogen with arrangement of filament segments matched to ETC's "Source Four" spotlight family, 575-750W, 230..240V, 20-26 lm/W at 3050/3200K and 1500-400h, 11780..19750 lumen, 2 pin, d=19, 26 - 32 euros excl. VAT & shipping

Figure 56 Ceramic MH lamp for theatres and studios (left), 250 W, 100V, 23000 lm (92 lm/W), 3200 K, 90Ra8, GZY9.5 base, Life to 50% failure 4000h. (Philips), Possible retrofit for 1000 W halogen lamp (75% energy saving). Right: Halogen lamp for professional spots 'Lock-it!'.

Figure 57 High-output halogen reflector for professional spot lights (left) GX5,3, 24V, 250W, 1000h (Philips ELC lamp). Right: LED spotlight.

D.8 Flash tubes

Figure 58 Xenon flash tube in photo cameras and cell phones. Producing a flash of artificial light during less than 1 ms (1/1000 second) at a colour temperature of about 5500 K to help illuminate a scene. The competitor, especially for cell phones, is an LED flash with super-capacitor, which accumulatively (at lower light output but longer flash time) can provide the same light output. Energy use can be estimated from capacitor characteristics, e.g. a cell phone xenon flash tube uses some 0.4 Wh per flash and the super-capacitor LED flash uses 0.76 Wh per flash. Note that there are also low-cost cell phones with 'normal' LED flash, i.e. without super-capacitor, but they do not deliver a comparable performance.

Figure 59 Non-photographic flash tubes. Left: Xenon flash tubes, here for Intense Pulse Light (IPL) application. Right: IPL device for hair removal

Backlights

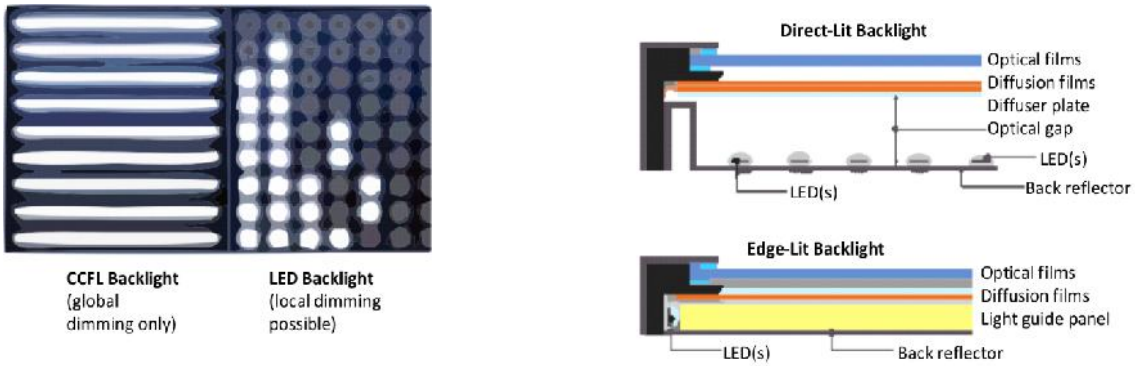


Figure 60 Backlighting techniques in modern electronic displays. Left: CCFL (Cold Cathode Fluorescent Lamps) and LEDs (Light Emitting Diodes). Right: Within the group of LED-lit displays there is a distinction between edge-lit LEDs and direct-lit LEDs. Local dimming, i.e. adjusting the lamp flux to the image being displayed, is only possible with direct-lit LEDs

D.9 Ultraviolet (UV)

The most important application of UV lamps is probably in tanning devices such as sunbeds and solaria. As the sector is in decline (see table below), most of them will be replacement lamps.

		Import in million euros					
		2007	**2008**	**2009**	**2010**	**2011**	**2012**
85437050	All					3	3
85437051	fluorescent tubes UV-A, <100 cm	1	0	1	1		
85437055	fluorescent tubes UV-A, >100 cm	2	2	2	2		
85437059	other than fluorescent tubes	9	11	6	7		
	total	**11**	**14**	**9**	**9**	**3**	**3**
		Export in million euros					
		2007	**2008**	**2009**	**2010**	**2011**	**2012**
85437050	All					25	26
85437051	fluorescent tubes UV-A, <100 cm	9	8	6	3		
85437055	fluorescent tubes UV-A, >100 cm	59	46	31	27		
85437059	other than fluorescent tubes	18	30	18	9		
		86	**83**	**55**	**38**	**25**	**26**

Note: Production data in Prodcom category (code 27904070) are confidential in UK, SV, NL, BE. No production in other countries 2011.

Table 9 TRADE SUNBEDS, SUNLAMPS AND SIMILAR SUNTANNING EQUIPMENT (Eurostat, extract 2013)

MEErP 2011 mentions 10708 hot baths and spas, 72302 other physical well-being establishments (including tanning salons) and 158709 beauty parlours. The UK association for sunbeds mentions an estimated 8000 tanning salons in the UK alone. Investigations in Nordic countries show that 7-10% of the interviewed persons use sunbeds on a regular basis. Some publications speak of a 1 billion euros business for Europe. On the basis of these data it is estimated that there are around 50 000

tanning facilities (salons, beauty parlours, hot baths and spas) that have a solarium or several sunbeds. Furthermore, it is estimated that at least a few million sunbeds are installed in private EU homes (penetration 1-2%).

Figure 61 UV lamps. Left: UVA/UVB tanning lamp, LLFL form factor, 80W/150cm or 100W/176cm-250W, 10-20 euros (Philips Cleo Performance-S by ISOLde). Right: High Pressure mercury lamp for facial/mobile tanning, 400 W, Rs7, l=100 or 120, 25-30 euros/lamp (Philips HPA)

Figure 62 Sunbeds. Left: top/down 20 UV tanning lamps (around 2000 euros), Right: Top with 10 UV tanning lamps (around 900 euros consumer price incl. VAT). Tanning lamps costs 10 - 20 euros per unit

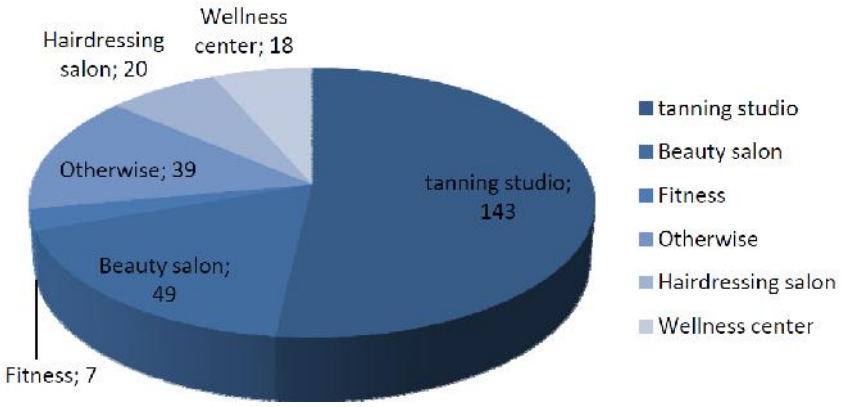


Figure 63 Distribution of tanning lamp studios, by type, from EU study on compliance with the directive on UV

Figure 64 Examples of UV-A applications. Left: UV-A nail polish curing. Middle: UV-A tracking forgeries. Right: UV-A in reprography (blue-sensitive plastics)

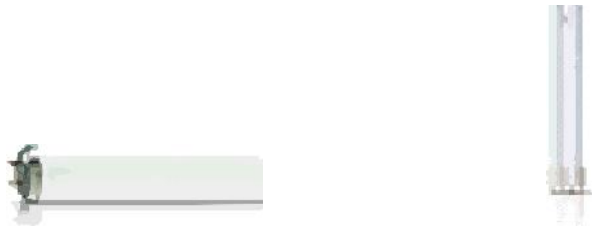


Figure 65 Medical phototherapy UV-A and UV-B lamps. With LFL (left) or PL (right) form factors

Figure 66 Examples of UV lamps. Left: Supratec Blacklight and blue light for industrial applications (18W, 57V). Middle: UV-A ('Blue') lamp, 45-61V, 7-18W. Right: UV-C germicidal ultraviolet lamps, 4-55W, disinfection without chemicals, low mercury content, long lifetime due to specific coating, ozone-free. dominant wavelength: 254 nm (OFR version)

Figure 67 Examples of UV-C applications. Left: Agricultural waste water treatment with germicidal UV-C lamps. Mid: Germicidal lamp in a butcher's shop. Right: 9 watt germicidal UV-C (short wave UV) lamp, in compact fluorescent (CF) form factor.

Figure 68 Industrial UV-C lamps. Left: Excimer lamp, UV-C radiation at 172 nm, Operation with pulse-type DC current, 20W, 2500h, irradiance 40 mW/cm2, d=120mm, l=247mm. Right: Low pressure mercury lamps, also used as an UV-C industrial lamp for e.g. cleaning.

D.10 Infrared (IR)

Figure 69 Infrared lamps. Left: Infrared incandescent lamp 100-375W, 230..240V, 1100 nm, E27, 30 °angle, 5000h, l=136, D=122 (OSRAM Siccatherm). Middle: Infrared halogen lamp 200-1000W, 230..240V, 1100 nm, R7s, position p15, lamp l=187.5, filament l=120 (OSRAM Halotherm). Right: Gold-coated IR heat lamp, as used for comfort heating (Dr. Fischer).

Figure 70. IR heat lamps when raising young animals (e.g. pigs, chicken, pets), using either the PAR-type glass bulb (see fig. below) or the ceramic bulb.

Figure 71 IR heat lamp applications. Left: terrace heating. Middle: heat source in hobs. Right: heat source for toner fusion.

Figure 72 Collagen heat lamp, NOT an IR lamp. Collagen lamps are optimised to emit light in the visible red spectrum (picture: 100W, LFL form factor). They do not give tanning but only heat without side effects. Proposed now as retrofit for sunbeds originally bought for (UV) tanning. Unit price around 15-20 euros. (10 or 20 lamps per sunbed).

D.11 Grow lights

Figure 73 Grow lights. Glass greenhouse with HPS grow lights (600-1000 W per unit). Average capacity, using HPS lamps, is 600W per 2 m².

D.12 Food display lamps

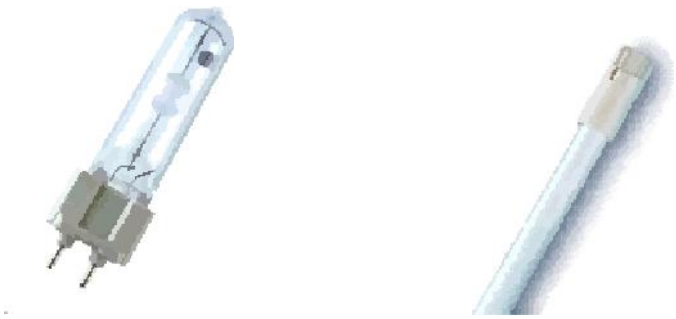


Figure 74 Typical lamps used in food display. Left: Metal halide lamp (used in spots). Right: T2 mini tube (diameter 7 mm), used in counters (6-13W, 8000h, Ra 70-79).

D.13 Scientific lamps

Figure 75 Examples of scientific lamps. Left: Lamp for scientific purposes: 31V, 6A, E27, 2856K. Application: Comparison standards and calibration lamps; Measurements in photometry, colourimetry and photophysics. Calibration for measurement of luminous intensity, luminous flux, black body temperature, colour temperature, spectral radiant intensity distribution. Right: Spectroscopic lamps, 15V, 15W versions with various metal vapour filling (Ti, Cs, Rb, Cd, Na, Zn, Hg etc.) applications in optics, photophysics, spectroscopy and chemical engineering and medicine.

D.14 Communication light sources

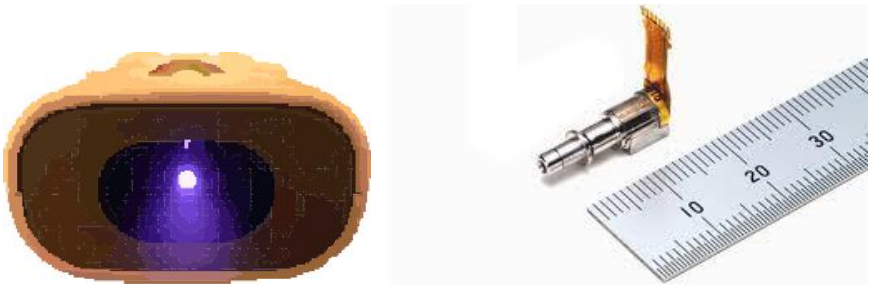


Figure 76 . Light sources in data communication. Left: Infrared light from the LED of a remote control. Right: Laser for optical fibre communication networks

D.15 Estimated sales and energy data

Nr	SPECIAL PURPOSE LAMPS	units stock	lamp power	opera-tion	energy	lamp life	total lamp sales	o/w new sales	o/w in-candes-cents
nr	**Signalling and signage lamps**	m #	W	h/yr	TWh/yr	h	m #/yr	m #/yr	m #/yr
3	traffic signalling lights (incand. 45% (LV/MV 50/50), HL 5%)	5.00	60	3000	0.900	2000	7.5	0.5	6.7
4	traffic signalling lights (LED 50%)	5.00	5	3000	0.075	20000	0.8	0.5	
5	railway lights (crossings and signals)	0.98	16	3650	0.057	2000	1.88	0.1	0.8
6	marine signalling lights (buoys, light houses)	0.10	10	8760	0.009	10000	0.10	0.01	0.05
7	airfield signalling (current controlled, in series)	1.20	71	4300	0.366	2000	2.7	0.12	
8	neon and (static) billboards (LFL, MH)	0.52	394	4380	0.896	10000	0.3	0.05	
9	exit signs, commercial and industrial buildings	50.00	11	7500	4.125	20000	5.0	5	
		62.80			*6.43*		*18.21*	*6.28*	*7.55*

		units stock	lamp power	opera-tion	energy	lamp life	total lamp sales	o/w new sales	o/w in-candes-cents
	Appliance-integrated (non-primary) lamps	m #	W	h/yr	TWh/yr	h	m #/yr	m #/yr	m #/yr
13	*residential*								
14	refrigerators	204.00	20	60	0.245	1000	16.0	13.9	2.1
15	freezers	14.00	20	30	0.008	1000	4.1	3.6	0.5
16	washing machines	10.00	3	10	0.000	20000	10.0	10	
17	range hoods	96.00	11	240	0.253	2000	12.0	7	0.5
18	laundry driers	62.00	20	10	0.012	1000	6.1	5.3	0.8
19	ovens electric	193.00	20	110	0.425	1500	14.5	10.5	4.0
20	ovens gas	22.00	20	110	0.048	1500	2.3	2	0.3
21	microwave	129.40	20	20	0.052	1000	17.0	14.8	2.2
22	sewing machine	17.00	20	50	0.017	1000	1.2	1	0.2
23	aquarium (T5 lamps)	8.30	48	8760	3.490	6000	12.9	0.83	
24	fish pond, decorative uplights (HL-LV), anti-algae (UV)	0.83	20	3000	0.050	1500	1.7	0.083	
25	swimming pool (PAR 300W, trend LED 24W, possibly UV-C)	16.00	300	456	2.189	1500	5.4	0.5	
26	*non-residential*								
27	refrigerators	35.00	20	200	0.140	1000	7.5	2.2	0.5
28	freezers	6.00	20	200	0.024	1000	1.3	0.5	0.1
29	laundry equipment	5.00	20	50	0.005	1000	2.3	2	0.0
30	range hoods	6.00	20	1200	0.144	1000	7.8	1	0.7
31	ovens	0.76	20	1000	0.015	1000	0.8	0.078	0.7
32	vending machines (T5, T2, LED lamps; display, task light)	3.70	80	8760	2.593	10000	6.9	3.7	
33	automatic dispensers, incl. ATM (T5, LED; task light, signage)	0.50	20	8760	0.088	10000	0.5	0.05	
34	machine tools integrated lamps (incandesc., HL; task & safety)	7.40	20	500	0.074	1500	3.0	0.522	0.2
35	elevators, escalators (CFLs, LFL; safety)	4.50	22	500	0.050	10000	0.4	0.135	0.0
		841.39			*9.92*		*133.71*	*79.70*	*12.94*

		units stock	lamp power	opera-tion	energy	lamp life	total lamp sales	o/w new sales	o/w in-candes-cents
	Decorative and architectural lamps	m #	W	h/yr	TWh/yr	h	m #/yr	m #/yr	m #/yr
39	*(semi)domestic*								
40	candle, chandelier lamps <11W	10.00	11	600	0.066	1000	6.0	0	6.0
41	coloured & mirror lamps <11W	8.00	11	100	0.009	1000	0.8	0	0.8
42	linear, tubular incandescent lamps	8.00	35	505	0.141	1000	4.0	0	4.0
43	night light (<11W incandescent, LED)	20.00	5	3650	0.365	2000	8	2	6.0
44	Xmas light string (mini bulb 50x0.5W=25W, LED 100 x 0.06=6W)	150	15	480	1.080	5000	15	15	0.0
45	*commercial (coloured and mirror bulbs <11W & LED)*								
46	fairs and amusement parks, etc.	55.00	11	1500	0.908	1000	82.5	0	8.3
47	(barber)shops, dressing rooms, theatre sets, street Xmas lights	5.00	11	1500	0.0825	1000	7.5	0	0.8
		256.00			*2.65*		*123.84*	*17.00*	*25.84*
	Shockproof lamps and similar								
50	shockproof-lamps car repair shop, inspection, mining, etc.	5.00	60	2000	0.600	2000	5.0	0.5	5.0
51	shockproof-lamps for trouble light at home	100.00	60	5	0.030	1000	0.5	0.4	0.3
52	temperature/ shatter/ vibration proof lamps	3.00	60	2000	0.36	1500	4.3	0.3	3.0
		108.00			*0.99*		*9.80*	*1.20*	*8.30*

		units stock	lamp power	opera-tion	energy	lamplife	total lamp sales	o/w new sales	o/w in-candes-cents
	Projection, microscopy, light guide lamps	m #	W	h/yr	TWh/yr	h	m #/yr	m #/yr	m #/yr
56	cinema projectors >16 mm (Xe short-arc, 0.9-15 kW)	0.03	1500	2000	0.078	1000	0.1	0.15	
57	legacy film projectors <16mm, slide/overhead projectors	15.00	20	100	0.030	1000	1.5	0	1.5
58	home cinema rear/front projectors (Xe short-arc, Phaser)	0.80	120	1500	0.144	6000	0.3	0.1	
59	office portable front projectors	2.80	100	200	0.056	1000	0.8	0.28	
60	office fixed projectors	0.40	200	500	0.040	1000	0.3	0.05	
61	schools rear/front projectors	4.00	120	1500	0.720	6000	1.5	0.5	
62	copier and scanner exposure lamps (CCFL, HL, Xe)	134.00	12	78	0.938	6000	110.0	110	
63	endoscopy, larascopy (Xe short-arc, LED)	0.10	75	200	0.002	500	0.1	0.012	
64	lab optical fluoresc. microscopy (HL, Xe short arc, Hg short arc, LED)	1.50	100	2000	0.300	1000	3.2	0.1875	
65	incidental/amateur microscopy (HL, incandescent)	15.00	10	100	0.015	1000	3.0	1.5	1.5
66	surgical lamps, headlights (Xe short-arc, LED)								
67	ophtalmic lamps (Xe-short arc)	0.10	100	500	0.005	1000	0.1	0.01	
68	museum and other photo-/heat-sensitive apps (lamps+fiber)	2.00	3000	15	0.090	2000	0.215	0.2	
		175.73			*2.42*		*120.96*	*112.99*	*3.00*
	Movie/TV or photo studio/theatre/event lamps								
72	TV/video/film studio lamps	1.80	775	1000	1.395	2000	1.1	0.18	
73	theatre lamps	0.30	500	500	0.075	500	0.3	0.03	
74	disco and other lamps	0.50	300	1000	0.150	2000	0.3	0.05	
75	event lighting	0.30	500	500	0.075	500	0.3	0.03	
76	outdoor stadium lighting	1.03	1661	365	0.624	6000	0.2	0.1	
77	photographic studio lamps	0.70	500	500	0.175	500	0.8	0.07	0.1
78	photographic flash tubes (Xe flash, LED flash)	400.00	703	0.0035	0.001	200	160.0	160	
79	Intense Pulse Light (Xe flash tube, laser)	2.00	100	100	0.020	2500	0.4	0.3	
		404.63			*2.50*		*162.98*	*160.46*	*0.10*

		units stock	lamp power	opera-tion	energy	lamp life	total lamp sales	o/w new sales	o/w in-candes-cents
		m #	W	h/yr	TWh/yr	h	m #/yr	m #/yr	m #/yr
	Grow lights (low-green visible spectrum)								
84	Growlights in glass greenhouses (roses, tomato, chrysantum)	2.00	1000	2600	5.200	1000	5.4	0.2	1
85	Growlights in private homes and offices, shopping malls	2.00	11	4000	0.088	6000	1.5	0.2	
		4.00			5.29		6.93	0.40	1
	Food display light (low UV & IR--> MH or LED or T2; not HPXe)								
88	ceiling based spot lights (HPMH), e.g. vegetables	2.50	70	3000	0.525	2500	3.0	0	
89	counter-based linear lights (T2, T5), e.g. meat/fish/bakery	20.00	9	3000	0.540	2500	24.0	24	1
		22.50			1.07		27.00	24.00	1
	Scientific lamps								
92	solar simulation in testing labs (Xe long arc)	0.002	1000	5000	0.010	500	0.02	0.001	
93	spectroscopic lamps (15 W, misc. metal vapours)	0.01	500	15	0.0001	700	0.0	0	
94	comparison standards and calibration lamps for photometry, colourimetry and photophysics (incandescent)	<0.001							
95	UV for artificial material aging (Xe long arc)	<0.001							
96	infrared vibrational spectroscopy	<0.001							
		0.012			*0.010*		*0.020*	*0.001*	*0.00*

		units stock	lamp power	opera-tion	energy use	lamp life	total lamp sales/yr	new sales
	UV lamps	m #	W	h/yr	TWh/yr	h	m #/yr	m #/yr
100	*tanning (LFL form<100 cm, LFL form>100 cm, HPHg UV)*							
101	tanning lamps (UVA/UVB), professional	0.50	150	2000	0.150	700	1.4	0.01
102	tanning lamps (UVA/UVB), home	30.00	150	100	0.450	500	8.0	2
103	*germicidal/ desinfection (UVC)*							
104	jacuzzi/hot tubs (reducing use of chlorine or other chemicals)	5.00	50	100	0.025	2000	0.37	0.12
105	drinking water (at home entry, under-the-sink, taps, mobile apps)							
106	waste water treatment (LPHg)	0.06	1000	8000	0.480	800	0.6	0.003
107	*curing/polymerisation*							
108	dental curing lamps	0.25	11	100	0.0003	6000	0.0	0.025
109	cosmetic nail modelling	0.20	11	200	0.0004	6000	0.0	0.02
110	UV printer lamps	0.01	100	200	0.0002	20000	0.0	0.02
111	*industrial UV lamps (excimer, LPHg)*							
112	removing organic residue							
113	etching plastic surfaces							
114	activating wafer surfaces							
115	setting of wetting angle	1.00	500	2000	1.000	5000.00	0.50	0.10
116	removing photo resist (electronics industry)							
117	producing ozone							
118	UV treatment of juices (instead of pasteurisation)							
119	creating a matt surface on lacquer							
120	EUV (13.5 nm) microlithography, etching lamps (Hg-arc)	0.01	5000	5000	0.125	500	0.1	0.002
121	*medical*							
122	forensic analysis, drug detection (200–400 nm)	0.03	20	500	0.000	10000	0.001	0.001
123	UV spectroscopy (30-200 nm, e.g. He discharge lamp)	<0.001						
124	bilirubin therapy lamps (HL, CFL/LFL, LED)	0.01	100	5000	0.003	3000	0.01	0.005
125	*other*							
126	insect traps (365 nm attracts insects)	10.00	15	500	0.075	6000	1.00	1

127	terrarium lamps (UVA/UVB light for reptiles; HPXe or LFL/CFL forms)	1.20	20	5000	0.120	2000	3.00	0.12
128	fake ID /tags/ labels checking lights/torches (LED, PL)	0.10	11	100	0.000	6000	0.0	0.01
129	forgery detection of banknotes (PL-form 'blacklight')	10.00	11	60	0.007	6000	1.3	1.25
130	public toilet blacklights (anti-drug abuse)	1.0	38	2000	0.076	6000	0.43	0.1
		59.36			*2.51*		*16.73*	*4.79*

	IR and collagen lamps	**units stock** m #	**lamp power** W	**opera-tion** h/yr	**energy use** TWh/yr	**lamp life** h	**total lamp sales/yr** m #/yr	**new sales** m #/yr
134	zootechnical (raising young animals)	2.00	250	5000	2.500	2000	5.0	0
135	therapeutic & comfort (e.g. saunas with IR lamps)	22.40	200	50	0.224	2000	2.8	2.24
136	copier and printer toner fixation (heater lamps)	23.40	500	286	3.35	2000	11.0	5.5
137	infrared heater lamps in electric hobs	16.00	1700	200	5.440	4000	0.8	6.5
138	counter-top heaters in restaurants (service counters)	6.00	1000	1800	10.800	5000	2.2	1
139	intensive drying of agricultural products							
140	drying of paint and lacquer							
141	graphical and printing industry	2.00	1000	2000	10.80	5000	2.16	0.20
142	blow moulding and thermoformingproduction (e.g. PET bottles)							
143	reflow soldering of PCBs							
144	pasteurisation and drying in the food industry							
145	collagen lamps (visible red spectrum)	3.00	150	100	0.045	700	0.4	0.3
		74.80			*33.16*		*24.35*	*15.74*

	Backlighting for electronic displays	**units stock** m #	**lamp power** W	**opera-tion** h/yr	**energy use** TWh/yr	**lamp life** h	**total lamp sales/yr** m #/yr	**new sales** m #/yr
149	CCFL TV lamps (65% of stock, 28% of sales 2011)	4000.00	7.5	1460	43.800	20000	300.0	300
150	LEDs for TV lamps (35% of stock, 78% of sales 2011)	3800.00	1	1460	5.548	20000	600.0	600
151	CCFL desktop monitor lamps (80% of stock, 50% of sales 2011)	825.00	7.5	1000	6.188	20000	60.0	60
152	LEDs desktop lamps (20% of stock, 50% of sales 2011)	344.00	1	1000	0.344	20000	100.0	100
153	CCFL notebook monitor lamps (50% of stock, 20% of sales 2011)	100.00	10	1000	1.000	20000	20.0	20
154	LED notebook monitor lamps (50% of stock, 80% of sales 2011)	500.00	1	1000	0.500	20000	120.0	120
155	LED lamps (OLED) tablet	471.00	1	500	0.236	20000	120.0	120
156	LED lamps (OLED) smartphone	200.00	1	150	0.030	20000	130.0	130
157	LED lamps (OLED) other mobile phone	300.00	0.5	100	0.015	20000	200.0	200
158	GPS mobile (not fixed in car)	200.00	1	150	0.030	20000	50.0	50
159	handheld game devices with backlight	25.00	1	200	0.005	20000	25.0	25
160	cash register displays (possibly with touchscreen)	10.00	10	2000	0.200	20000	1.3	1.25
161	Other: public signage, medical, security, all-in-one video conferencing, CAM machine tool displays (LEDs, CCFL lamps)	20.00	10	3000	0.600	10000	10.0	10
		10795			*58.50*		*1736*	*1736*

	Lights in vehicles (rough estimate)	**units stock** m #	**lamp power** W	**opera-tion** h/yr	**energy use** TWh/yr	**lamp life** h	**total lamp sales/yr** m #/yr	**new sales** m #/yr
165	Car headlights (beamers, custom made)	448	20	150	1.344	2000	100.0	64
166	Car taillights	448	10	150	0.672	2000	100.0	64
167	Car indicator/emergency lights (6 per car)	1344	10	10	0.134	2000	200	192
168	Car search/fog lights, offroad vehicle lights (beamers, standard)	150	50	5	0.038	2000	55	23
169	Car interior lights	448	20	10	0.090	2000	64	64
170	Truck/van headlights(beamers, custom made)	64	35	1500	3.36	2000	60.8	12.8
171	Truck/van taillights	64	20	1500	1.92	2000	60.8	12.8
172	Truck/van indicator/emergency lights (6 per truck/van)	192	20	50	0.192	2000	43.2	38.4
173	Truck/van contour lights	192	10	1500	2.88	2000	182.4	38.4
174	Truck/van interior lights	192	20	500	1.92	2000	86.4	38.4
175	Train interior lights	6	9	2000	0.108	6000	3.2	1.2
176	Train head- and taillights	0.1	75	5000	0.0375	6000	0.1033	0.02
177	Boats interior and signal/contour light	0.325	17	200	0.0011	6000	0.0758	0.065
178	Airplanes interior and contour light	0.3	11	5000	0.0165	6000	0.31	0.06
		3549			*12.713*		*956*	*549*

	Other mobile lights	**units stock** m #	**lamp power** W	**opera-tion** h/yr	**energy use** TWh/yr	**lamp life** h	**total lamp sales/yr** m #/yr	**new sales** m #/yr
182	Gas lights (camping)	2.8	100	100	0.028	6000	0.3267	0.28
183	Torch lights	200	1	5	0.001	6000	25.167	25
		202.8			0.029		25.493	25.28

	Data communication and (other) laser applications							
186	remote control LED (IR/red light)	1000	1	1	0.001	20000	150.0	150
187	Dashboard and indicator lights (rough estimate)	20000	0.05	150	0.15	6000	2000	2000
188	lasers for optical fibre networks							
189	lasers for light projection							
190	lasers for cutting metals, plastics, etc.							
191	lasers for positioning							
192	misc. laser applications							
		21000	*1*	*151*	*0.15*	*26000*	*2150*	*2150*

	TOTALS	units stock m #	lamp power W	opera-tion h/yr	energy TWh/yr	lamp life h	total lamp sales m #/yr	o/w new sales m #/yr	o/w in-candes-cents m #/yr
	Signalling and signage lamps	62.80			6.43		18.21	6.28	7.55
	Appliance-integrated (non-primary) lamps	841.39			9.92		133.71	79.70	12.94
	Decorative and architectural lamps	256.00			2.65		123.84	17.00	25.84
	Shock-proof lamps and similar (incandescent, CFL, LED)	108.00			0.99		9.80	1.20	8.30
	Projection, microscopy, light guide lamps	175.73			2.42		120.96	112.99	3.00
	Movie/TV or photo studio/theatre/event lamps	404.63			2.50		162.98	160.46	0.10
	Grow lights (low-green visible spectrum)	4.00			5.29		6.93	0.40	1.00
	Food display light (low UV & IR--> MH or LED or T2; not HPXe)	22.50			1.07		27.00	24.00	1.00
	Scientific lamps	0.012			0.01		0.020	0.001	
	UV lamps	59.36			2.51		16.73	4.79	
	IR and collagen lamps	74.80			33.16		24.35	15.74	
	Backlighting for electronic displays	10795			58.50		1736	1736	
	Lights in vehicles	3549			12.71		956	549	
	Other mobile lights	202.8			0.03		25.493	25.28	
	Data communication and (other) laser applications	21000			0.15		2150	2150	
	TOTAL	***37556***			***138***		***5513***	***4883***	***60***

Table 10 Estimated Sales and Energy data for Special Purpose Lamps (VHK, preliminary)

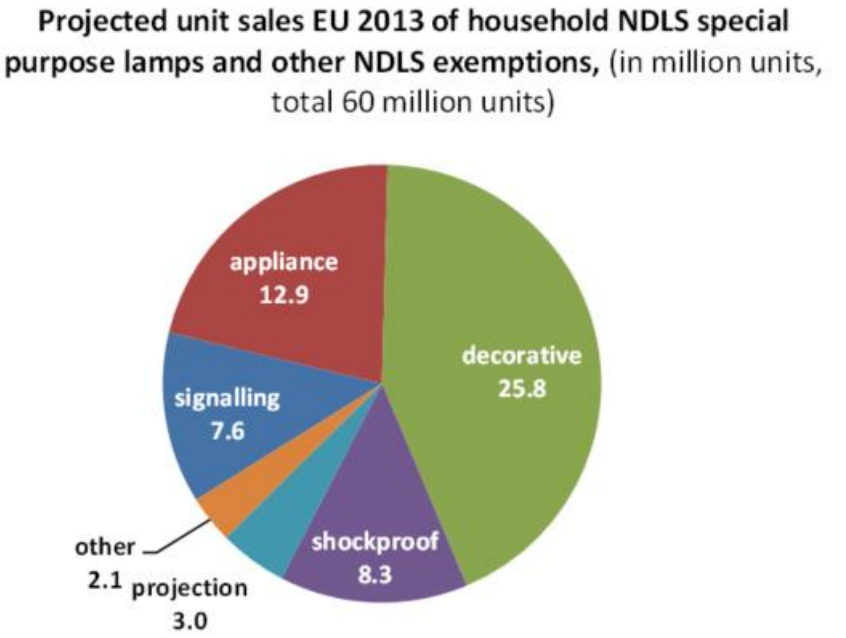


Figure 77 Subdivision of Sales data for Special Purpose Lamps

NOTES/ COMMENTS (referring to row numbers in Table 10**:**

3
Compare: US 2010 --> 15.9 m traffic signals (95% LED). For EU sources (mostly city councils and local statistics) there is much confusion caused by the definition of 1 'traffic light', which can mean 1 signalling installation at a crossroads (e.g. 30-60 bulbs), 1 luminaire with 3 or 2 bulbs (a.k.a. as 'red light bulbs') or 1 traffic light bulb.
On average for the EU 1 traffic light bulb per 60 inhabitants was deduced from the anecdotal data (--> 8 m bulbs). To this the mobile and other traffic signal light sources have to be added. See table.

5
US data: 0.976 m total stock, of which 0.549 incandescent, rest LED. Average 16W

6
legacy buoy light bulbs have vertical filament for better horizontal radiance. Lighthouses are almost extinct

7
3300 airfields of which 150 bigger ones with multiple (say 3) strips --> 4 k airstrips of 3000 m with light every 10 m--> 300 lights x 4 k=1.2 m lights

8
'neon' is a cold cathode discharge tubular lamp, filled with Ne (red) or other gases. It is custom made. No market data are available. Other advertising signs rely usually on LFL or more recently LED back- or edge-lit billboards. Other data from US 2010 study

9
US 2010: 38 m LED exit signs for 5.4 m buildings. EU has 7.05 m industrial and commercial buildings (MEErP) and also a higher share of CFLs (11W?) besides LEDs. So estimate 50 m exit signs. An exit sign is a battery backed-up device (on mains voltage). In the US an exit sign works 23 h/d. In the EU assumed as well.
Energy-efficient alternative (but requires proper handling in production and disposal) are 'self-luminous'exit signs using tritium (H3) gas, where the radioactive isotope makes the signs light up (no electricity, works reportedly for 15 years, 130 000 hours). In the US, they are allowed by the US Nuclear Regulatory Commission and also sold (at least as imports) in the EU. www.michigan.gov: More than two million tritium EXIT signs are estimated to be in use in the United States.
Wattage: LED signs of 7W (incl. some emergency lighting facility) found in NL.

15
total stock 72 m (most without light)

16
total stock 186 m (most without light)

20
total gas oven stock 45 m (half without light)

22
only anecdotal: 1 m sewing machines sold in US recently. Stock=17x sales

23
fixture with 2x24W T5 lamps (55cm wide)

24
Number of fish ponds is estimated at 10% of aquariums

25
EUSA (industry ass): stock 4-5 swimming pools. 99% private. With avg. 4 x 300W PAR (now rapidly being replaced by LED. Operation: 5 months/yr (152 d) x 3h/d x 4 m pools. Philips mentions UV(C) light to reduce chemicals use (?)

29
total stock 10 m

32
T5, T2, LED lamps. nr. of machines, not lights. Around 70% is hot drinks

33
MEErP 220 k branch offices with 2 machines each. Light is T5 20W

34
ENTR Lot 5: 7.4 m stock (lathes, milling, etc.). Sales 2010: 522 k

35
Elevators WP2: 2010: 4.4 m stock; 0.13 sales. 2x11W CFL.
EscalatorsWP2: 0.09 m stock (2010), 0.005 m sales. Sometimes LFL in handrail and/or at start/end

41
Party lights, probably also includes small restaurants

42
(Philinea, Linesta) 35-40W. Mostly lamps above mirrors. Also used in the past under (kitchen) cabinets

43
11 W incandescents or 2-3 W LED. Families with young children 10% of 200 m EU hh, active use 10h x 36544
50 lights x 0.5W x 30d x
16 h/d or LED 100 x .06 x
30 x 16

46
MEErP: 11 k amusement parks
5000 per park (mainly coloured bulbs). Varies from 1500 to 1000000 bulbs (village fair to Blackpool Illuminations

47
mirror bulbs. Also string lights (used to be small incandescent, now primarily LED)

50
US DoE projects 5.8 m shockproof lamps for US 2012. The EU is 1.5 times the number of inhabitants, but has less mining activities and non-incandescent shock-proof lamps have been around for a while in the EU DIY sector.

52
US DoE expected 3 m vibration service lamps and 1.7 m shatter-resistant lamps to be sold in the US 2012. These lamps are sold for professional applications, especially those with safety risks, e.g. industrial ovens, machine tools, etc..

56
NL 883 cinema screens/17 m inhabitants--> ca. 50/m inhab..
EU 500 m inhab.--> 25k screens/projectors.
discharge lamps with Mercury-halogen gas >60 lm/W. Projector life ca. 10 years (sales=0.1stock)

57
legacy 8mm or double 8 film projectors with small incandescent bulb. Category could also contain legacy slide and overhead projectors no longer in use

62
30% of 21 kWh/yr (=IJ annual) =7 kWh/year, 12W CCFL. B2B 110 m.

63
Light guide application with external Xe-arc lamp (high radiation) projected into glass fiber. Trend: Use LED in the inspection head (internally)

64
optical, fluorescence microscopes for medical, forensics, industry labs (pharmaceutical, electronics). Includes fluorescence excitation (with black glass filters). Trend: large demand for electron microscopes by industry

67
http://www.hbd.nl/: 2200 opticiens in NL Handelsdaten: 12000 in DE. Ca. 150 per m inhab.--> 75 k in EU. Plus medical doctors (eye specialists)--> 100 k

68
ca. 20 'museums' per m inhabitants--> EU 10k museums. Per museum on average 200 special lamps (average 10-20 W HL or LED source)

72
MEErP 60 k production companies. 3-4 studios per company, 10 lamps per studio (halogen 1000 W, ceramic MH

250 W, LED 220W). 70% HL 1000W, 30% ceramic 250W

73
MEErP: 16 k theatres. 18-20 lamps per theatre

74
NACE: 31 k disco-bars and 31 k dancing and other entertainment. Spots, blacklight, strobes. Blacklights in toilets --
>anti-drug use (difficult to find veins)

75
No data, assumed same as theatre (in reality fewer, but bigger lamps)

76
US data 2010:

77
136 k pro studios x 5 lamps. Incandescents are used as a preparatory light (in the same reflector as the real lamp)
to test lighting set-up

78
stock: 200 m smartphones + 200 m cameras. Sales 130 m smartphones +30 m cameras (GfK). LED flash ca. 3J/50 ms (=60W). Xenon flash 1.4 J/1 ms (=1.4 kW). Average 703 W on 25 ms. e.g. 500 flashes/yr --> 12.5 seconds =0.0035 h
Import nr 26701700 value 210 million (no volume), definition Flashlights (excluding photographic flashbulbs, flashcubes and the like); photographic enlargers; apparatus for photographic laboratories; negatoscopes, projection screens.
Note that traditional flashbulbs (import nr. 27403100 value 4 million, no volume), are almost extinct.

79
cosmetic or medical therapy, hair removal and treatment of skin (dyspigmentation, acne, freckles, broken capillaries, etc.). New upcoming market

84
HPS 600-1000W. Experimental: LED
In the US metal halides are popular growlights (instead of HPS)

84
incandescents are still in use in specific appliactions

85
90% CFL-PL, 10% HPS

87
700 k food retailers (incl. supermarkets). Around 150 m2 average--> 100 Mm2. Fresh food and meat 20%=20 Mm2. 1x70 W HPMH-spot or counter with 8 x T2/T5 (also 70 W) per 4m2 --> 5 m light units

89
Espcially in outdoor markets, incandescent lamps are still in use.

92
10-20 test labs. Each max. 100 Xe long arc lamps. Around 750-1000W. 5000h/yr

93
no data. Scientific research lamps

94
Only a few labs in the EU are specialised in this type of light source testing

95
Similar as solar test lab. Used for e.g. testing of new plastics or paints

100

Between brackets: the 3 types distinguished by ProdCom and EU trade statistics

101
10 lamps per sunbed. 50k tanning studios & beauty parlours

104
WP2: stock 5 m. sales 0.15 m. 50 W?

106
UV instead of ozone, chlorine or sodium hypochlorite for disinfection in water purification. Used for waste water from farms (LPHg source, e.g. 200W for 160 m3/h), industry and public waste water purification. NL purification public 360 + industrial 1000 + agricultural --> 2000 on 17 m inhab.--> 120 reactors per m. inhab-->60 k reactors. Say 1000 W

108
surface curing of photosensitive thermoset polymers. MEErP: around 157 k dental practices, possibly with several studios, say 250 k dental curing lamps (11 W, PL form factor)

109
Curing of photosensitive thermoset polymers. MEErP: ca. 160 k beauty parlours in EU. Say 200 k nail curing lamps (11 W, PL form factor). No replacement sales. Sales 10% of stock

110
Large format Printing on any material (mostly plastics). UV lamp LED array of 100 W e.g.
1 UV printshop per 0.1 m inhabitants --> 5 k x 1 printers per shop= 10 k

111
UV excimer lamps with a wavelength of 172 nm or UV low-pressure mercury lamps with emission wavelengths of 185 and 254 nm. Low-pressure lamps and excimer lamps with outputs up to 800 W and 3,000 W (e.g. Heraeus Noblelight)

112
Application fields of excimer lamps (UVC) and other UVC

115
Wetting angle is the angel between a drop of liquid on a solid surface. Can be controlled for certain polymers with UV

116
a.k.a. photocatalytic cleaning of wafers

117
Ozone is used for purification of water, but also --according to EPA not convincingly-- in special air purification devices

118
allowed for juices instead of heat treatment, but sparsely applied (in US only 2% of juices). Perhaps in the future also for milk (instead of heat treatment)

120
e.g. used by ASML and chip manufacture.

122
Human fluids 'light up' and can thus be made visible with UV light e.g. at a crime scene. Narcotics such as amphetamine, cocaine and certain MDMA tablets are clearly fluorescent when illuminated with UV light (e.g. from an UV-LED torch used by police)

123
protein analysis, DNA sequencing, drug discovery (270–360 nm)

124
NL: 200 incubators ('couveuses') for 17 m inhabitants (10k children of 180k are premature= 5-7%). For EU around 6k. 8x20W=160 W HL or 40W CFL/LFL or 20W LED (450-470 nm wavelength)

126
Assumed 5% market penetration households. 15W CFL . Used only in certain hours in summer
Assumed no replacement sales (lamp lasts the lifetime of the trap)

127
Reptiles can 'see' UVA light and need it e.g. to recognize prey or mates. According to the American Pet Product Manufacturers
Association, approximately 3.9 million US households, keep one or more reptiles and amphibians. This is around 3% of population. For EU this comes down to 6 million. Assuming 20% with UV lamps this is around 1.2 million

128
MEErP: Around 0.2-0.3 m officers working in border control. Assumed is a stock 0.1 m with PL-type lamp 11W, used for low hours

129
Also SSC (KR) has brought LED portable detectors on the market
MEErP: 3.53 retailers, of which 0.9 with multiple cash registers (e.g. 5)--> estimate 10 m devices with 8 yr life. Pushbutton activated so low hours

130
UV blacklight lighting is used in public areas for deterring drug use. The colour of the skin under these lights makes it harder for a drug user to find a vein.

134
Eurostat 2012 EU27: 9.2 bn eggs from incubator, of 6.2 bn chickens for hatchery utility (meat) and the rest for laying or reproduction. 6 weeks per chicken --> 9.2 x 6/52= 1.06 bn chickens being raised permanently, requiring 1 x 250 IR lamp per 50 chickens--> around 20 m lamps ('on' at least in the first 4 of the 6 weeks, e.g. 5000h/yr). However, this is professional farming, which uses normally gasheating. In reality, hobby-farms use these lamps
but are maybe 10% of total. Another approach: The Eurostat IRENA identified on-third (34%) of the 1.85 m agricultural companies as 'hobby-farms'= 0.63. Add to this others (e.g. raising pets, private homes with poultry, etc.) to have a round figure of 1 m farms/etc. that have occasional breeding. Assume that this will keep on average 1 IR lamp (250W) occupied during 5000 h per hobby farm (thisi is an abstration of more likely 3 IR lampsduring much shorter times)

135
WP2: 7 m EU saunas, IR 20% market share (5% wood, 75% steam/electric)= 1.4 m, power 1.6-1.7 kW (8*200W lamps), 2 x 0.5h/week, 50h/yr. --> 119 GWh. Sometimes combined with ceramic radiation elements (e.g. 2 ceramic + 6 IR), but assumed here that all is IR.
Market and power data of other IR therapy and comfort lamps unknown (home local IR against hernia, terrace heating, etc.)--> double the above numbers. Sales IR sauna=10% of stock=0.14.
Near-infrared heat is advertised to increases blood circulation and oxygen delivery to all tissues in body, helping the body to auto-repair and activates “heat shock” proteins, which alert the immune system. Lower EMF than ceramic (far IR) heaters or electric heaters in conventional dry saunas. Saves energy compared to Finnish sauna (typical 6 kW)

136
50% of total copier/printer energy (286 kWh/yr-->143 kWh). The lamps are part of fuser or 'maintenance kits' (50% of sales)

137
faster than conventional (better control); no special pots needed as with induction cooking. But energy transfer is lower than with induction. Average 1700W (x4 hotspots, of which 3 simulataneously during 40 min./day) x 300 dagen
Lot 22/23: 10.3 m sales, 134 m stock, 31.2 TWh, 233 kWh/yr, sales 65% radiant hobs (190 Wh/kg), 25% induction (172 Wh/kg), <10% solid cast iron (210 Wh/kg). Estimated that IR glass tubes ('lamps') are 25% of hot zones in radiant hobs (other hot zones are ceramic resistance heater lamps)

138
MEErP restaurants 1.7 m and canteens 0.3 m. per place 3 lamps
6h/d during 300 days

139
hot air drying is a very energy-intensive operation and leads to undesirable product colour due to elevated drying temperature and the presence of oxygen in the drying system. Heating with the use of infrared radiation (IR) becomes

more and more interesting to the food industry due to the progress in the IR heating technology

140
heat is evenly and consistently distributed. especially for water-based coatings

141
drying and fusing of ink also in larger (e.g. newspaper) printing machines

142
IR lamps replacing traditional resistance heaters (e.g. wound spirals) for better control, speed (lower inertia), etc.

143
Apply soldering paste and put in the reflow oven. After 10 minutes PCB is ready. Replaces hot plates or convection ovens; better control. Uses e.g. 2 x 1000 W for a small-shop oven.

144
surface pasteurisation with IR heating of e.g. ready-to-eat meat products, nuts, almonds, baked products. IR heating is basically a thermal treatment. See also http://www.foodtech-portal.eu

145
10% of tanning lamps. Alternative for sunbed when scared by skin cancer messages

149
total 400 m TVs stock, 62 m sales, 68 TWh on-mode, 4h/d--> 1460h-->116 W (stock). average 31.4" (27 dm2)--> 4.3 W/dm2--> 16 CCFLs of 11-12W nominal, using 65% (7.5 W) in normal operation-->

150
The number of LEDs depends strongly on configuration (edge/direct lit, how many edges, W per LED). For simplicity sake 1 LED of 1 W (normal use, nominal 1.5W) per dm2 is assumed --> 27 LEDs per average TV (31.6")

151
total 172 m monitor stock, 20 m sales, 9.4 TWh on-mode, 4h/d and 250 days--> 1000h-->54 W (stock). average 21" (10 dm2)--> 5.4 W/dm2--> 6 CCFLs of 11-12W nominal, using 65% (7.5 W) in normal operation

152
The number of LEDs depends strongly on configuration (edge/direct lit, how many edges, W per LED). For simplicity sake 1 LED of 1 W (normal use, nominal 1.5W) per dm2 is assumed --> 27 LEDs per average TV (31.6")

153
Various sources (IDC, Gartner, CNET, GfK) are contradictory. EU estimate 40 m notebook sales (4 yr life), 20 m desktop (5 yr life), 40 m tablets
Notebook screen 15" (1 edge-lit CCFL of 10 W (15W nominal)

154
6 edge-lit LEDs for 15 "(=6.2 dm2)

155
10"=2.76 dm2=avg. 3 LEDs of 1 W (BAT is IGZO= 0.5 W for whole display, Sharp)
GfK stock EU15 since 2009 is 2+12+30=44 m x 1.3 --> EU27 = 57.2 m
Used 2h/day, 250 days-->500h/yr

156
GfK: 99 m sales smartphones in 2012, EU15. For EU27 x 1.3--> 130 m. 1 LED of 1 W per smartphone (or 2 x 0.5W)

157
Gartner: 1.75 bn mobile phones worldwide. EU27=17-20%= 300 m --> minus smartphones 130 m --> 170 m (rounded 200 m). Product service life 1.5 years --> 300 m stock. 1 x 0.5W LED

158
12 000 km/car/yr. At 50 km/h=240h/yr. 1 car per hh --> 200 m. 40% GPS--> 80 m. Other non-car GPS 20 m. Total 100 m in stock. Service life 4 years--> 25 m sales. 2 LEDs x 1W per GPS

159
e.g. PS3. 1 LED of 1 W. 5% of EU population

160
Around 15" --> 10 W CCFL edge-lit. MEErP: 3.53 retailers, of which 0.9 with multiple cash registers (e.g. 5)-->
estimate 10 m cashregisters with 8 yr life

161
p.m. rough estimate

165
224 m cars x 2 lamps x 20W HL x 150h (12000 km/yr div. 50 km/h=240h of which 150h with light; mandatory)
car life 7-8 yr --> sales 32 m/yr x 2 lamps

168
Eurostat: Beamers apparent consumption 2009 is 23 m units. 23 x 7 yrs avg life=150

170
stock 32 m commercial vehicles. Drive 3000 h/yr. (150-210 k km) of which 1500 with lights. Lamps 2x car lamps power

173
Eurostat: Beamers apparent consumption 2009 is 23 m units. 23 x 7 yrs avg life=150

175
60 lamps per passenger train unit (LFL, CFL) ca. 9 W.
0.1 m train carts in EU

176
2 x 100 W front, 2 x 50W rear --> avg 75W x 4. Used only when front or rear --> 1 out of 4 --> 0.025 m

177
NL: 10000 pleasure crafts. 1000 yachts and river boats. 100 seagoing --> 11100 per 17 m inhab-->650 per m inhabitants--> 325 k in EU
On average 1 x 11 W interior lamp plus 2 x 3W signal lights

178
3 k planes, 100 per plane 11 W.

179
(= 130 PJ to make =3 Mtoe=0.8% of transport fuel, i.e. 376 Mtoe)

182
Non-electrical lamps and lighting fittings. Imports 0.28 m units.
Presumably most camping gas lamps. Uses 1 standard 300 g butane container a week (7*5h), for 3 weeks --> 900 g butane (40 MJ, 10 kWh) per year (=100h) --> 100 W energy use
Note: Historical gas street lamps also included (e.g. Napels, Castel del'Ovo)

183
import nr 27402100 4 million. units value 174 million. Description: Portable electric lamps worked by dry batteries, accumulators or magnetos (excluding for cycles or motor vehicles). These are replacements, usually they will be sold with the torch.

186
Remote control of TV (400 m), video/DVD player (200 m), complex set-top boxes (150-200 m) and varies other apps. The LED in the battery operated emits IR which is captured by the machine.
(compare also IrDA: a legacy optical communication protocol; now replaced by WiFi and Blu-ray

D.16 References

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Johannesburg, ZA: http://www.joburg.org.za/index.php?option=com_content&id=58&Itemid=71#ixzz2WbXxv6LI

London, UK: http://www.london.gov.uk/mayor/economic_unit/docs/traffic-signals.pdf

Tokyo, JP: http://global-sei.com/its/common/pdf/2011_ITSWC_TS110-3089.pdf

Amsterdam, NL: http://www.amsterdam.nl/parkeren-verkeer/infrastructuur/verkeerslichten/uitleg_over_verkeerslichten

Torino, IT: Citta di Torino, sito web (sul investimento in semafori LED)

Capannori, TO, IT: Sito web della cittadina, sul investimento in semafori LED

München,DE: http://www.muenchen.de/rathaus/Stadtverwaltung/Kreisverwaltungsreferat/Verkehr/Verkehrssteuerung/Lichtzeichenanlage.html

Berlin, DE: http://www.stadtentwicklung.berlin.de/verkehr/lenkung/ampeln/

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SEC(2010) 1354, *Draft Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household washing machines,* Brussels 10.11.2010 available at: http://ec.europa.eu/governance/impact/ia_carried_out/cia_2010_en.htm#ener

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SWD(2012) 289, *implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household tumble driers*, Brussels 3.10.2012 Available at: http://ec.europa.eu/governance/impact/ia_carried_out/cia_2012_en.htm#ener

Market data on growlights

Krista Kolehmainen, MARKET RESEARCH OF GERMAN HORTICULTURE, Case: Netled Oy, Bachelor's Thesis, Tampere University of Applied Sciences, Finland, April 2011.

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LEI energiemonitor van de Nederlandse glastuinbouw, Landbouw Economisch Instituut, Wageningen, 2009.

Brochure, Energiebesparing in de GLASTUINBOUW.

Annex E. EU ENERGY LABEL CLASSIFICATION FOR ELECTRICAL LAMPS (SUMMARY)

In accordance with:

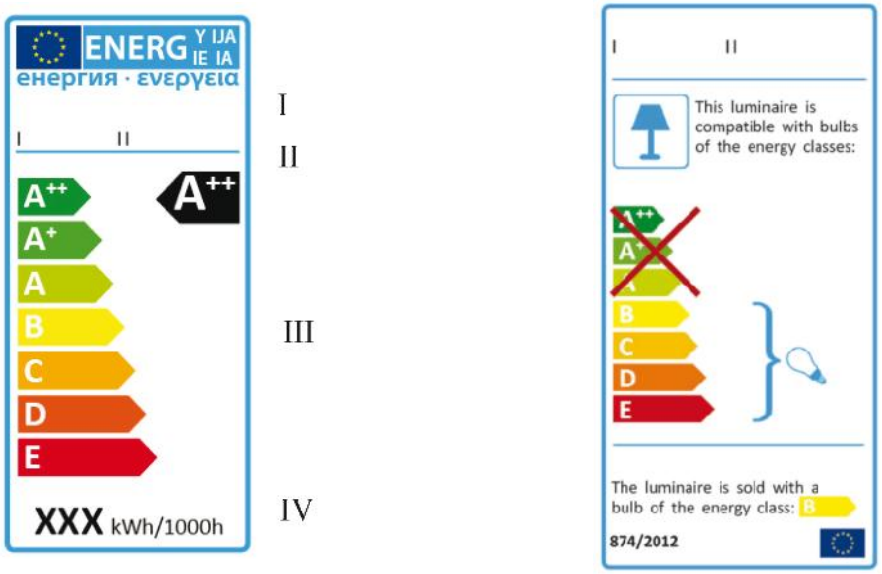
COMMISSION DELEGATED REGULATION (EU) No 874/2012 of 12 July 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires, OJ L 258, 26.9.2012, p. 1-20.

Entry into force and application

The delegated regulation mentioned above enters into force 16.10.2012 and applies (mandatory) from 1.9.2013 for non-directional and directional lamps.

Until 1.9.2013 the 1998 lamp energy label[18], with classes A-G but otherwise the same class limits and similar calculation method as the new label, applies for non-directional lamps.

Basic label design for lamps (cf. ANNEX I) *Example label for a luminaire (cf. ANNEX I)*



Classification by Energy Efficiency Index EEI (cf. ANNEX VI)

Table 1. Lamp energy efficiency classes

Energy efficiency class	Energy efficiency index (EEI) for non-directional lamps	Energy efficiency index (EEI) for directional lamps
A++ (most efficient)	EEI ≤ 0,11	EEI ≤ 0,13
A+	0,11 < EEI ≤ 0,17	0,13 < EEI ≤ 0,18
A	0,17 < EEI ≤ 0,24	0,18 < EEI ≤ 0,40
B	0,24 < EEI ≤ 0,60	0,40 < EEI ≤ 0,95
C	0,60 < EEI ≤ 0,80	0,95 < EEI ≤ 1,20
D	0,80 < EEI ≤ 0,95	1,20 < EEI ≤ 1,75
E (least efficient)	EEI > 0,95	EEI > 1,75

[18] According to COMMISSION DIRECTIVE 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps, OJ L 71, 10.3.1998, p. 1-8

Calculation method for EEI

$EEI = P_{cor} / P_{ref}$

where:

P_{cor} is the rated power (P_{rated}) for models without external control gear and the rated power (P_{rated}) corrected in accordance with Table 2 for models with external control gear. The rated power of the lamps is measured at their nominal input voltage.

P_{ref} is the reference power obtained from the useful luminous flux of the model (Φ_{use}) by the following formulae:

- For models with $\Phi_{use} < 1300$ lumen: $P_{ref} = 0{,}88\sqrt{\Phi_{use}} + 0{,}049\Phi_{use}$
- For models with $\Phi_{use} \geq 1300$ lumen: $P_{ref} = 0{,}07341\Phi_{use}$

Please note that for high lumen output lamps ($\Phi_{use} \geq 1300$ lumen), the proposed stage 6 requirements ($0.6 * (0.88\sqrt{\Phi}+0.049\Phi)$) of Regulation 244/2009 did not follow the class B formula ($0.6 * 0{,}07341\Phi$) of Regulation 874/2012.

For non-directional lamps, the useful luminous flux (Φ_{use}) is the total rated luminous flux (Φ in lm). For directional lamps Φ_{use} is the flux in a 120 degree cone (non-filament lamps with beam angle ≥90° and warning that they are not suitable for accent lighting) or a 90 degree cone (other directional lamps).

Table 2. Power correction if the model requires external control gear

Scope of the correction	**Power corrected for control gear losses (P_{cor})**
Lamps operating on external halogen lamp control gear	$P_{rated} \times 1{,}06$
Lamps operating on external LED lamp control gear	$P_{rated} \times 1{,}10$
Fluorescent lamps of 16 mm diameter (T5 lamps) and 4-pin single capped fluorescent lamps operating on external fluorescent lamp control gear	$P_{rated} \times 1{,}10$
Other lamps operating on external fluorescent lamp control gear	$P_{rated} \times (0{,}24\sqrt{\Phi_{use}} + 0{,}0103\Phi_{use}) / (0{,}15\sqrt{\Phi_{use}} + 0{,}0097\Phi_{use})$
Lamps operating on external high-intensity discharge lamp control gear	$P_{rated} \times 1{,}10$
Lamps operating on external low pressure sodium lamp control gear	$P_{rated} \times 1{,}15$

The weighted energy consumption (E_c) is calculated in kWh/1000 h (from P_{cor}).

The graph and table on the next page illustrate the maximum electric (corrected) power allowed per labelling class.

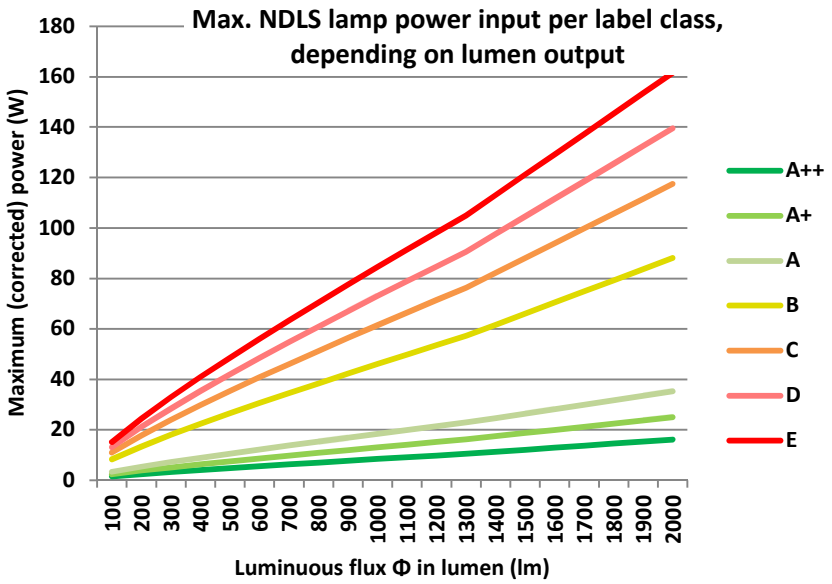


Table 3. Maximum electric power Pcor per energy label class for non-directional light sources

	Luminous flux Φ (lm)																				
lbl	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**	**1100**	**1200**	**1300**	**1400**	**1500**	**1600**	**1700**	**1800**	**1900**	**2000**	**EEI≤**
A++	1.5	2.4	3.3	4.1	4.9	5.6	6.3	7.0	7.8	8.5	9.1	9.8	10	11	12	13	14	15	15	16	**0.11**
A+	2.3	3.8	5.1	6.3	7.5	8.7	9.8	11	12	13	14	15	16	17	19	20	21	22	24	25	**0.17**
A	3.3	5.3	7.2	8.9	11	12	14	15	17	18	20	21	23	25	26	28	30	32	33	35	**0.24**
B	8.2	13	18	22	27	31	35	38	42	46	50	54	57	62	66	70	75	79	84	88	**0.6**
C	11	18	24	30	35	41	46	51	56	61	66	71	76	82	88	94	100	106	112	117	**0.8**
D (phase-out)	*13*	*21*	*28*	*35*	*42*	*48*	*55*	*61*	*67*	*73*	*79*	*85*	*91*	*98*	*105*	*112*	*119*	*126*	*133*	*139*	***0.95***
E (old)	*15*	*24*	*33*	*41*	*49*	*56*	*63*	*70*	*78*	*85*	*91*	*98*	*105*	*113*	*121*	*129*	*137*	*145*	*153*	*162*	***1.1***

Table 4. Minimum luminous efficacy (in lm/W) per label class for selected power inputs Pcor

	mains-voltage halogen						low voltage halogen (corr=1.06)					
	18	**28**	**42**	**53**	**70**	**105 W**	**20**	**25**	**35**	**50**	**75**	**EEI**
A++	124	124	124	124	124	124	131	131	131	131	131	**0.11**
A+	49	80	80	80	80	80	54	85	85	85	85	**0.17**
A	34	41	57	57	57	57	38	42	60	60	60	**0.24**
B	**14**	**16**	**19**	**20**	23	23	15	17	19	21	24	**0.6**
C	**10**	**12**	**14**	**15**	**16**	17	11	12	14	16	17	**0.8**
D (phase-out)	*9*	*10*	*12*	*13*	*13*	*14*	*10*	*10*	*12*	*13*	*14*	***0.95***
E (old)	*8*	*9*	*10*	*11*	*12*	*12*	*8*	*9*	*10*	*11*	*12*	***1.1***

Annex F. CODING SYSTEMS FOR LIGHTING PRODUCTS

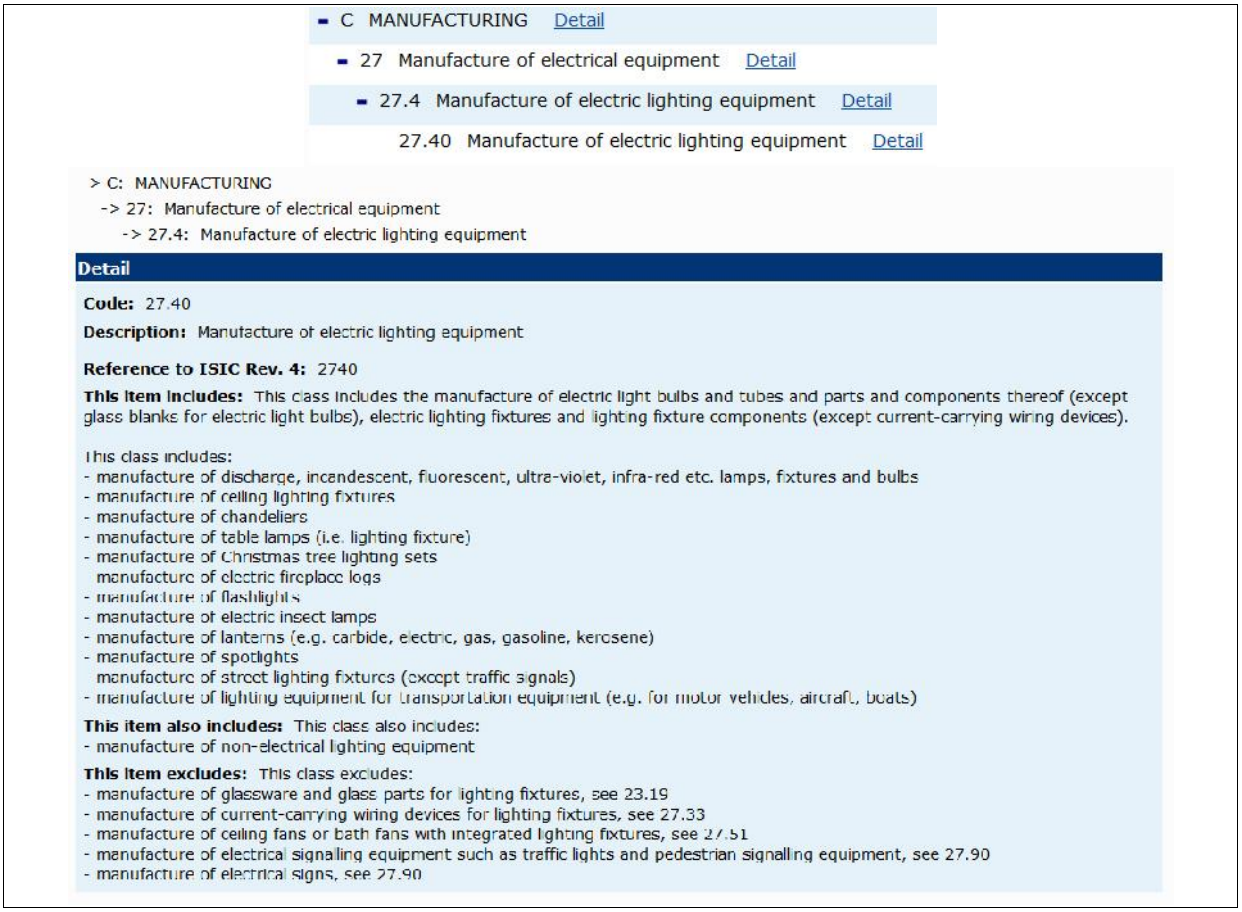


Table 11 NACE rev.2 codes. These codes are used in the current preparatory study. Taken from: http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=NACE_REV2&StrLanguageCode=EN&IntPcKey=18504134&StrLayoutCode=HIERARCHIC

ProdCom code	Product Description
27115013	Inductors for discharge lamps or tubes[19]
27115015	Ballasts for discharge lamps or tubes (excluding inductors)[20]
27401100	Sealed beam lamp units
27401250	Tungsten halogen filament lamps for motorcycles and motor vehicles (excluding ultraviolet and infrared lamps)
27401293	Tungsten halogen filament lamps, for a voltage > 100 V (excluding ultraviolet and infra-red lamps, for motorcycles and motor vehicles)
27401295	Tungsten halogen filament lamps for a voltage <= 100 V (excluding ultraviolet and infrared lamps, for motorcycles and motor vehicles)
27401300	Filament lamps of a power <= 200 W and for a voltage > 100 V including reflector lamps (excluding ultraviolet, infrared lamps, tungsten halogen filament lamps and sealed beam lamp units)
27401460	*Filament lamps for motorcycles or other motor vehicles excluding sealed beam lamp units, tungsten halogen lamps*
27401490	Filament lamps n.e.c.
27401510	Fluorescent hot cathode discharge lamps, with double ended cap (excluding ultraviolet lamps)
27401530	Fluorescent hot cathode discharge lamps (excluding ultraviolet lamps, with double ended cap)
27401550	Other discharge lamps (excluding ultraviolet lamps)
27401570	Ultraviolet or infrared lamps, arc lamps
27402100	*Portable electric lamps worked by dry batteries, accumulators or magnetos (excluding for cycles or motor vehicles)*
27402200	Electric table, desk, bedside or floor-standing lamps
27402300	*Non-electrical lamps and lighting fittings*
27402400	Illuminated signs, illuminated name-plates and the like (including road signs)
27402500	Chandeliers and other electric ceiling or wall lighting fittings (excluding those used for lighting public open spaces or thoroughfares)
27403100	Photographic flashbulbs, flashcubes and the like
27403200	Lighting sets for Christmas trees
27403300	Searchlights and spotlights (including for stage sets, photographic or film studios)
27403910	*Electrical lighting or visual signalling equipment for motor vehicles (excluding electric filament or discharge lamps, sealed beam lamp units, ultraviolet, infrared and arc lamps)*
27403930	Electric lamps and lighting fittings, of plastic and other materials, of a kind used for filament lamps and tubular fluorescent lamps
27404100	Parts for electric filament or discharge lamps (including sealed beam lamp units, ultraviolet or infrared lamps, arc lamps)
27404230	*Parts of portable electric lamps worked by dry batteries, accumulators or magnetos (excluding for cycles or motor vehicles)*
27404250	Parts (excluding of glass or plastics) of lamps and lighting fittings, etc

Table 12 ProdCom codes relevant for lighting products. The first 4 digits correspond to the NACE rev.2 code; the first 6 digits to the CPA code. See references in par. 1.7.1 of the main text.

[19] Corresponds to ferromagnetic ballast (see Lot 8 preparatory study)
[20] Corresponds mainly to electronic ballast (see Lot 8 preparatory study)

CN code	Description
1	2
8504	**Electrical transformers, static converters (for example, rectifiers) and inductors:**
8504 10	**– Ballasts for discharge lamps or tubes:**
8504 10 20	– – Inductors, whether or not connected with a capacitor
8504 10 80	– – Other
	– Lamp holders, plugs and sockets:
8536 61	**– – Lamp holders:**
8536 61 10	– – – Edison lamp holders
8536 61 90	– – – Other
8539	**Electric filament or discharge lamps, including sealed beam lamp units and ultraviolet or infra-red lamps; arc lamps:**
8539 10 00	**– Sealed beam lamp units**
	– Other filament lamps, excluding ultraviolet or infra-red lamps:
8539 21	**– – Tungsten halogen:**
8539 21 30	– – – Of a kind used for motorcycles or other motor vehicles
	– – – Other, for a voltage:
8539 21 92	– – – – Exceeding 100 V
8539 21 98	– – – – Not exceeding 100 V
8539 22	**– – Other, of a power not exceeding 200 W and for a voltage exceeding 100 V:**
8539 22 10	– – – Reflector lamps
8539 22 90	– – – Other
8539 29	**– – Other:**
8539 29 30	– – – Of a kind used for motorcycles or other motor vehicles
	– – – Other, for a voltage:
8539 29 92	– – – – Exceeding 100 V
8539 29 98	– – – – Not exceeding 100 V
	– Discharge lamps, other than ultraviolet lamps:
8539 31	**– – Fluorescent, hot cathode:**
8539 31 10	– – – With double ended cap
8539 31 90	– – – Other
8539 32	**– – Mercury or sodium vapour lamps; metal halide lamps:**
8539 32 20	– – – Mercury or sodium vapour lamps

CN code	Description
1	2
8539 32 90	– – – Metal halide lamps
8539 39 00	– – **Other**
	– **Ultraviolet or infra-red lamps; arc lamps:**
8539 41 00	– – **Arc lamps**
8539 49 00	– – **Other**
8539 90	– **Parts:**
8539 90 10	– – Lamp bases
8539 90 90	– – Other
8543 70	– **Other machines and apparatus:**
8543 70 10	– – Electrical machines with translation or dictionary functions
8543 70 30	– – Aerial amplifiers
8543 70 50	– – Sunbeds, sunlamps and similar suntanning equipment
	– **Photographic flashlight apparatus and flashbulbs:**
9006 61 00	– – **Discharge lamp (electronic) flashlight apparatus**
9006 69 00	– – **Other**
9404 90	– **Other:**
9404 90 10	– – Filled with feathers or down
9404 90 90	– – Other
9405	**Lamps and lighting fittings including searchlights and spotlights and parts thereof, not elsewhere specified or included; illuminated signs, illuminated nameplates and the like, having a permanently fixed light source, and parts thereof not elsewhere specified or included:**
9405 10	– **Chandeliers and other electric ceiling or wall lighting fittings, excluding those of a kind used for lighting public open spaces or thoroughfares:**
	– – Of plastics or of ceramic materials:
9405 10 21	– – – Of plastics, of a kind used with filament lamps
9405 10 40	– – – Other
9405 10 50	– – Of glass
	– – Of other materials:
9405 10 91	– – – Of a kind used with filament lamps
9405 10 98	– – – Other

CN code	Description
1	2
9405 20	**– Electric table, desk, bedside or floor-standing lamps:**
	– – Of plastics or of ceramic materials:
9405 20 11	– – – Of plastics, of a kind used with filament lamps
9405 20 40	– – – Other
9405 20 50	– – Of glass
	– – Of other materials:
9405 20 91	– – – Of a kind used with filament lamps
9405 20 99	– – – Other
9405 30 00	**– Lighting sets of a kind used for Christmas trees**
9405 40	**– Other electric lamps and lighting fittings:**
9405 40 10	– – Searchlights and spotlights
	– – Other:
	– – – Of plastics:
9405 40 31	– – – – Of a kind used with filament lamps
9405 40 35	– – – – Of a kind used with tubular fluorescent lamps
9405 40 39	– – – – Other
	– – – Of other materials:
9405 40 91	– – – – Of a kind used with filament lamps
9405 40 95	– – – – Of a kind used with tubular fluorescent lamps
9405 40 99	– – – – Other
9405 60	**– Illuminated signs, illuminated nameplates and the like:**
9405 60 20	– – Of plastics
9405 60 80	– – Of other materials
	– Parts:
9405 91	**– – Of glass:**
9405 91 10	– – – Articles for electrical lighting fittings (excluding searchlights and spotlights)
9405 91 90	– – – Other
9405 92 00	**– – Of plastics**
9405 99 00	**– – Other**

Table 13 Combined Nomenclature CN8 codes for 2014. These codes are used in Europroms for the reporting of import and export data. See references in par. 1.7.2 of the main text.

Incandescent Lamps

IA	Large Lamp
IB	Compact bulb lamp
IN	Other non reflector lamp
I_A	Pear shape lamp
I_B	Candle(bulged)
I_C	Conical
I_G	Globular
I_M	Mushroom
I_P	Round bulb
I_S	Pigmy (straight-sided)
I_T	Tubular
I_BA	Candle with angular tip
I_BF	Twisted candle
IR	Reflector lamp
IRR	Normal R. bulb reflector lamp
IRA	Pear shape bowl mirror lamp
IRP	Round bulb bowl mirror lamp
IPAR	Normal PAR bulb reflector lamp
IPARD	Dichroic PAR bulb reflector lamp

Tungsten Halogen Lamps

HS	Single-ended halogen lamp
HD	Double-ended halogen lamp
HR	Dichroic reflector halogen lamp
HM	Metal reflector halogen lamp
HA	Aluminised glass reflector
HI	Single-ended with integral metal reflector
H_P	Projection
H_S	Photo/Studio/Video
H_F	Floodlight (in and outdoor)
H_A	Airfield
H_T	Traffic signal
H_G	General purpose
H__I	Reflector halogen lamp with integral front cover
HE	Double envelope, single-ended halogen lamp
HEGB	Candle shape halogen lamp
HEGBT	Bulged tubular shape halogen lamp
HEGT	Tubular shape halogen lamp
HEGPAR	Normal PAR halogen lamp
HEGPARD	Dichroic PAR halogen lamp

Fluorescent Lamps

FD	Linear double capped lamp
FDR	With internal reflector
FDH	For high frequency ballasts only
FU	"U" shaped lamp
FC	Circular lamp
FS	Single capped lamp
FSD	Dual shaped
FSQ	Quad shaped
FSS	Square shaped
FSM	Multi limbed
FSG	Globular shaped
FS_H	For high frequency ballasts only
FB	Self-ballasted lamp
FBT	Tubular shaped
FBC	Circular shaped
FBG	Globular shaped
FBR	Reflector type

High Pressure Sodium Lamps

ST	Tubular clear lamp
SE	Elliptical diffuse coated lamp
SC	Elliptical clear lamp
SD	Double ended clear lamp
SR	Reflector type lamp
S_Q	For high pressure mercury equipment
S_M	Colour improved lamp
S_H	High colour rendering lamp
S_T	Twin arc tube lamp

Low Pressure Sodium Lamps

LS	Single capped lamp
LD	Double capped lamp
LSE	Single capped lamp of the E-type

High Pressure Mercury Lamps

QT	Tubular clear lamp
QE	Diffuse coated elliptical lamp
QC	Clear elliptical lamp
QG	Globular, coated
QR	Reflector type lamp
QB	Self ballasted lamp
QBR	Self ballasted lamp with reflector

Metal Halide Lamps

MT	Tubular clear lamp
ME	Diffuse coated elliptical or BT bulb
MC	Clear elliptical or BT bulb
MR	Reflector type lamp
MD	Clear double ended lamp
MN	Double ended lamp without outer bulb

Special Lamps

XX	High pressure Xenon lamp
XIR	IR emitter
XUV	UV emitter
XFD	Special fluorescent lamp

Table 14 ILCOS 'L' (short) lamp code according to IEC/TS 61231:1993 and IEC 61231:2010. The amendment of 2013 also includes a classification for LEDs, not shown above. Source: http://www.oxytech.it/PDF/ILCOS%20ENG.pdf

LBS (ZVEI)	ILCOS	Description
A	IA	General purpose incandescent lamp
R	IRR	Reflector lamps
QT	HSG	Halogen incandescent lamps
QT-DE	HDG	Halogen incandescent lamps, linear double-ended
QPAR	HA	Halogen incandescent lamps for mains voltage with reflector
QR	HAG / HMG	Low voltage halogen incandescent lamps with reflector
QR-CBC	HRG	Low voltage halogen incandescent lamp with dichroic reflector and glass cover
T16	FDH	Fluorescent lamps Ø16mm
T26	FD	Fluorescent lamps Ø26mm
T16-R	FSC	Circular fluorescent lamps Ø16mm
TC-S	FSD	Compact fluorescent lamps (1 tube)
TC-SEL	FSDH	Compact fluorescent lamps (1 tube) for electronic ballast up to 80W
TC-L	FSD	Compact fluorescent lamps (1 tube) up to 36W
TC-D	FSQ	Compact fluorescent lamps (2 tubes)
TC-DEL	FSQH	Compact fluorescent lamps (2 tubes) for electronic ballast
TC-T	FSM	Compact fluorescent lamps (3 tubes) up to 36W
TC-TEL	FSMH	Compact fluorescent lamps (3 tubes) for electronic ballast up to 120W
TC-DD	FSS	Compact fluorescent lamps (double D)
LMG-IHf	FSS	Induction lamps (Philips QL type)
HIT-DE	MD	Double ended tubular metal halide lamp
HIT-DE-CE	MT	Double ended tubular metal halide lamp with ceramic burner
HIT	MT	Single ended tubular metal halide lamp
HIE	ME	Single ended elliptical metal halide lamp
HIE-CE	ME	Single ended elliptical metal halide lamp with ceramic burner
HME	QE	High pressure mercury discharge lamp
HSE	SE	Single ended elliptical high pressure sodium lamp
HSE-I	SE/I	Single ended elliptical high pressure sodium lamp with internal ignitor
HST	ST	Single ended tubular high pressure sodium lamp
HSE-MF	SE	Single ended elliptical high pressure sodium lamp, increased light output (MF = more luminous flux)
HST-MF	ST	Single ended tubular high pressure sodium lamp, increased light output (MF = more luminous flux)
HSE-CRI	SEM	Single ended elliptical high pressure sodium lamp improved colour rendering (Philips SON Comfort Pro type)
HST-CRI	STH	Single ended tubular high pressure sodium lamp improved colour rendering (Philips SON-T Comfort Pro type)
HST	STH	Single ended tubular high pressure sodium lamp with high colour rendering (e.g. Philips SDW-T, Iwasaki NHT-SDX)
HST-DE	SD	Double ended tubular high pressure sodium lamp
LST	LS	Single ended tubular low pressure sodium lamp

Table 15 ILCOS 'L' (short) lamp code and correspondence with LBS code according to ZVEI. Source: http://www.thornlighting.com/download/handbook8-10.pdf

Annex G. LIGHTINGEUROPE POSITION ON LED CODING

HTTP://WWW.LIGHTINGEUROPE.ORG/UPLOADS/FILES/LIGHTINGEUROPE_POSITION_PAPER_ON_LED_CUSTOMS_CODES_FEBRUARY2014.PDF

LIGHTINGEUROPE
THE VOICE OF THE LIGHTING INDUSTRY

LightingEurope Position Paper
Customs Codes for LED Lighting Products

February 2014

SUMMARY

European lighting companies as represented by the European industry association LightingEurope are seriously concerned about inappropriate classification of LED lighting products resulting in certain cases in significant cost disadvantages and a non-level playing field in international competition. Therefore, LightingEurope requests a thorough review of the current practice for classification of LED lighting products into customs tariff classes in the different European countries and by the different customs offices. Furthermore, LightingEurope requests the publication of relevant classification regulations supported by transparent guidelines (CN explanatory notes) for product classification which are necessary for reliable and accurate business planning. LightingEurope also suggests a review and appropriate amendment of the existing nomenclature to better accommodate LED lighting products.

LightingEurope and their member companies would welcome any opportunity to explain the situation and concerns in more detail and will be happy to provide their support and technical expertise to related public authorities and other involved stakeholders.

1. Background & Current Situation

The lighting industry is currently undergoing a paradigm shift from conventional lighting to LED lighting and the development of new LED lighting products is continuously moving forward very rapidly. The clear distinction between lamps, luminaires, control-gear, etc. which was well-defined in the Harmonized System (HS) for conventional lighting (i.e. non-LED lighting) is not automatically applicable to LED lighting. In LED lighting, we have new types of components and products and the conventional boundaries between such products and components are dissolving, respectively need re-definition.

European lighting companies as represented by LightingEurope are concerned about customs tariff classification of LED lighting products imported into the EU. Due to the new LED lighting products and their configuration, the customs classification has become less apparent; we witness diverging classification practices within the EU for similar products. This results in application of different duty rates and thus a non-level playing field for the industry. Currently, the classification of LED products seems to mainly evolve around three

HS headings with corresponding Combined Nomenclature (CN) subheadings.

As an example, LEDs (Light Emitting Diodes) are sometimes classified by national customs offices into CN subheading **85.41** 4010:

„Diodes, transistors and similar semiconductor devices, photosensitive semiconductor devices, incl. photovoltaic cells whether or not assembled in modules or made up into panels (excl. photovoltaic generators), light emitting diodes, mounted piezoelectric crystals, parts thereof"

In other instances LEDs are classified into CN subheading **85.43** 7090:

"Electrical machines and apparatus, having individual functions, not specified or included elsewhere in this chapter"

Finally, we also find LEDs being classified into CN subheadings 94.05 4039 or 94.05 4099 under HS heading **94.05**:

„Lamps and lighting fittings, incl. searchlights and spotlights, and parts thereof, n.e.s, illuminated signs, illuminated nameplates and the like having a permanently fixed light source, and parts thereof, n.e.s."

It should be noted that the duty implication for CN subheading 94.05 4039 is 4.7%, for 85.437090 it is 3.7% and for 85.41 4010 it is 0%. Accordingly, this classification can have a significant impact on the costs for related products and the profitability of a corresponding business line.

It is a fair observation that the current Harmonized System (2012) headings and text are not discriminatory enough to distinguish the different LED products in a careful manner. In fact, the approach of different national customs offices towards LED lighting products appears currently inconsistent. Technical explanations on presumed product differences provided by the national customs offices are not always in line with the actual product use and seem at odds with product classification schemes developed by national and international standardization committees.

In view of this situation, it is desirable to have classification regulations together with clear and transparent guidelines (CN-explanatory notes) to ensure a correct and consistent classification throughout the Customs Union securing a level playing field for the industry.

In fact, as industry, we see the need for two complementary measures:

Short-term measure: Provide transparent guidelines for classification of LED products into the existing scheme with the understanding, as explained above, that the existing scheme is not fully appropriate for all the new LED products which are already on the market and which will be developed in the future.

Long-term measure: Extend the existing scheme in the context of the HS review in 2017 to be better adopted for the different LED products and to facilitate uniform classification of these products throughout the world.

2. Guiding Principles regarding the Classification of LED Lighting Products

As LightingEurope, we consider it essential keeping a clear distinction between lighting components which have to be integrated into a more comprehensive product or system on the one hand and, on the other hand, luminaires which do not require any further integration, but can be used as stand-alone products by the end user.

Such distinction between components and luminaires is in accordance with the LED value chain which is meanwhile fully established in the lighting industry and which is also reflected in relevant international standardization (like IEC classification of lighting products).

In fact, this LED value chain distinguishes the following main product categories:

- Light Emitting Diodes (LEDs) as the basic semiconductor devices, including the bare LED chips/dies as well as LED packages encapsulating one or multiple chips (and possibly additional protective elements). In general lighting applications, such LEDs are not intended to be directly connected to a (commercial) power supply.

- LED Light Sources comprising one or multiple LEDs on a joint mounting device (like a printed circuit board), typically together with further active or passive electronic components and other elements (like optical or thermal components). Such LED Light Sources may have the form of LED Modules/Assemblies or LED Lamps and are intended to be installed in a luminaire or other general lighting system.

- LED Luminaires designed to incorporate one or more LED Light Sources. These LED Luminaires are the final lighting fittings intended for the end user and are designed to be operated on their own. In addition to their illumination function, (LED) Luminaires may serve esthetical and other demands.

It should be noted that similar product categories and definitions are also being used by the European Commission for the recent *Commission Regulation (EU) No 1194/2012 of 12 December 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment* (EcoDesign Regulation).

When looking into the current (2012) HS scheme, we find headings which are used for the classification of conventional (non-LED) lighting products following a similar structure along the value chain. In particular:

- Heading 85.41 is defined to cover typical electronic components, and here in particular semiconductor devices (e.g. transistors or opto-couplers and also certain basic types of light-emitting diodes).




- Heading 85.39 is defined to cover typical (conventional) lamps, i.e. conventional electrical light sources.





- Heading 94.05 is defined to cover typical (conventional) luminaires for use with different types of light sources (e.g. filament or fluorescent lamps).




In view of these considerations, LightingEurope considers the following general approach for the HS 2017 revision as most appropriate:

- **LEDs** (i.e. **LED Chips** and **LED Packages**) should be covered under new/modified sub-headings of appropriately amended **heading 85.41**.
- LED Light Sources (i.e. **LED Lamps** and **LED Modules/Assemblies**) should be covered under new/modified sub-headings of appropriately amended **heading 85.39**.
- **LED Luminaires** should be covered under new/modified sub-headings of appropriately amended **heading 94.05**.

Of course, proper definitions of these different types of LED lighting products may be added as chapter notes or explanatory notes.

3. Joint Proposal with DG TAXUD for HS 2017

Based on the general approach explained above, a proposal for the HS 2017 revision has been jointly worked out by LightingEurope and the European Commission DG TAXUD end 2012 / beginning 2013 and has subsequently been submitted to the WCO.

As part of this proposal, the following specific wording was suggested for **new/amended notes to HS chapter 85** (changes indicated in blue):

(x) "Light-emitting diodes" are semiconductor devices based on semiconductor materials which convert electrical energy into visible, infra-red or ultra-violet rays, whether or not combined with protective diodes and whether or not assembled in modules, combined for all intents and purposes indivisibly.

(x) For the purpose of heading 85.39, "Light-emitting diode (LED) assemblies" are assemblies for the generation of light consisting of printed circuits containing light emitting-diodes. They may also contain discrete active elements, discrete passive elements, and articles of heading 85.36 or 85.42 for the purpose of providing power supply or power control.

The following specific wording was suggested for the **amendment of heading 85.41**:

8541	Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes; mounted piezoelectric crystals:
	…
~~8541 40~~	- Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes
8541 41	- Light-emitting diodes
8541 49	- Other
	…

The following specific wording was suggested for the **amendment of heading 85.39**:

8539	Electric filament or discharge lamps, including sealed beam lamp units and ultraviolet or infra-red lamps; arc lamps; light-emitting diode (LED) lamps and light-emitting diode (LED) assemblies:
	…
	- Light-emitting diode (LED) lamps and light-emitting diode (LED) assemblies
8539 51	- - Light-emitting diode (LED) lamps
8539 52	- - Light-emitting diode (LED) assemblies
	…

The following specific wording was suggested for the **amendment of heading 94.05**:

9405	Lamps and lighting fittings including searchlights and spotlights and parts thereof, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like, having a permanently fixed light source, and parts thereof not elsewhere specified or included.
~~9405 10~~	Chandeliers and other electric ceiling or wall lighting fittings, excluding those of a kind used for lighting public open spaces or thoroughfares:
9405 11	- - Designed for use with light-emitting diodes only
9405 19	- - Other
~~9405 20~~	- Electric table, desk, bedside or floor-standing lamps
9405 21	- - Designed for use with light-emitting diodes only
9405 29	- - Other
~~9405 30~~	- Lighting sets of a kind used for Christmas trees
9405 31	- - Designed for use with light-emitting diodes only
9405 39	- - Other
~~9405 40~~	- Other electric lamps and lighting fittings
9405 41	- - Designed for use with light-emitting diodes only
9405 49	- - Other
9405 50	- Non-electrical lamps and lighting fittings
~~9405 60~~	- Illuminated signs, illuminated nameplates and the like
9405 61	- - Designed for use with light-emitting diodes only
9405 69	- - Other
	…

Notes:

- Corresponding amendments have also been suggested for headings 85.12 and 85.13.
- The use of the word *"lamps"* under heading 94.05 is rather misleading and should better be replaced by the word *"luminaires"*. (See also the French translation of the CN which uses the different words *"appareils d'éclairage"* and *"lampes"* for a clear distinction between lamps and luminaires.)

LightingEurope would highly welcome any agreement among WCO members respecting this proposal or at least the general approach behind this proposal.

4. Related Considerations & Ongoing Discussions

LED Packages

LightingEurope considers it essential that LED Packages (LEDs) are being understood as basic semiconductor devices, regardless of the number of LED chips included in the package, regardless whether or not these LED chips are connected among each other, and regardless of the presence of any protective diodes (Zener diodes). Accordingly, such LED Packages (LEDs) should be classified under appropriately amended heading 85.41.

LED Assemblies

LED assemblies comprise one or multiple LEDs on a printed circuit board (PCB), possibly together with other active or passive elements like electrical, mechanical, optical or thermal components.

LightingEurope is aware of ongoing discussions regarding potential distinctions between rather "SIMPLE" and more "COMPLEX" LED Assemblies, e.g. by using any of the following features as distinctive elements:

- "SIMPLE" LED Assemblies
  - only LEDs on the PCB, no other components;
  - LEDs together with passive components, but no active electrical components;
  - electrical control gear not included in the assembly;
  - no (standardized) socket.
- "COMPLEX" LED Assemblies
  - LEDs plus additional components on the PCB;
  - active components present in the assembly;
  - electrical control gear is included in the assembly;
  - with (standardized) socket.

Proposals for customs classification of LED Assemblies may then suggest using different headings for these different types of assemblies, e.g. amended heading 85.41 for "SIMPLE" LED Assemblies and amended heading 85.39 for "COMPLEX" LED Assemblies.

LightingEurope believes that it is difficult to find a meaningful and convincing distinction of LED Assemblies and would prefer a classification of all LED Assemblies under amended heading 85.39. Any further distinction of different types of assemblies should not take place at WCO/HS level, but may rather be implemented as regional/national refinement.

LED Lamps

While LightingEurope might be willing to consider meaningful distinctions of LED Assemblies, LED Lamps should clearly be classified under amended heading 85.39.

Here, LED Lamps include LED replacement lamps having a socket which is also used for the conventional (non-LED) lamps that can be replaced. LED Lamps may also come with new types of sockets that have not been used for conventional lamps. The main characteristic is the presence of a socket that allows the easy installation of the LED Lamp into a

corresponding luminaire by an ordinary person (regardless whether the socket is also used for conventional lamps or not).

LED Luminaires

The joint proposal of LightingEurope and DG TAXUD as described in Chapter 3 above suggests distinct subheadings for luminaires *designed for use with LEDs only*.

Such luminaires *designed for use with LEDs only* should comprise the following:

- Integrated LED Luminaires incorporating LED light sources (LED Lamps or LED Assemblies) which are not intended to be replaced by an ordinary person. The LED light sources are typically installed by the luminaire maker as part of the manufacturing process before the luminaire is sold to the end user.
- Luminaires for (replaceable) LED Lamps having sockets not used for conventional lamps. Such luminaires are equipped with lampholders that can engage with corresponding LED Lamp sockets, but would not engage with conventional lamp sockets.

Annex H. EUROPEAN STANDARDS

This Annex collects information on European Standards, Guides and Technical papers that are relevant for lighting products. Non-European Standards are discussed in a separate Annex.

The first chapter of the annex describes the organisations involved in standardisation.

Annex H.2 provides a table with a survey of all identified European standards. This table only contains reference number and title. Annex H.3 through 0 provide short descriptions for the standards, grouped by type of product or type of application.

New standards, under drafting or under approval, are also shown. Where new versions or amendments for already approved existing standards are being developed both the old and the new version are cited.

Annex H.20 deals with Standardisation Mandates.

Annex H.21 provides information on the Zhaga Interface Specifications for LED Lighting products.

Sources examined in May 2014:

http://standards.cen.eu/ (keywords: lighting, lamp, luminaire, TC169)

http://www.cenelec.eu/dyn/www/f?p=104:105:0:::::

http://www.cie.co.at/ →

http://www.techstreet.com/cie/subgroups/16861 (standards, technical papers)

http://www.iso.org/iso/home.htm →

https://www.iso.org/obp/ui/

http://ec.europa.eu/enterprise/policies/european-standards/harmonised-standards/index_en.htm

http://ec.europa.eu/enterprise/standards_policy/mandates/database/index.cfm?fuseaction=titSearch.main

For definition of measurement procedures for application of regulations 244/2009, 874/2012 and 1194/2012 (OJ C 22/17 24.1.2014):

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2014:022:0017:0031:EN:PDF

For definition of measurement procedures for application of regulation 245/2009 (OJ C 92/11 10.4.2010):

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:092:0011:0014:EN:PDF

H.1 Introduction to standards development

Description of organisations

CEN, the European Committee for Standardization [21] is an international non-profit organisation.
Through its services, CEN provides a platform for the development of European Standards (ENs) and other consensus documents. CEN's 33 National Members work together to develop these publications in a large number of sectors to help build the European internal market in goods and services, removing barriers to trade and strengthening Europe's position in the global economy.
CEN is working to promote the international harmonisation of standards in the framework of technical cooperation agreements with ISO (International Organisation for Standardisation).

The Technical Committee that deals with '*Light and Lighting*' is **CEN/TC 169**.

CENELEC [22] is the European Committee for Electrotechnical Standardisation and is responsible for standardisation in the electrotechnical engineering field. CENELEC prepares voluntary standards, which help facilitate trade between countries, create new markets, cut compliance costs and support the development of a Single European Market.
CENELEC creates market access at European level but also at international level, adopting international standards wherever possible, through its close collaboration with the International Electrotechnical Commission (IEC).

CENELEC concentrates most of its work on 2 major deliverables: The **European Standard (EN)** and the **Harmonization Document (HD)**. These two documents are referred to commonly as "standards" and must be implemented in all CENELEC member countries, who must also withdraw any conflicting standard.
There are a few differences in the implementation process of EN's and HD's. Basically, the EN must be transposed as it is, not adding or deleting anything. The process for HD's is a bit more flexible. It is the technical content that must be transposed, no matter the wording or how many documents are made of it. In addition to these two major deliverables, CENELEC also produces and approves documents with a different objective and target.

CEN and CENELEC work in a decentralised way. Its members – the National Standardisation Bodies (NSBs) of the EU and EFTA countries – operate the technical groups that draw up the standards; the CEN-CENELEC Management Centre (CCMC) in Brussels manages and coordinates this system.
Designated as European Standards Organizations by the European Commission, CEN and CENELEC are non-profit technical organizations.

European standards (EN)

A standard is a publication that provides rules, guidelines or characteristics for activities or their results, for common and repeated use. Standards are created by bringing together all interested parties including manufacturers, users, consumers and regulators of a particular material, product, process or service. Everyone benefits from standardisation through increased product safety and quality as well as lower transaction costs and prices.

[21] Main website: http://www.cen.eu/Pages/default.aspx
Search for Standards: http://standards.cen.eu/
[22] Main website: http://www.cenelec.eu/

A European Standard (EN) is a standard that has been adopted by one of the three recognized European Standardisation Organisations (ESOs): CEN, CENELEC or ETSI. It is produced by all interested parties through a transparent, open and consensus based process.

European Standards are a key component of the Single European Market. Although rather technical and often unknown to the public and media, they represent one of the most important issues for businesses. Often perceived as boring and not particularly relevant to some organisations, they are actually crucial in facilitating trade and hence have high visibility among manufacturers inside and outside Europe. A standard represents a model specification, a technical solution against which a market can trade. It codifies best practice and is usually state of the art.

In essence, European Standards relate to products, services or systems. Today, however, standards are no longer created solely for technical reasons but have also become platforms to enable greater social inclusiveness and engagement with technology, as well as convergence and interoperability within growing markets across industries.

Developing a European standard

The development of an EN is governed by the principles of consensus, openness, transparency, national commitment and technical coherence (more information is given in the BOSS - Business Operation Support System - Production processes) and follows several steps:

Publication of the EN

After its publication, a European Standard must be given the status of national standard in all CEN member countries, which also have the obligation to withdraw any national standards that would conflict with it. This guarantees that a manufacturer has easier access to the market of all these European countries when applying European Standards and applies whether the manufacturer is based in the CEN territory or not.

Review of the EN

To ensure that a European Standard is still current, it is reviewed at least within five years from its publication. This review results in the confirmation, modification, revision or withdrawal of the EN.

The concept of Harmonised Standards

The European Standards Organisations (ESOs) CEN, CENELEC and ETSI are involved in a successful partnership with the European Commission and the European Free Trade Association. The ESOs support European legislation in helping the implementation of the European Commission directives, particularly those developed under the New Approach.

To support its policies and legislation, the European Commission requests the ESOs to develop and adopt European Standards, by means of 'standardisation mandates'. Those European Standards developed in response to a mandate are called 'Harmonised Standards'. A list of Harmonized Standards supporting EU Directives and Regulations is available in a dedicated area on the European Commission website.

Beyond Europe

European Standards are drafted in a global perspective. CEN has signed the 'Vienna Agreement' with the International Organization for Standardization (ISO), through which European and international standards can be developed in parallel. About 30 % of the ENs in the CEN collection are identical to ISO standards. These EN ISO standards have the dual benefits of automatic and identical implementation in all CEN Member countries, and global applicability.

The **International Electrotechnical Commission (IEC)** [23] **,** founded in 1906, is the world's leading organization that prepares and publishes International Standards for all electrical, electronic and related technologies. Over 10 000 experts from industry, commerce, government, test and research labs, academia and consumer groups participate in IEC Standardisation work. IEC provides a platform to companies, industries and governments for meeting, discussing and developing the International Standards they require.

All IEC International Standards are fully consensus-based and represent the needs of key stakeholders of every nation participating in IEC work. Every member country, no matter how large or small, has one vote and a say in what goes into an IEC International Standard.

The IEC is one of three global sister organizations (IEC, ISO, ITU) that develop International Standards for the world. When appropriate, IEC cooperates with ISO (International Organization for Standardization) or ITU (International Telecommunication Union) to ensure that International Standards fit together seamlessly and complement each other. Joint committees ensure that International Standards combine all relevant knowledge of experts working in related areas.

ISO (International Organisation for Standardisation) [24] is the world's largest developer of voluntary International Standards. International Standards give state of the art specifications for products, services and good practice, helping to make industry more efficient and effective. Developed through global consensus, ISO helps to break down barriers to international trade.

ISO was founded in 1947, and since then it has published more than 19 500 International Standards covering almost all aspects of technology and business. From food safety to computers, and agriculture to healthcare. Today ISO has members from 164 countries and 3 368 technical bodies to take care of standard development. More than 150 people work full time for ISO's Central Secretariat in Geneva, Switzerland.

The **International Commission on Illumination** - also known as the **CIE** from its French title, the Commission Internationale de l´Eclairage - is devoted to worldwide cooperation and the exchange of information on all matters relating to the science and art of light and lighting, colour and vision, photobiology and image technology.

With strong technical, scientific and cultural foundations, the CIE is an independent, non-profit organization that serves member countries on a voluntary basis. Since its inception in 1913, the CIE has become a professional organisation and has been accepted as representing the best authority on the subject and as such is recognized by ISO as an international standardization body.

Many CIE standards become European Standards (EN) with no or only few modifications.

ETSI, the **European Telecommunications Standards Institute** [25], produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies.

[23] Main website: http://www.iec.ch/
[24] Main website: http://www.iso.org/iso/home.htm
[25] Main website: http://www.etsi.org/

H.2 Summary table for European standards

A survey of European standards, guides and technical papers relevant for the product scope is provided in Table 16. The table is limited to reference number and title; short descriptions of the standards are provided in the following paragraphs.

Standards have been grouped per type of product or application as indicated by the subheadings in the table and as reflected in the paragraph-subdivision of this Annex. Some standards may appear in more than one group, e.g. a standard regarding Safety of LEDs is listed both under Safety and under LEDs.

The list of standards and related similar documents has been drawn up by consulting previous studies on lighting and by checking for updates on the websites of EC, CEN, CENELEC, CIE, IEC and ISO in May 2014.

For most standards the year of publication and the last amendment are indicated. Standards that are currently under drafting or under approval are also listed. For example '*EN 60969:1993/ A2:2000 ; FprEN 60969:2013*' means that the standard was originally published in 1993, with the last amendment in the year 2000 and a new version under drafting or under approval since 2013.

Standards or measurement procedures that have been indicated by the EC as being relevant for the application of regulations 244/2009, 874/2012 and 1194/2012 [26] or of regulation 245/2009 [27] have been indicated by means of red *italic* text in Table 16. Note that the indicated applicable versions of the standards (red *italic*) are not always the most recent ones available (black).

Harmonised Standards, following mandates of the European Commission, are not explicitly indicated in Table 16, but additional information can be found in Annex H.20 and in reference [28].

Reference	Title
Lighting in General	
EN 12665:2011	'Light and lighting - Basic terms and criteria for specifying lighting requirements'
CIE S 017/E:2011	'ILV: International lighting vocabulary, new
IEC/TR 60887:2010 (ed3.0)	'Glass bulb designation system for lamps'
EN 61231:2010/ A1:2013	'International lamp coding system (ILCOS)'
CIE 019.21:1981	'An analytic model for describing the influence of lighting parameters upon visual performance, 2nd ed., Vol.1.: Technical foundations'
CIE 019.22:1981	'An analytic model for describing the influence of lighting parameters upon visual performance, 2nd ed., Vol.2.: Summary and application guidelines'
Lamps	
EN 50285:1999	'Energy efficiency of electric lamps for household use - Measurement methods.'
EN 60064:1995/ A4:2007 A5:2009	'Tungsten filament lamps for domestic and similar general lighting purposes - Performance requirements'.
EN 60081:1998/ A4:2010 A5:2013	'Double-capped fluorescent lamps - Performance specifications.'
EN 60188:2001	'High-pressure mercury vapour lamps - Performance specifications'
EN 60192:2001	'Low pressure sodium vapour lamps - Performance specifications'

[26] (OJ C 22/17 24.1.2014): http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2014:022:0017:0031:EN:PDF

[27] (OJ C 92/11 10.4.2010): http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:092:0011:0014:EN:PDF

[28] http://ec.europa.eu/enterprise/policies/european-standards/standardisation-requests/index_en.htm http://ec.europa.eu/enterprise/policies/european-standards/harmonised-standards/index_en.htm

Reference	Title
EN 60357:2003/ A1:2008 A3:2011	'Tungsten halogen lamps (non-vehicle) - Performance specifications'
EN 60630:1998/ FprA7:2014 (under approval)	'Maximum lamp outlines for incandescent lamps'
IEC 61126:1992/ Am2 ed1.0 :2005	'Procedure for use in the preparation of maximum lamp outlines'
EN 60662:1993/A10:1997 EN 60662:2012	'High-pressure sodium vapour lamps. Performance specifications'
EN 60901:1996/ A4:2008 FprA6:2012 (under approval)	'Single-capped fluorescent lamps – Performance specifications'
EN 60969:1993/ A2:2000 ; FprEN 60969:2013 (under approval)	'Self-ballasted lamps for general lighting services – Performance requirements'
EN 61167:2011/ FprA1:2013 under approval	'Metal halide lamps - Performance specifications.'
EN 61228:2008	'Fluorescent ultraviolet lamps used for tanning - Measurement and specification method'
IEC/TR 61341 EN 61341:2011	'Method of measurement of centre beam intensity and beam angle(s) of reflector lamps'
EN 61549:2003/ A3:2012	'Miscellaneous lamps'
EN 62639:2012	'Fluorescent induction lamps - Performance specifications.'
EN 2240-001:2009	'Aerospace series - Lamps, incandescent - Part 001: Technical specification'
CIE 153:2003	'Report on intercomparison of measurements of the luminous flux of high-pressure sodium lamps'
Lamp Caps and Holders	
EN 60061-1:1993/ A41:2009 A50:2014	'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 1: Lamp caps'
EN 60061-2:1993/ A47:2014	'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 2: Lampholders'
EN 60061-3:1993/ A48:2014	'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 3: Gauges'
EN 60061-4:1992/A9:2005	'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 4: Guidelines and general information'
EN 60238:2004/ A2:2011 ; FprEN 60238:2013 (under approval)	'Edison screw lampholders'
EN 60360:1998	'Standard method of measurement of lamp cap temperature rise'
EN 60399:2004/ A1:2008	'Barrel thread for lampholders with shade holder ring'
EN 60400:2008/ FprA2:2014 (under approval)	'Lampholders for tubular fluorescent lamps and starterholders'
EN 60838-1:2004/ A2:2011 ; FprEN 60838-1:2013 under approval	'Miscellaneous lampholders - Part 1: General requirements and tests'
EN 60838-2-1:1996/ A2:2004	'Miscellaneous lampholders - Part 2-1: Particular requirements - Lampholders S14'
EN 60838-2-2:2006/ A1:2012	'Miscellaneous lampholders - Part 2-2: Particular requirements - Connectors for LED-modules'
Project EN/IEC 60838-2-3 (under approval)	'Miscellaneous lampholders - Part 2-3: Particular requirements - Lampholders for double-capped linear LED lamps'
EN 61184:2008/A1:2011	'Bayonet lampholders'
Luminaires	
EN 16268:2013	'Performance of reflecting surfaces for luminaires'
EN 60598-1:2008/ A11:2009 ; FprEN 60598-1:2014 (under approval)	'Luminaires - Part 1: General requirements and tests'
EN 60598-2-1:1989	'Luminaires - Part 2-1: Particular requirements - Fixed general purpose luminaires'
EN 60598-2-2:2012	'Luminaires - Part 2-2: Particular requirements - Recessed luminaires'
EN 60598-2-3:2003/ A1:2011	'Luminaires - Part 2-3: Particular requirements - Luminaires for road and street lighting'
EN 60598-2-4:1997	'Luminaires - Part 2-4: Particular requirements - Portable general purpose luminaires'

Reference	Title
EN 60598-2-5:1998 ; FprEN 60598-2-5:2014 (under approval)	'Luminaires - Part 2-5: Particular requirements – Floodlights.'
EN 60598-2-6:1994/A1:1997	'Luminaires - Part 2-6: Particular requirements - Luminaires with built-in transformers or convertors for filament lamps'
EN 60598-2-7:1989/A13:1997	'Luminaires. Particular requirements. Portable luminaires for garden use.
EN 60598-2-8:2013	'Luminaires - Part 2-8: Particular requirements – Handlamps'
EN 60598-2-9:1989/A1:1994	'Luminaires - Part 2: Particular requirements - Section 9: Photo and film luminaires (non-professional)'
EN 60598-2-10:2003/ corrigendum Aug. 2005	'Luminaires - Part 2-10: Particular requirements - Portable luminaires for children'
EN 60598-2-11:2013	'Luminaires - Part 2-11: Particular requirements - Aquarium luminaires'
EN 60598-2-12:2013	'Luminaires - Part 2-12: Particular requirements - Mains socket-outlet mounted nightlights'
EN 60598-2-13:2006/A1:2012	'Luminaires - Part 2-13: Particular requirements - Ground recessed luminaires'
EN 60598-2-14:2009	'Luminaires - Part 2-14: Particular requirements - Luminaires for cold cathode tubular discharge lamps (neon tubes) and similar equipment'
EN 60598-2-17:1989	'Luminaires - Part 2: Particular requirements - Section 17: Luminaires for stage lighting, television film and photographic studios (outdoor and indoor)'
EN 60598-2-18:1994/A1:2012	'Luminaires - Part 2-18: Particular requirements - Luminaires for swimming pools and similar applications'
EN 60598-2-19:1989/ corrigendum Dec. 2005	'Luminaires - Part 2: Particular requirements - Air-handling luminaires (safety requirements)'
EN 60598-2-20:2010 /corrigendum Sep. 2010 ; FprEN 60598-2-20:2013 (under approval)	'Luminaires - Part 2-20: Particular requirements - Lighting chains'
FprEN 60598-2-21:2013 (under approval)	'Luminaires - Part 2-21: Particular requirements - Sealed lighting chains'
EN 60598-2-22:1998/A2:2008 FprEN 60598-2-22:2014 (under approval)	'Luminaires - Part 2-22: Particular requirements - Luminaires for emergency lighting'
EN 60598-2-23:1996/A1:2000	'Luminaires. Particular requirements - Extra low voltage lighting systems for filament lamps'
EN 60598-2-24:2013	'Luminaires - Part 2-24: Particular requirements - Luminaires with limited surface temperatures'
EN 60598-2-25:1994/A1:2004	'Luminaires. Part 2-25: Particular requirements. Luminaires for use in clinical areas of hospitals and health care buildings.'
FprEN 62722-1:2013 (under approval)	'Luminaire performance - Part 1: General Requirements'
FprEN 62722-2-1:2013 (under approval)	'Luminaire performance - Part 2-1: Particular requirements for LED luminaires'
LED Lighting	
prEN 13032-4:201X (under approval)	'Light and lighting - Measurement and presentation of photometric data - Part 4: LED lamps, modules and luminaires'
EN 60838-2-2:2006/A1:2012	'Miscellaneous lampholders - Part 2-2: Particular requirements - Connectors for LED-modules'
Project EN/IEC 60838-2-3 (under approval)	'Miscellaneous lampholders - Part 2-3: Particular requirements - Lampholders for double-capped linear LED lamps'
EN 61347-2-13:2006/ corrigendum Dec. 2010 ; FprEN 61347-2-13:2012 under approval	'Lamp controlgear - Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules'
EN 62031:2008/ FprA2:2014 (amendment under approval)	'LED modules for general lighting - Safety specifications'
EN 62384:2006/A1:2009	'DC or AC supplied electronic control gear for LED modules. Performance requirements'
EN 62386-207:2009	'Digital addressable lighting interface. Particular requirements for control gear. LED modules (device type 6).'

Reference	Title
FprEN 62442-3:2014 (under approval)	'Energy performance of lamp controlgear - Part 3: Controlgear for halogen lamps and LED modules - Method of measurement to determine the efficiency of the controlgear '
FprEN 62504:2014 (under approval)	'General lighting - Light emitting diode (LED) products and related equipment - Terms and definitions'
EN 62560:2012/FprA1:2013 (amendment under approval)	'Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specifications'
EN 62612:2013	'Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements'
FprEN 62663-1:2012 (under approval)	'Non-ballasted LED-lamps - Part 1: Safety specifications'
prEN 62663-2:201X (under drafting)	'Non-ballasted LED lamps - Performance requirements'
IEC 62717 FprEN 62717:2013 (under approval)	'LED modules for general lighting - Performance requirements'
FprEN 62722-2-1:2013 (under approval)	'Luminaire performance - Part 2-1: Particular requirements for LED luminaires'
FprEN 62776:2013 (under approval)	'Double-capped LED lamps for general lighting services - Safety specifications'
prEN 62838:201X (under drafting)	'Semi-integrated LED lamps for general lighting services with supply voltages not exceeding 50 V a.c. r.m.s. or 120V ripple free d.c. - Safety specification'
FprEN 62868:2013 (under approval)	'Organic light emitting diode (OLED) panels for general lighting - Safety requirements'
CIE 127:2007	'Measurement of LED's' (2nd ed.)
CIE 177:2007	'Colour Rendering of White LED Light Sources'
CIE 205:2013	'Review of Lighting Quality Measures for Interior Lighting with LED Lighting Systems'
CIE DIS 024/E:2013	'Light Emitting Diodes (LEDs) and LED Assemblies - Terms and Definitions'
Outdoor Lighting, Workplaces	
EN 12464-2:2014	'Light and Lighting-Part 2: Lighting of outdoor work places.'
CIE S015/E:2005	'Lighting of Outdoor Work Places'
CIE S 016/E:2005 (ISO 8995-3:2006)	'Lighting of Work Places - Part 3: Lighting Requirements for Safety and Security of Outdoor Work Places'
CIE 128:1998	'Guide to the lighting for open-cast mines'
CIE 129:1998	'Guide for lighting exterior work areas'
Outdoor Lighting, Streets and External Public Spaces	
CEN/TR 13201-1:2004 ; FprCEN/TR 13201-1 (under approval in 2014)	'Road lighting - Part 1: Selection of lighting classes.'
EN 13201-2:2003 ; prEN 13201-2 rev (under approval in 2014)	'Road lighting - Part 2: Performance requirements.'
EN 13201-3:2003/ AC:2007 ; prEN 13201-3 rev (under approval in 2014)	'Road lighting - Part 3: Calculation of performance.'
EN 13201-4:2003 ; prEN 13201-4 rev (under approval in 2014)	'Road lighting - Part 4: Methods of measuring lighting performance.'
prEN 13201-5 (under approval in 2014)	'Road lighting-Part 5: Energy performance indicators.'
HD 60364-7-714:2012	'Low-voltage electrical installations - Part 7-714: Requirements for special installations or locations - External lighting installations'
CIE 032:197	'Lighting in situations requiring special treatment'
CIE 033:1977	'Depreciation of installations and their maintenance'
CIE 034-1977	'Road lighting lantern and installation data: photometrics, classification and performance'
CIE 047:1979	'Road lighting for wet conditions'
CIE 066:1984	'Road surfaces and lighting (joint technical report CIE/PIARC)'
CIE 093:1992	'Road lighting as an accident countermeasure'

Reference	Title
CIE 094:1993	'Guide for floodlighting'
CIE 100:1992	'Fundamentals of the visual task of night driving
CIE 115:2010	'Lighting of Roads for Motor and Pedestrian Traffic'
CIE 132:1999	'Design methods for lighting of roads'
CIE 136:2000	'Guide to the lighting of urban areas'
CIE 140:2000	'Road Lighting Calculations (Rev. 2)'
CIE 144:2001	'Road surface and road marking reflection characteristics'
CIE 154:2003	'The maintenance of outdoor lighting systems'
CIE 206:2014	'The Effect of Spectral Power Distribution on Lighting for Urban and Pedestrian Areas'
Outdoor Lighting, Tunnels	
CEN/ CR 14380:2003	'Lighting applications - Tunnel lighting'
EN 16276:2013	'Evacuation Lighting in Road Tunnels'
CIE 061:19	'Tunnel entrance lighting: A survey of fundamentals for determining the luminance in the threshold zone'
CIE 088:2004	'Guide for the lighting of road tunnels and underpasses, 2nd ed.'
CIE 189:2010	'Calculation of Tunnel Lighting Quality Criteria'
CIE 193:2010	'Emergency Lighting in Road Tunnels'
Outdoor Lighting, Traffic Lights	
EN 12352:2006	'Traffic control equipment - Warning and safety light devices'
EN 12368:2006 FprEN 12368 (under approval)	'Traffic control equipment - Signal heads'
EN 50556:2011	'Road traffic signal systems'
CIE S 006.1/E-1998 (ISO 16508:1999)	'Road traffic lights - Photometric properties of 200 mm roundel signals'
CIE 079:1988	'A guide for the design of road traffic lights'
Outdoor Lighting, Sky Glow and Obtrusive Light	
CIE 001-1980	'Guidelines for minimizing urban sky glow near astronomical observatories (Joint Publication IAU/CIE)'
CIE 126:1997	'Guidelines for minimizing sky glow'
CIE 150:2003	'Guide on the limitation of the effects of obtrusive light from outdoor lighting installations'
Indoor Lighting	
EN 12464-1:2011	'Light and Lighting-Part 1: Lighting of indoor work places.'
EN 15193:2007/AC:2010 ; prEN 15193 rev (under drafting)	'Energy performance of buildings – Energy requirements for lighting'
DIN V 18599 - 4	'Energy efficiency of buildings - Calculation of the net, final and primary energy demand for heating, cooling, ventilation, domestic hot water and lighting - Part 4: Net and final energy demand for lighting.'
EN 15251:2007	'Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics'
CEN/TC 169 (WI=00169067) (under drafting)	'Energy performance of buildings - Energy requirements for lighting - Part 2: Technical Report to EN 15193-1'
CEN/TS 16163:2014	'Conservation of Cultural Heritage - Guidelines and procedures for choosing appropriate lighting for indoor exhibitions'
HD 60364-5-559:2005/ corrigendum Oct. 2007	'Electrical installations of buildings - Part 5-55: Selection and erection of electrical equipment - Other equipment - Clause 559: Luminaires and lighting installations'
HD 60364-5-559:2012	'Low-voltage electrical installations - Part 5-559: Selection and erection of electrical equipment - Luminaires and lighting installations'
CIE S 008/E:2001 (ISO 8995-1:2002 Cor.1 2005)	'Lighting of Work Places - Part 1: Indoor'
CIE 040:1978	'Calculations for interior lighting: Basic method'
CIE 052:1982	'Calculations for interior lighting: Applied method'
CIE 097:2005	'Maintenance of indoor electric lighting systems'
CIE 161:2004	'Lighting design methods for obstructed interiors'

Reference	Title
Sports Lighting	
EN 12193:2007	'Light and lighting - Sports lighting.'
CIE 042:1978	'Lighting for tennis'
CIE 045:1979	'Lighting for ice sports'
CIE 057:1983	'Lighting for football'
CIE 058:1983	'Lighting for sports halls'
CIE 062:1984	'Lighting for swimming pools'
CIE 067:1986	'Guide for the photometric specification and measurement of sports lighting installations'
CIE 083:1989	'Guide for the lighting of sports events for colour television and film systems'
CIE 169:2005	'Practical design guidelines for the lighting of sport events for colour'
Emergency Lighting	
EN 1838:2013	'Lighting applications - Emergency lighting.'
EN 13032-3:2007	'Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 3: Presentation of data for emergency lighting of work places.'
EN 50171:2001 ; prEN 50171:2013 (under approval)	'Central power supply systems.'
EN 50172:2004	'Emergency escape lighting systems.'
CIE S 020/E:2007 (ISO 30061:2007)	'Emergency Lighting'
Gears, Ballasts and Drivers	
EN 50294:1998/A2:2003	'Measurement Method of Total Input Power of Ballast-Lamp Circuits'
EN 50564:2011	'Electrical and electronic household and office equipment - Measurement of low power consumption' (stand-by, no-load)
EN 60155:1995/A2:2007	'Glow-starters for fluorescent lamps'
EN 60730-2-3:2007	'Automatic electrical controls for household and similar use - Part 2-3: Particular requirements for thermal protectors for ballasts for tubular fluorescent lamps'
EN 60730-2-7:2010	'Automatic electrical controls for household and similar use - Part 2-7: Particular requirements for timers and time switches'
EN 60921:2004/A1:2006	'Ballasts for tubular fluorescent lamps – Performance requirements'
EN 60923:2005/A1:2006	'Auxiliaries for lamps. Ballasts for discharge lamps (excluding tubular fluorescent lamps). Performance requirements.'
EN 60925:1991/A2:2001	'D.C. supplied electronic ballasts for tubular fluorescent lamps - Performance requirements'
EN 60927:2007/A1:2013	'Auxiliaries for lamps - Starting devices (other than glow starters) - Performance requirements.'
EN 60929:2011/AC:2011	'AC-supplied electronic ballasts for tubular fluorescent lamps – Performance requirements'
EN 61047:2004	'D.C. or A.C. supplied electronic step-down converters for filament lamps. Performance requirements'.
EN 61048:2006/ FprA1:2013 (amendment under approval)	'Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General and safety requirements'
EN 61049:1993	'Capacitors for Use in Tubular Fluorescent and Other Discharge Lamp - Circuits Performance Requirements'
EN 61050:1992/A1:1995	'Transformers for tubular discharge lamps having a no-load output voltage exceeding 1 kV (generally called neon-transformers) - General and safety requirements'
EN 61347-1:2008/FprA3:2013 (amendment under approval)	'Lamp control gear - Part 1: General and safety requirements'
EN 61347-2-1:2001/A2:2014	'Lamp control gear - Part 2-1: Particular requirements for starting devices (other than glow starters)'
EN 61347-2-2:2012	'Lamp control gear - Part 2-2: Particular requirements for d.c. or a.c. supplied electronic step-down convertors for filament lamps'
EN 61347-2-3:2011/AC:2011	'Lamp control gear - Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps'
EN 61347-2-4:2001/ corrigendum Dec. 2010	'Lamp control gear - Part 2-4: Particular requirements for d.c. supplied electronic ballasts for general lighting'

Reference	Title
EN 61347-2-7:2012	'Lamp controlgear - Part 2-7: Particular requirements for battery supplied electronic controlgear for emergency lighting (self-contained)
EN 61347-2-8:2001/ corrigendum Dec. 2010	'Lamp control gear - Part 2-8: Particular requirements for ballasts for fluorescent lamps'
EN 61347-2-9:2013	'Lamp control gear – Part 2-9: Particular requirements for electromagnetic control gear for discharge lamps (excluding fluorescent lamps)'
EN 61347-2-10:2001/A1:2009 corrigendum Dec. 2010	'Lamp controlgear - Part 2-10: Particular requirements for electronic invertors and convertors for high-frequency operation of cold start tubular discharge lamps (neon tubes)'
EN 61347-2-11:2001/ corrigendum Dec. 2010	'Lamp control gear. - Part 2-11: Particular requirements for miscellaneous electronic circuits used with luminaires.'
EN 61347-2-12:2005/A1:2010	'Lamp control gear - Part 2-12: Particular requirements for d.c. or a.c. supplied electronic ballasts for discharge lamps (excluding fluorescent lamps)'
EN 61347-2-13:2006/ corrigendum Dec. 2010 ; FprEN 61347-2-13:2012 under approval	'Lamp controlgear - Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules'
EN 62442-1:2011/AC:2012	'Energy performance of lamp control gear - Part 1: Control gear for fluorescent lamps - Method of measurement to determine the total input power of control gear circuits and the efficiency of the control gear'
IEC-62442-2 FprEN 62442-2:2014 (under approval)	'Energy performance of lamp controlgear - Part 2: Controlgear for high intensity discharge lamps (excluding fluorescent lamps) - Method of measurement to determine the efficiency of controlgear '
IEC 62442-3 FprEN 62442-3:2014 (under approval)	'Energy performance of lamp controlgear - Part 3: Controlgear for halogen lamps and LED modules - Method of measurement to determine the efficiency of the controlgear '
FprEN 62811:2014 (under approval)	'AC and/or DC-supplied electronic controlgear for discharge lamps (excluding fluorescent lamps) - Performance requirements for low frequency squarewave operation'
Lighting Control	
EN 15232:2012 ; prEN 15232 rev (under drafting)	'Energy performance of buildings - Impact of Building Automation, Controls and Building Management.'
EN 50428:2005	'Switches for household and similar fixed electrical installations - Collateral standard - Switches and related accessories for use in home and building electronic systems (HBES)'
EN 50490:2008	'Electrical installations for lighting and beaconing of aerodromes - Technical requirements for aeronautical ground lighting control and monitoring systems - Units for selective switching and monitoring of individual lamps'
EN 50491-3:2009 (and other parts of 50491)	'General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Part 3: Electrical safety requirements'
EN 60669-1:1999/IS1:2009	'Switches for household and similar fixed-electrical installations - Part 1: General requirements'
EN 60669-2-1:2004/A12:2010 FprA2:2013 (under approval)	'Switches for household and similar fixed electrical installations - Part 2-1: Particular requirements - Electronic switches'
EN 60669-2-2:2006	'Switches for household and similar fixed electrical installations Particular requirements. Electromagnetic remote-control switches (RCS)'
EN 60669-2-3:2006	'Switches for household and similar fixed electrical installations. Particular requirements Time-delay switches (TDS)'
EN 60669-2-4:2005	'Switches for household and similar fixed electrical installations - Part 2-4: Particular requirements - Isolating switches'
EN 60669-2-5:2014	'Switches for household and similar fixed electrical installations - Part 2-5: Particular requirements - Switches and related accessories for use in home and building electronic systems (HBES)'
EN 60669-2-6:2012	'Switches for household and similar fixed electrical installations - Part 2-6: Particular requirements - Fireman's switches for exterior and interior signs and luminaires'
EN 62386-101:2009 ; FprEN 62386-101:2013 (under approval)	'Digital addressable lighting interface - Part 101: General requirements – System.'

Reference	Title
EN 62386-102:2009 ; FprEN 62386-102:2013 (under approval)	'Digital addressable lighting interface. General requirements. Control gear.'
FprEN 62386-103:2013 (under approval)	'Digital addressable lighting interface. Part 103. General requirements. Control devices.'
EN 62386-201:2009 ; FprEN 62386-201:2014 (under approval)	'Digital addressable lighting interface. Particular requirements for control gear. Fluorescent lamps (device type 0).'
EN 62386-202:2009	'Digital addressable lighting interface. Particular requirements for control gear. Self-contained emergency lighting (device type 1). '
EN 62386-203:2009	'Digital addressable lighting interface. Particular requirements for control gear. Discharge lamps (excluding fluorescent lamps) (device type 2).'
EN 62386-204:2009	'Digital addressable lighting interface. Particular requirements for control gear. Low voltage halogen lamps (device type 3).'
EN 62386-205:2009	'Digital addressable lighting interface. Particular requirements for control gear. Supply voltage controller for incandescent lamps (device type 4).'
EN 62386-206:2009	'Digital addressable lighting interface. Particular requirements for control gear. Conversion from digital signal into d.c. voltage (device type 5).'
EN 62386-207:2009	'Digital addressable lighting interface. Particular requirements for control gear. LED modules (device type 6).'
EN 62386-208:2009	'Digital addressable lighting interface. Particular requirements for control gear. Switching function (device type 7).'
EN 62386-209:2011	'Digital addressable lighting interface - Part 209: Particular requirements for control gear - Colour control (device type 8).'
EN 62386-210:2011	'Digital addressable lighting interface Particular requirements for control gear. Sequencer (device type 9).'
FprEN 62733:2014 (under approval)	'Programmable components in electronic lamp controlgear - General and safety requirements'
Safety aspects of Lighting	
EN 50102:1995/ A1:1998/ corrigendum Jul. 2002	'Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)'
EN 60432-1:2000/A2:2012	'Incandescent lamps - Safety specifications - Part 1: Tungsten filament lamps for domestic and similar general lighting purposes'
EN 60432-2:2000/A2:2012	'Incandescent lamps - Safety specifications - Part 2: Tungsten halogen lamps for domestic and similar general lighting purposes.'
EN 60432-3:2013	'Incandescent lamps - Safety specifications - Part 3: Tungsten-halogen lamps (non-vehicle)'
EN 60529:1991/ A2:2013	'Degrees of protection provided by enclosures (IP Code)'
EN 60968:2013/A11:201X ; FprEN 60968:2013 (under approval)	'Self-ballasted lamps for general lighting services - Safety requirements.'
EN 61195:1999/ FprA2:2014 (amendment under approval)	'Double-capped fluorescent lamps - Safety specifications'
EN 61199:2011/ FprA2:2014 (amendment under approval)	'Single-capped fluorescent lamps - Safety specifications'
EN 61558-2-9:2011	'Safety of transformers, reactors, power supply units and combinations thereof - Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps for tungsten filament lamps'
EN 62031:2008/ FprA2:2014 (amendment under approval)	'LED modules for general lighting - Safety specifications'
EN 62035:2000/ A1:2003 A2:2012 ; prEN 62035:201X (under approval) ; IEC 62035:2014	'Discharge lamps (excluding fluorescent lamps) - Safety specifications.'
EN 62532:2011	'Fluorescent induction lamps - Safety specifications.'
EN 62560:2012/FprA1:2013 (amendment under approval)	'Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specifications'

Reference	Title
EN 62471:2008 ; FprEN 62471-5:2014 (under approval)	'Photobiological safety of lamps and lamp systems'
CIE S 009 E:2002 / IEC 62471:2006	'Photobiological safety of lamps and lamp systems '
CIE 138:2000	'CIE Collection in photobiology and photochemistry 2000'
CIE 139:2001	'The influence of daylight and artificial light variations in humans - a bibliography'
CIE 158:2009	'Ocular lighting effects on human physiology and behaviour'
IEC 62321:2008	'Electrotechnical products - Determination of levels of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers)'
IEC 62321-1:2013	'Determination of certain substances in electrotechnical products - Part 1: Introduction and overview'
IEC 62321-2:2013	'Determination of certain substances in electrotechnical products - Part 2: Disassembly, disjunction and mechanical sample preparation'
IEC 62321-3-1:2013	'Determination of certain substances in electrotechnical products - Part 3-1: Screening - Lead, mercury, cadmium, total chromium and total bromine using X-ray fluorescence spectrometry'
IEC 62321-3-2:2013	'Determination of certain substances in electrotechnical products - 3-2: Screening - Total bromine in polymers and electronics by Combustion - Ion Chromatography'
IEC 62321-4:2013	'Determination of certain substances in electrotechnical products - Part 4: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS'
IEC 62321-5:2013	'Determination of certain substances in electrotechnical products - Part 5: Cadmium, lead and chromium in polymers and electronics and cadmium and lead in metals by AAS, AFS, ICP-OES and ICP-MS'
EN 62554:2011	'Sample preparation for measurement of mercury level in fluorescent lamps'
FprEN 62663-1:2012 (under approval)	'Non-ballasted LED-lamps - Part 1: Safety specifications'
FprEN 62776:2013 (under approval)	'Double-capped LED lamps for general lighting services - Safety specifications'
IEC/TR 62778: 2012	'Application of IEC/EN 62471 for the assessment of blue light hazard to light sources and luminaires (Technical report)'
prEN 62838:201X (under drafting)	'Semi-integrated LED lamps for general lighting services with supply voltages not exceeding 50 V a.c. r.m.s. or 120V ripple free d.c. - Safety specification'
FprEN 62868:2013 (under approval)	'Organic light emitting diode (OLED) panels for general lighting - Safety requirements'
CEN/TC 169, (WI=00169063) (under drafting, expected 2015)	'Eye mediated non visual effects of light on humans - Measures of neurophysiological and melanopic photosensitivity'
Emission aspects of Lighting	
EN 14255-1:2005	'Measurement and assessment of personal exposures to incoherent optical radiation - Ultraviolet radiation emitted by artificial sources in the workplace'
EN 14255-2:2005	'Measurement and assessment of personal exposures to incoherent optical radiation - Visible and infrared radiation emitted by artificial sources in the workplace'
EN 14255-4:2006	'Measurement and assessment of personal exposures to incoherent optical radiation - Terminology and quantities used in UV-, visible and IR-exposure measurements'
EN 55015:2013 ; FprA1:2014 (under approval)	'Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment'
EN 55103-1:2009/A1:2012	'Electromagnetic compatibility - Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use - Part 1: Emissions'
EN 55103-2:2009/IS1:2012	'Electromagnetic compatibility - Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use - Part 2: Immunity'
EN 60335-2-27:2013	'Household and similar electrical appliances - Safety - Part 2-27: Particular requirements for appliances for skin exposure to ultraviolet and infrared radiation'
EN 61000-3-2:2006 ; FprA3:2013 (under approval)	'Electromagnetic compatibility (EMC) Limits. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)'

Reference	Title
EN 61000-3-3:2013	'Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection'
EN 61000-4-1:2007	'Electromagnetic compatibility (EMC) - Part 4-1: Testing and measurement techniques - Overview of EN 61000-4 series'
EN 61000-4-6:2014	'Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields'
EN 61000-4-15:2011	'Electromagnetic compatibility (EMC) - Part 4-15: Testing and measurement techniques - Flickermeter - Functional and design specifications'
EN 61547:2009	'Equipment for general lighting purposes - EMC immunity requirements'
EN 62493:2010	'Assessment of lighting equipment related to human exposure to electromagnetic fields'
Colour and Colour Rendering	
CIE 013.3:1995	'Method of measuring and specifying colour rendering properties of light sources'
CIE 015:2004	'Colourimetry, 3rd edition'
CIE S004/E-2001	'Colours of light signals'
CIE S 014-1/E:2006 (ISO 11664-1:2007)	'CIE Standard Colourimetric Observers'
CIE S 014-2/E:2006/ ISO 11664-2:2007(E)	'CIE Standard lIluminants for Colourimetry'
CIE S 014-3/E:2011 (ISO 11664-3:2012)	'Colourimetry - Part 3: CIE Tristimulus Values'
CIE S 014-4/E:2007 (ISO 11664-4:2008)	'Colourimetry - Part 4: CIE 1976 L*a*b* Colour Spaces'
CIE S 014-5/E:2009 (ISO 11664-5:2009)	'Colourimetry - Part 5: CIE 1976 L*u*v* Colour Space and u', v' Uniform Chromaticity Scale Diagram'
ISO/CIE 11664-6:2014(E)	'Colourimetry – Part 6: CIEDE2000 Colour-Difference Formula'
CIE 177:2007	'Colour Rendering of White LED Light Sources'
IEC/TR 62732:2012	'Three-digit code for designation of colour rendering and correlated colour temperature'
Light Measurement and Photometry	
EN 13032-1:2004+A1:2012	'Light and lighting — Measurement and presentation of photometric data of lamps and luminaires — Part 1: Measurement and file format.'
EN 13032-2:2004/AC:2007	'Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 2: Presentation of data for indoor and outdoor work places.'
EN 13032-3:2007	'Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 3: Presentation of data for emergency lighting of work places'
prEN 13032-4:201X (under approval in 2014)	'Light and lighting - Measurement and presentation of photometric data - Part 4: LED lamps, modules and luminaires'
IES TM-25-13	'Ray File Format for the Description of the Emission Property of Light Sources.'
CIE 102:1993	'Recommended file format for electronic transfer of luminaire photometric data'
CIE S 010/E:2004 (ISO 23539:2005)	'Photometry - The CIE system of physical photometry'
CIE 018.2:1983	'The Basis of Physical Photometry, 2nd ed.'
CIE 041:1978	'Light as a true visual quantity: Principles of measurement'
CIE 043:1979	'Photometry of floodlights'
CIE 063:1984	'The spectroradiometric measurement of light sources'
CIE 067:1986	'Guide for the photometric specification and measurement of sports lighting installations'
CIE 070:1987	'The measurement of absolute luminous intensity distributions'
CIE 084:1989	'Measurement of luminous flux'
CIE 121:1996	'The photometry and goniophotometry of luminaires'
CIE 194:2011	'On Site Measurement of the Photometric Properties of Road and Tunnel Lighting'
Glare	
CIE 031-1976	'Glare and uniformity in road lighting installations'
CIE 055:1983	'Discomfort glare in the interior working environment'
CIE 112:1994	'Glare evaluation system for use within outdoor sports and area lighting'
CIE 117:1995	'Discomfort glare in interior lighting'
CIE 146:2002	'CIE Equations for Disability Glare'
CIE 147:2002	'Glare from Small, Large and Complex Sources'

Reference	Title
CIE 190:2010	'Calculation and Presentation of Unified Glare Rating Tables for Indoor Lighting Luminaires'
Others	
prEN 50625-2-1 (under drafting)	'Collection, logistics & Treatment requirements for WEEE - Part 2-1: Treatment requirements for lamps'
EN 61995-1:2008	'Devices for the connection of luminaires for household and similar purposes - Part 1: General requirements'
EN 61995-2:2009	'Devices for the connection of luminaires for household and similar purposes - Part 2: Standard sheets for DCL'
HD 60364-7-715:2012	'Low-voltage electrical installations - Part 7-715: Requirements for special installations or locations - Extra-low-voltage lighting installations'
prHD 60364-7-719:2011 (under approval)	'Low-voltage installations - Part 7-719: Requirements for special installations or locations - Lighting installations for advertising signs with a rated output voltage not exceeding 1 000 V, which are illuminated by hot-cathode-fluorescent-lamps, luminous-discharge tubes (neon-tubes), inductive discharge lamps, light emitting diodes (LED) and/or LED modules'
EN ISO 24502:2010	'Ergonomics - Accessible design - Specification of age-related luminance contrast for coloured light (ISO 24502:2010)'
CIE 123:1997	'Low vision - Lighting needs for the partially sighted'
CIE 196:2011	'CIE Guide to Increasing Accessibility in Light and Lighting'

Table 16 Survey of European Standards, Guides etc. relevant for Lighting Products.

H.3 Standards, guides etc. for lighting in general

EN 12665:2011:

'Light and lighting - Basic terms and criteria for specifying lighting requirements'

This standard defines basic terms for use in all lighting applications; specialist terms with limited applications are given in individual standards. This standard also sets out a framework for the specification of lighting requirements, giving details of aspects which shall be considered when setting those requirements.

CIE S 017/E:2011

'ILV: International lighting vocabulary, new'

This new edition of the International Lighting Vocabulary (ILV) is the result of intensive work carried out by the Divisions of the CIE to update, and supplement where necessary, the contents of the previous edition (1987). Many new terms have been added, to reflect changes in technologies and practices, existing terms have been updated as necessary, and obsolete terms have been removed.

The aim of this edition of the International Lighting Vocabulary is to promote international standardization in the use of quantities, units, symbols and terminology related to the science and art of light and lighting, colour and vision, photobiology and image technology.

This vocabulary provides the definitions and essential information necessary for the understanding and correct usage of the terms included. It does not give extensive detail or explanations of the application of these terms; such information, relevant for experts in each specialized field, is available in the Technical Reports and Standards produced by the CIE.

The Standard presents the definitions of 1448 terms related to light and lighting.

Also available on-line: http://eilv.cie.co.at/

IEC/TR 60887:2010 (ed3.0)

'Glass bulb designation system for lamps'

Describes a system of nomenclature that provides designations of the glass bulbs used as envelopes for electric lamps. The application of such designations is directed towards the descriptions of finished lamps. This third edition cancels and replaces the second edition, published in 2003. It constitutes a technical revision. The reason for this new edition is the addition of a new bulb type designation and drawing.

EN 61231:2010/A1:2013:

'International lamp coding system (ILCOS)'

This technical specification gives the rules for the international lamp coding system and covers all lamp categories, excluding vehicle lamps. Coding for the main lamp types is specified and, for the others, will follow by amendments to this technical specification as appropriate.

The object of the international lamp coding system is:

- to improve communication about the different types of lamps;

- to help in discussions concerning interchangeability and compatibility of products;
- to create a closer relationship between international standards and manufacturers' literature (for example the code could be given in future in the relevant parts of a standard);
- to enable correct replacements of lamps;
- to be used as a complementary marking on the luminaire;
- to replace national and regional coding systems.

CIE 019.21:1981

'An analytic model for describing the influence of lighting parameters upon visual performance, 2nd ed., Vol.1.: Technical foundations'

CIE 019.22:1981

'An analytic model for describing the influence of lighting parameters upon visual performance, 2nd ed., Vol.2.: Summary and application guidelines'

CIE 19.21-1981 Technical Foundations

CIE 19.22-1981 Summary and Application Guidelines

CIE 19.21-1981 describes a comprehensive analytic model of the influence of lighting parameters upon the visual performance potential of observers engaged in tasks with significant visual components, and describes the evidence used to develop each phase of the model.

CIE 19.22-1981 summarizes the model and makes recommendations for its application in lighting practice.

The model has been derived from study and analysis of the extensive published literature that relates visual performance potential to lighting parameters, and includes two technical approaches which may be described as the empirical and analytical methods for studying visual performance. Empirical methods involve measurements of the speed and accuracy of task performance under real or simulated conditions of visual work. Analytical methods involve measurements of the operational characteristics of processes which are believed to be operative in visual work, either taken singly or in simple combinations, with subsequent synthesizing of the operational characteristics of the individual processes into a quantitative model which describes visual performance potential for given visual conditions. The analytic model described was derived from experimental data that the pertinent CIE committee was aware of. These data were obtained during a 50-year period form the two types of measurements mentioned. More than 2.200 persons residing in CIE member countries took part in these studies, either as observers or as unknowing subjects of field observations.

H.4 Standards, guides etc. for lamps

EN 50285:1999

'*Energy efficiency of electric lamps for household use - Measurement methods*.'

This European Standard has been **produced under Standardisation Mandate M/202** in response to the European Commission Directive implementing Council Directive 92/75/EEC

with regard to energy labelling of household lamps. A method of classification of lamps according to energy efficiency is given in the directive and is not a part of this standard. **This standard specifies the test conditions and method of measurement of luminous flux, lamp wattage and lamp life as given on a label on the lamp packaging**, together with a procedure for verification of the declared values. Only those parameters that are specific to the above mentioned Directive are included in this standard. All other parameters are included in the relevant lamp performance standards. Lamps covered by this standard are: mains voltage tungsten filament lamps; mains voltage tungsten halogen lamps; self-ballasted lamps; double-capped fluorescent lamps; single-capped fluorescent lamps.

EN 60064:1995/A5:2009

'*Tungsten filament lamps for domestic and similar general lighting purposes - Performance requirements*'.

This standard applies to tungsten filament incandescent lamps for general lighting services (GLS) which comply with the safety requirements in EN 60432-1.

EN 60081:1998/A5:2013

'Double-capped fluorescent lamps - Performance specifications.'

Gives technical requirements for double-capped tubular fluorescent lamps with preheated cathodes for general lighting service, operated with or without a starter from a.c. mains, also describes tests for the lamps with non-preheated cathodes operated without the use of a starter. Gives testing methods to be used for checking quality and interchangeability for type testing, for individual lamp batches or for a manufacturer's entire production. Consists of a series of standard data sheets, each giving the characteristics of a specific lamp type. Introduces new co-ordinates for the standard colours together with a new standard 'white' colour.

The following lamp types and modes of operation are included:

a) lamps having preheated cathodes, designed for operation on a.c. mains frequencies with the use of a starter, and additionally operating on high frequency;

b) lamps having preheated high-resistance cathodes, designed for operation on a.c. mains frequencies without the use of a starter (starter less), and additionally operating on high frequency;

c) lamps having preheated low-resistance cathodes, designed for operation on a.c. mains frequencies without the use of a starter (starter less), and additionally operating on high frequency;

d) lamps having preheated cathodes, designed for operation on high frequency;

e) lamps having non-preheated cathodes, designed for operation on a.c. mains frequencies;

f) lamps having non-preheated cathodes, designed for operation on high frequency.

EN 60188:2001

'High-pressure mercury vapour lamps - Performance specifications'

This standard specifies the performance requirements for high-pressure mercury vapour lamps for general lighting purposes, with or without a red correcting fluorescent coating. For some of the requirements given in this standard, reference is made to the relevant lamp data sheet. For some lamps these data sheets are contained in this standard. For other lamps, falling under the scope of this standard, the relevant data are supplied by the lamp manufacturer or responsible vendor.

EN 60192:2001

'Low pressure sodium vapour lamps - Performance specifications'

States the methods of test to be used for determining the characteristics of low pressure sodium vapour lamps of the integral type, both U-shaped and linear, operating on a.c. mains, 50 Hz or 60 Hz.

EN 60357:2003/A3:2011

'*Tungsten halogen lamps (non-vehicle) - Performance specifications*'.

This standard specifies the performance requirements for single-capped and double capped tungsten halogen lamps, having rated voltages of up to 250 V, used for the following applications:

- projection (including cinematograph and still projection)
- photographic (including studio)
- floodlighting
- special purpose
- general purpose
- stage lighting.

EN 60630:1998/FprA7:2014 (amendment under approval)**:**

'*Maximum lamp outlines for incandescent lamps*'

Comprises maximum lamp outlines for tungsten filament lamps for domestic and similar general lighting purposes.

IEC 61126:1992/Am2 ed1.0:2005

'Procedure for use in the preparation of maximum lamp outlines'

Provides guidelines for the preparation of maximum lamp outlines for the specific bulb shapes and caps noted. Is primarily for the use of lamp standardizing committees.

EN 60662:2012

'*High-pressure sodium vapour lamps. Performance specifications*'

IEC 60662:2011 specifies performance requirements for high-pressure sodium vapour lamps for general lighting purposes which comply with the safety requirements of IEC 62035.

EN 60901:1996/FprA6:2012 (amendment under approval)**:**

'*Single-capped fluorescent lamps – Performance specifications*'.

This International Standard specifies the performance requirements for single-capped fluorescent lamps for general lighting service. The requirements of this standard relate only to type testing. Conditions of compliance, including methods of statistical assessment, are under consideration. The following lamp types and modes of operation with external ballasts are included:

a) lamps operated with an internal means of starting, having preheated cathodes, for operation on a.c. mains frequencies;
b) lamps operated with an external means of starting, having preheated cathodes, for operation on a.c. mains frequencies with the use of a starter, and additionally operating on high frequency;
c) lamps operated with an external means of starting, having preheated cathodes, for operation on a.c. mains frequencies without the use of a starter (starter less), and additionally operating on high frequency;
d) lamps operated with an external means of starting, having preheated cathodes, for operation on high frequency;
e) lamps operated with an external means of starting, having non-preheated cathodes, for operation on high frequency.

EN 60969:1993/A2:2000 ; FprEN 60969:2013 under approval

'Self-ballasted lamps for general lighting services – Performance requirements'.

This Standard specifies the performance requirements, together with the test methods and conditions, required to show compliance of tubular fluorescent and other gas discharge lamps with integral means for controlling starting and stable operation (self-ballasted lamps) intended for domestic and similar general lighting purposes.

EN 61167:2011/FprA1:2013:

'*Metal halide lamps - Performance specifications*.'

This International Standard specifies the methods of test to be used for determining the characteristics of metal halide lamps, both single-ended and double-ended, operated on a.c. mains, 50 Hz or 60 Hz, with ballasts satisfying the requirements of IEC 923. These requirements relate only to type testing. The standard specifies lamp dimensions, electrical characteristics for lamp starting and operation together with information for ballast, ignitor and luminaire design and colour characteristics.

EN 61228:2008

'Fluorescent ultraviolet lamps used for tanning - Measurement and specification method'

This International Standard describes the method of measuring, evaluating and specifying the characteristics of fluorescent ultraviolet lamps that are used in appliances for tanning purposes. It includes specific requirements regarding the marking of such lamps. An equivalency code for the lamps is introduced. This equivalency code characterises the spectral energy distribution and is to be applied when replacing lamps in tanning equipment.

EN 61341:2011

'Method of measurement of centre beam intensity and beam angle(s) of reflector lamps'

EN 61549:2003/A3:2012

'Miscellaneous lamps'

Relevant to lamps not covered elsewhere in the scope of existing IEC standards.

EN 62639:2012

'Fluorescent induction lamps - Performance specifications.'

This standard specifies the performance requirements for fluorescent induction lamps for general lighting purposes. In this standard, the term 'lamp' stands for 'induction lamp'. It may be expected that lamps which comply with this standard will start and operate satisfactorily at voltages between 92 % and 106 % of rated supply voltage and at an ambient air temperature between 10 °C and 50 °C, when operated with ballasts complying with IEC 60929 and IEC 61347-2-3, as far as applicable, and in a luminaire complying with IEC 60598-1.

EN 2240-001:2009

'***Aerospace series - Lamps, incandescent - Part 001: Technical specification***'

This European Standard specifies the characteristics of incandescent lamps for aerospace applications. Only part 001 is listed here, but the norm consists of 101 parts published between 2009 and 2011. Part 002 deals with 'Main characteristics'. All other parts are 'Product Standards' for specific lamp codes. The norm is listed here as it could be relevant for 'Special Purpose Lamps'.

CIE 153:2003

'Report on intercomparison of measurements of the luminous flux of high-pressure sodium lamps'

This report summarizes the results of an international intercomparison of measurements of the luminous flux of high-pressure sodium discharge lamps. Thirteen laboratories from nine different countries took part in the intercomparison, both lamp manufacturers and national standards laboratories being represented. In view of the complex spectral power distribution of the radiation from this type of lamp, the results of intercomparison show an acceptable level of agreement for lighting applications, nine of the thirteen participants reporting results within ± 2% of the mean level.

H.5 Standards, guides etc. for lamp caps and holders

EN 60061-1:1993/A50:2014

'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 1: Lamp caps'

EN 60061-2:1993/A47:2014

'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 2: Lampholders'

EN 60061-3:1993/A48:2014

'*Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 3: Gauges'*

EN 60061-4:1992/A9:2005

'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 4: Guidelines and general information'

EN 60238:2004/A2:2011 ; FprEN 60238:2013 (under approval)

'*Edison screw lampholders*'

This International Standard applies to lampholders with Edison thread E14, E27 and E40, designed for connection to the supply of lamps and semi-luminaires only. It also applies to switched-lampholders for use in a.c. circuits only, where the working voltage does not exceed 250 V r.m.s. This standard also applies to lampholders with Edison thread E5 designed for connection to the supply mains of series connected lamps, with a working voltage not exceeding 25 V, to be used indoors, and to lampholders with Edison thread E10 designed for connection to the supply mains of series connected lamps, with a working voltage not exceeding 60 V, to be used indoors or outdoors. It also applies to lampholders E10 for building-in, for the connection of single lamps to the supply. These lampholders are not intended for retail sale.

EN 60360:1998

'*Standard method of measurement of lamp cap temperature rise'*

Describes the standard method of measurement of lamp cap temperature rise which is to be used when testing tungsten filament or discharge lamps for compliance with the limits. Covers the method of test and the specifications for test lampholders for lamps fitted with various sizes of ES and BC caps. This method has been used widely for incandescent lamps but its application is not limited to that type of lamp.

EN 60399:2004/A1:2008

'*Barrel thread for lampholders with shade holder ring*'

Gives limit dimensions of thread for metal or plastic and ceramic lampholders with shade holder rings made of metal or plastic.

EN 60400:2008/FprA2:2014 (amendment under approval)

'Lampholders for tubular fluorescent lamps and starterholders'

IEC 60400:2008 states the technical and dimensional requirements for lampholders for tubular fluorescent lamps and for starterholders, and the methods of test to be used in determining the safety and the fit of the lamps in the lampholders and the starters in the starterholders. Information on lampholders intended to be used in applications where they are accessible in normal use (class II luminaires as well as class I luminaries), as well as requirements for contact-making to pins for single-capped fluorescent lamps, and requirements for shade holder rings.

EN 60838-1:2004/A2:2011 ; FprEN 60838-1:2013 under approval

'*Miscellaneous lampholders - Part 1: General requirements and tests'*

This part of EN 60838 applies to lampholders of miscellaneous types intended for building-in (to be used with general purpose light sources, projection lamps, floodlighting lamps and street-lighting lamps with caps as listed in annex A) and the methods of test to be used in determining the safe use of lamps in lampholders. This part of EN 60838 also covers lampholders which are integral with a luminaire. It covers the requirements for the lampholder only.

EN 60838-2-1:1996/A2:2004

'*Miscellaneous lampholders - Part 2-1: Particular requirements - Lampholders S14'*

Applies to lampholders S14 intended for building-in as well as for independent lampholders for use with linear incandescent lamps for general lighting service (GLS). Independent lampholders are also tested as luminaires.

EN 60838-2-2:2006/A1:2012

'*Miscellaneous lampholders - Part 2-2: Particular requirements - Connectors for LED-modules'*

This part of IEC 60838-2 applies to connectors for building-in (including those used for interconnection between LED modules) of miscellaneous types to be used with PCB-based LED modules

Project EN/IEC 60838-2-3 (under approval)

'*Miscellaneous lampholders - Part 2-3: Particular requirements - Lampholders for double-capped linear LED lamps*'

EN 61184:2008/A1:2011

'Bayonet lampholders'

H.6 Standards, guides etc. for luminaires

EN 16268:2013

'Performance of reflecting surfaces for luminaires'

This European standard is applicable to the optical performance of untreated or coated materials supplied in plane sheet or strip form for use as a plane or formed reflector as well as preformed reflectors both as originally produced and after prescribed tests to determine probable maintained performance in service. This includes: a) untreated base materials, including: 1) aluminium, 2) steel, 3) plastic, 4) glass. b) surface treated materials, including: 1) polished materials, 2) anodised materials, 3) vacuum metallised materials, 4) painted materials, 5) multilayer systems. This European Standard is not applicable to fluorescent materials.

EN 60598-1:2008/A11:2009 ; FprEN 60598-1:2014 (under approval)

'Luminaires - Part 1: General requirements and tests'

This Part 1 specifies general requirements for luminaires, incorporating electric light sources for operation from supply voltages up to 1 000 V. The requirements and related tests of this standard cover: classification, marking, mechanical construction and electrical construction.

EN 60598-2-1:1989

'Luminaires - Part 2-1: Particular requirements - Fixed general purpose luminaires'

This chapter of Part 2 of IEC Publication 598 specifies requirements for fixed general purpose luminaires for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 1000 V. It is to be read in conjunction with those chapters of Part 1 to which reference is made.

EN 60598-2-2:2012

'Luminaires - Part 2-2: Particular requirements - Recessed luminaires'

Specifies requirements for recessed luminaires incorporating electric light sources for operation from supply voltages up to 1 000 V. This section does not apply to air-handling or liquid-cooled luminaires.

EN 60598-2-3:2003/A1:2011

'Luminaires - Part 2-3: Particular requirements - Luminaires for road and street lighting'

Specifies requirements for luminaires for road and street lighting, for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 1 000 V.

EN 60598-2-4:1997

'Luminaires - Part 2-4: Particular requirements - Portable general purpose luminaires'

Specifies requirements for portable general purpose luminaires, other than hand lamps, for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 250 V.

EN 60598-2-5:1998 ; FprEN 60598-2-5:2014 (under approval)

'*Luminaires - Part 2-5: Particular requirements – Floodlights*.'

Specifies requirements for floodlights for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 1 000 V.

EN 60598-2-6:1994/A1:1997

'*Luminaires - Part 2-6: Particular requirements - Luminaires with built-in transformers or convertors for filament lamps*'

Specifies requirements for luminaires with built-in transformers for filament lamps, with supply voltages and output voltages not exceeding: - 1 000 V for class I and class II luminaires and - 250 V for class 0 luminaires.

EN 60598-2-7:1989/A13:1997

'*Luminaires. Particular requirements. Portable luminaires for garden use*.'

Specifies requirements for portable pedestal luminaires for use in places such as gardens and for portable luminaires for use in places such as flower beds, for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 250 V.

EN 60598-2-8:2013

'*Luminaires - Part 2-8: Particular requirements – Handlamps*'

IEC 60598-2-8:2013 specifies requirements for handlamps and similar portable luminaires which are held in the hand, hooked up or resting on a surface for use with electric light sources on supply voltages not exceeding 250 V.

EN 60598-2-9:1989/A1:1994

'Luminaires - Part 2: Particular requirements - Section 9: Photo and film luminaires (non-professional)'

Specifies requirements for photo and film luminaires (non-professional) for use with low-pressure tungsten halogen lamps, specified in EN 60357.

EN 60598-2-10:2003/corrigendum Aug. 2005:

'*Luminaires - Part 2-10: Particular requirements - Portable luminaires for children*'

Specifies requirements for portable child-appealing luminaires for use with tungsten filament lamps on supply voltages not exceeding 24 V (SELV).

EN 60598-2-11:2013

'Luminaires - Part 2-11: Particular requirements - Aquarium luminaires'

This part of EN 60598 specifies requirements for household aquarium luminaires for use with tungsten filament, tubular fluorescent or other discharge lamps on supply voltages not exceeding 1 000V.

EN 60598-2-12:2013

'Luminaires - Part 2-12: Particular requirements - Mains socket-outlet mounted nightlights'

Specifies requirements for mains socket-outlet mounted nightlights for use with electric light sources, on supply voltages not exceeding 250 V a.c. 50/60 Hz. It is to be read in conjunction with those sections of Part 1 to which reference is made.

EN 60598-2-13:2006/A1:2012

'Luminaires - Part 2-13: Particular requirements - Ground recessed luminaires'

Specifies requirements for ground recessed luminaires incorporating electric light sources for operation from supply voltages up to 1 000 V, for indoor or outdoor use, e.g. in gardens, yards, carriageways, parking lots, cycleways, footways, pedestrian areas, swimming pools areas outside zones for SELV, nurseries and similar applications.

EN 60598-2-14:2009

'Luminaires - Part 2-14: Particular requirements - Luminaires for cold cathode tubular discharge lamps (neon tubes) and similar equipment'

IEC 60598-2-14:2009 applies to luminaires for cold cathode tubular discharge lamps and similar equipment, operating on a no-load rated output voltage over 1 000 V but not exceeding 10 000 V, mainly used for general lighting, for indoor or outdoor applications and for supply voltages up to 1 000 V. This publication is intended to be read in conjunction with IEC 60598-1.

EN 60598-2-17:1989

'Luminaires - Part 2: Particular requirements - Section 17: Luminaires for stage lighting, television film and photographic studios (outdoor and indoor)'

Specifies requirements for stage, television and film studio luminaires (including spot and floodlighting projectors), for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 1 000 V.

EN 60598-2-18:1994/A1:2012

'Luminaires - Part 2-18: Particular requirements - Luminaires for swimming pools and similar applications'

Specifies requirements for fixed luminaires intended for use in water, or in contact with water, for example in swimming pools, fountains, paddling pools, and garden pools, and for use with tungsten filament lamps.

EN 60598-2-19:1989/corrigendum Dec. 2005:

'Luminaires - Part 2: Particular requirements - Air-handling luminaires (safety requirements)'

Specifies safety requirements for air-handling luminaires for use with a ventilation space (plenum), for use with tubular fluorescent lamps on supply voltages not exceeding 1 000 V.

EN 60598-2-20:2010 /corrigendum Sep. 2010 ; **FprEN 60598-2-20:2013** (under approval) **:**

'Luminaires - Part 2-20: Particular requirements - Lighting chains'

IEC 60598-2-20:2010 specifies requirements for lighting chains fitted with series- or parallel- or a combination of series/parallel-connected incandescent lamps for use either indoors or outdoors on supply voltages not exceeding 250 V.

FprEN 60598-2-21:2013 (under approval):

'Luminaires - Part 2-21: Particular requirements - Sealed lighting chains'

EN 60598-2-22:1998/A2:2008; **FprEN 60598-2-22:2014** (under approval) :

'Luminaires - Part 2-22: Particular requirements - Luminaires for emergency lighting'

Specifies requirements for emergency lighting luminaires for use with tungsten filament fluorescent and other discharge lamps on emergency power supplies not exceeding 1 000 V.

EN 60598-2-23:1996/A1:2000

'Luminaires. Particular requirements - Extra low voltage lighting systems for filament lamps'

Specifies requirements for extra low voltage systems for filament lamps intended for ordinary use on supply voltages not exceeding 1 000 V. The luminaires, being connected in parallel, are supplied via freely suspended continuous supporting conductors or profiles. The current in the output circuit of the system is limited to 25 A.

EN 60598-2-24:2013

'Luminaires - Part 2-24: Particular requirements - Luminaires with limited surface temperatures'

IEC 60598-2-24:2013 series specifies requirements for luminaires intended for use where the necessity of limited temperature on the outer surface exists, due to the risk of thermal effects, combustion or degradation of materials but where the risk of explosion in the atmosphere does not exist. The luminaires are for use with electric light sources on supply voltages not exceeding 1 000 V. This standard specifically excludes requirements for luminaires for use in explosive gas atmospheres and explosive dust atmospheres.

EN 60598-2-25:1994/A1:2004

'*Luminaires. Part 2-25: Particular requirements. Luminaires for use in clinical areas of hospitals and health care buildings*.'

Details specific requirements for luminaires for use with tungsten filament, fluorescent and other discharge lamps on supply voltages not exceeding 1 000 V for use in clinical areas in which medical treatment, examination and medical care takes place in hospital and health care buildings.

FprEN 62722-1:2013 (under approval)**:**

'*Luminaire performance - Part 1: General Requirements*'

FprEN 62722-2-1:2013 (under approval)**:**

'*Luminaire performance - Part 2-1: Particular requirements for LED luminaires*'

H.7 Standards, guides etc. for LED lighting

prEN 13032-4:201X (under approval):

'Light and lighting - Measurement and presentation of photometric data - Part 4: LED lamps, modules and luminaires'

This European Standard specifies the requirements for measurement of electrical, photometric, and colourimetric quantities of LED lamps, modules, light engines and luminaires, for operation with AC or DC supply voltages, possibly with associated control gear. Photometric and colourimetric quantities covered in this standard include total luminous flux, luminous efficacy, partial luminous flux, luminous intensity distribution, centre-beam intensities, luminance and luminance distribution, chromaticity coordinates, correlated colour temperature (CCT), Colour Rendering Index (CRI), and spatial uniformity of chromaticity. This standard does not cover LED packages and products based on OLEDs (organic LEDs).

In relation to Directive 1194/2012/EU.

EN 60838-2-2:2006/A1:2012

'*Miscellaneous lampholders - Part 2-2: Particular requirements - Connectors for LED-modules*'

This part of IEC 60838-2 applies to connectors for building-in (including those used for interconnection between LED modules) of miscellaneous types to be used with PCB-based LED modules

Project EN/IEC 60838-2-3 (under approval)

'*Miscellaneous lampholders - Part 2-3: Particular requirements - Lampholders for double-capped linear LED lamps*'

EN 61347-2-13:2006/corrigendum Dec. 2010 **; FprEN 61347-2-13:2012** under approval

'***Lamp controlgear - Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules'***

This part of IEC 61347 specifies particular safety requirements for electronic controlgear for use on d.c. supplies up to 250 V and a.c. supplies up to 1 000 V at 50 Hz or 60 Hz and at an output frequency which can deviate from the supply frequency, associated with LED modules.

EN 62031:2008/FprA2:2014 (amendment under approval)**:**

'*LED modules for general lighting - Safety specifications'*

This International Standard specifies general and safety requirements for light-emitting diode (LED) modules: - LED modules without integral control gear for operation under constant voltage, constant current or constant power; - self-ballasted LED modules for use on d.c. supplies up to 250 V or a.c. supplies up to 1 000 V at 50 Hz or 60 Hz.

EN 62384:2006/A1:2009

'*DC or AC supplied electronic control gear for LED modules. Performance requirements'*

EN 62386-207:2009

'*Digital addressable lighting interface. Particular requirements for control gear. LED modules (device type 6)*.'

IEC 62386-207:2009 specifies a protocol and test procedures for the control by digital signals of electronic control gear for use on a.c. or d.c. supplies, **associated with LED modules**. This Part 207 is intended to be used in conjunction with IEC 62386-101 and IEC 62386-102, which contain general requirements for the relevant product type (control gear or control devices).

FprEN 62442-3:2014 (under approval)**:**

'*Energy performance of lamp controlgear - Part 3: Controlgear for halogen lamps and LED modules - Method of measurement to determine the efficiency of the controlgear* '

IEC 62442-3:2014 defines a measurement method for the power losses of magnetic transformers and the power losses with the standby power of electronic convertor for halogen lamps and LED modules. Also a calculation method of the efficiency for the mentioned controlgear for halogen lamps and LED modules is defined.

FprEN 62504:2014 (under approval):

'*General lighting - Light emitting diode (LED) products and related equipment - Terms and definitions'*

IEC/TS 62504:2011 presents terms and definitions relevant for lighting with LED light sources. It provides both descriptive terms (such as 'built-in LED module') and measurable terms (such as 'luminance').

EN 62560:2012/FprA1:2013 (amendment under approval)**:**

'***Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specifications'***

Specifies the safety and interchangeability requirements, together with the test methods and conditions required to show compliance of LED-lamps with integrated means for stable operation (self-ballasted LED-lamps), intended for domestic and similar general lighting purposes, having: - a rated wattage up to 60 W; - a rated voltage of > 50 V up to 250 V; - caps according to Table 1.

EN 62612:2013

'***Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements'***

IEC 62612:2013 specifies the performance requirements, together with the test methods and conditions, required to show compliance of LED lamps with integral means for stable operation, intended for domestic and similar general lighting purposes, having:
– a rated wattage up to 60 W;
– a rated voltage of up to 250V AC or DC;
– a lamp cap according to IEC 62560
The requirements of this standard relate to type testing. This standard does not cover self-ballasted LED lamps that intentionally produce tinted or coloured light neither does it cover OLEDs. Recommendations for whole product testing or batch testing are under consideration. These performance requirements are additional to the requirements in the draft standard IEC 62560: safety standard for self-ballasted LED lamps.

FprEN 62663-1:2012 (under approval):

'Non-ballasted LED-lamps - Part 1: Safety specifications'

prEN 62663-2:201X (under drafting):

'Non-ballasted LED lamps - Performance requirements'

FprEN 62717:2013 (under approval):

'LED modules for general lighting - Performance requirements'

FprEN 62722-2-1:2013 (under approval)**:**

'*Luminaire performance - Part 2-1: Particular requirements for LED luminaires*'

FprEN 62776:2013 (under approval):

'Double-capped LED lamps for general lighting services - Safety specifications'

prEN 62838:201X (under drafting):

'Semi-integrated LED lamps for general lighting services with supply voltages not exceeding 50 V a.c. r.m.s. or 120V ripple free d.c. - Safety specification'

FprEN 62868:2013 (under approval):

'Organic light emitting diode (OLED) panels for general lighting - Safety requirements'

CIE 127:2007

'Measurement of LED's' (2nd ed.)

This report is an update of the previously published CIE Technical Report CIE 127-1997. There are significant differences between LEDs and other light sources which made it necessary for the CIE to introduce new quantities for their characterization with precisely defined measurement conditions. New quantities introduced here are "Averaged LED Intensity" and "Partial LED Flux". The report describes in detail the measurement conditions for ALI (Averaged LED Intensity), Total and Partial LED Flux and Spectral Power Distribution. It is shown that measurements by substitution method using LED standards can be simpler; however it is important to compare similar coloured LEDs or use colour correction on the measurement results. The standard LEDs need to be calibrated by National Metrology Laboratories or a laboratory traceable to National Metrology Laboratories.

CIE 177:2007

'Colour Rendering of White LED Light Sources'

The Committee recommends the development of a new colour rendering index (or a set of new colour rendering indices) by a Division 1 Technical Committee. This index (or these indices) shall not replace the current CIE colour rendering index immediately. The usage of the new index or indices should provide information supplementary to the current CIE CRI, and replacement of CRI will be considered after successful integration of the new index. The new supplementary colour rendering index (or set of supplementary colour rendering indices) should be applicable to all types of light sources and not only to white LED light sources. Possibilities for an improved description of colour rendering are summarized in the Appendix of this Technical Report.

CIE 205:2013

'*Review of Lighting Quality Measures for Interior Lighting with LED Lighting Systems*'

With recent increases in luminous flux and efficacy, LEDs have started to compete with conventional light sources in luminaires for general lighting. Typical LED characteristics, such as directional light, small size and high brightness are as such not new light source characteristics; nonetheless they are (alone or as combination) new characteristics in some areas of functional interior lighting, such as offices, class rooms, meeting rooms or patient rooms. Most existing quality measures for those applications are derived from research with and referring to the use of diffuse fluorescent lighting. This report provides information on the suitability of existing lighting quality measures when applied to (commercial) interior LED lighting systems. It identifies the gaps and weaknesses in existing quality measures, recommends new quality measures and includes suggestions for required research.

CIE DIS 024/E:2013

'*Light Emitting Diodes (LEDs) and LED Assemblies - Terms and Definitions*'

This Draft International Standard summarizes the most important terms and definitions in the field of lighting by inorganic semiconductors used in CIE documents, which are intended to become part of the International Lighting Vocabulary.

The Draft International Standard has been sent to CIE National Committees for comments and sales to interested parties. It is still subject to changes and may not yet be referred to as a CIE International Standard. When approved by the CIE NCs, it will be published as a CIE International Standard and later on get part of the International Lighting Vocabulary.

H.8 Standards, guides etc. for outdoor lighting

H.8.1 Lighting of outdoor workplaces

EN 12464-2:2014:

'Light and Lighting-Part 2: Lighting of outdoor work places.'

EN 12464-2 focuses on the recommendations for outdoor work places that are used at night. It includes important recommendations on how obtrusive light can be limited, to keep our night sky free of light pollution.

This European Standard does not specify lighting requirements with respect to the safety and health of workers at work and has not been prepared in the field of application of Article 153 of the EC treaty, although the lighting requirements, as specified in this standard, usually fulfil safety needs. Lighting requirements with respect to the safety and health of workers at work may be contained in Directives based on Article 153 of the EC treaty, in national legislation of member states implementing these directives or in other national legislation of member states.

To enable people to perform outdoor visual tasks efficiently and accurately, especially at night, adequate and appropriate lighting has to be provided. The degree of visibility and comfort required in a wide range of outdoor work places is governed by the type and duration of activity.

This part 2 of EN 12464 provides the lighting design criteria for 15 installation task groups and 97 task activities in terms of quantity and quality of illumination. It also defines the maintenance, energy efficiency and system verification procedures. In addition recommendations are given for good lighting practice.

This European Standard neither provides specific solutions, nor restricts the designer's freedom from exploring new techniques nor restricts the use of innovative equipment.

CIE S015/E:2005

'Lighting of Outdoor Work Places'

To enable people to perform visual tasks efficiently and accurately, especially during the night, adequate and appropriate lighting has to be provided. The degree of visibility and comfort required in a wide range of outdoor work places is governed by the type and duration of activity.

This standard specifies requirements for lighting of tasks in most outdoor work places and their associated areas in terms of quantity and quality of illumination. In addition recommendations are given for good lighting practice. All usual visual tasks are considered.

After the definitions of terms, the standard gives detailed information on lighting design criteria. Fifteen tables specify the lighting requirements for various areas, tasks and activities, and a short chapter recommends verification procedures. Following a bibliography, an extensive index of areas, tasks and activities facilitates consultation of the tables of the standard.

CIE S 016/E:2005 (ISO 8995-3:2006)

'Lighting of Work Places - Part 3: Lighting Requirements for Safety and Security of Outdoor Work Places'

To enable people to perform visual tasks efficiently and accurately, especially during the night, adequate and appropriate lighting has to be provided. The degree of visibility and comfort required in a wide range of outdoor work places is governed by the type and duration of activity.

The standard specifies the lighting requirements that will contribute to the visual needs for safety and security within outdoor work places.

CIE 128:1998

'Guide to the lighting for open-cast mines'

Open-cast mines cover a large area and continually change their shape as mining proceeds. Effective illumination is required to achieve production and safe operation of various machinery at different work areas.

Mobile mining machinery is equipped with luminaires powered by on board generators. Movable lighting towers are used in the mine faces for general lighting. Deep, compact pits and permanent facilities such as stockpiles, conveyors and processing plant, can be lit from fixed lighting arrangements.

Illuminance levels are provided for each work area to meet the visibility requirements of equipment operators and other workers.

Luminaires must have a high degree of protection against ingress of dust and moisture due to the atmosphere prevalent in open-cast mines. Luminaire design and installation must facilitate ease of maintenance. Strict adherence to agreed-upon maintenance schedules is important for prevention of undue loss of light with time and to avoid capital investment in higher initial lighting levels thus saving energy.

Lighting quality parameters like average illuminance, uniformity and glare limitation have been described. Further guidance can be obtained from existing CIE publications. Requirements for areas typical of open-cast mines have been given.

CIE 129:1998

'Guide for lighting exterior work areas'

The present document updates and replaces Publication CIE 68-1986 Guide to the lighting of exterior working areas.

The values published are based on illuminance concept. Further to the average maintained illuminance and minimum to average ratio, the minimum to maximum ratio was introduced. Glare is limited by Glare Rating (GR). The values are "maintained" and determined to achieve efficient working conditions, safe movement and traffic and safety/security of people and property. Work areas are divided into twelve sections and listed in the Application Tables.

Attention is focused on design values. Other topics, as colour quality, maintenance, environmental aspects, design and measurement are only mentioned in this paper, detailed recommendations or standards are to be sought for in relevant CIE and ISO publications.

H.8.2 Street lighting and external public space lighting

CEN/TR 13201-1:2004 :

'*Road lighting - Part 1: Selection of lighting classes*.'

This technical report specifies the lighting classes set out in EN 13201-2 and gives guidelines on the application of these classes. To do this, it includes a system to define an outdoor public traffic area in terms of parameters relevant to lighting. To assist in the application of classes, it suggests a practical relationship between the various series of lighting classes, in terms of comparable or alternative classes. It also gives guidelines on the selection of the relevant area to which the lighting classes from EN 13201-2 and the calculation grids and procedure from EN 13201-3 should be applied.

FprCEN/TR 13201-1 (under approval in 2014)

'*Road lighting - Part 1: Selection of lighting classes*.'

The decision on whether a road should be lit is defined in the national road lighting policy. This varies by country or municipality. Specific guidelines are usually available at national level for each country. This Technical Report does not give the criteria on which a decision to light an area can be made, nor on how a lighting installation should be used. Further guidance is given in CIE 115:2010 (Paragraph 1.2 and Annex A).

This Technical Report specifies the lighting classes set out in EN 13201-2 and gives guidelines on the selection of the most appropriate class for a given situation. To do this, it includes a system to define appropriate lighting classes for different outdoor public areas in terms of parameters relevant to guarantee the aims presented in introductions. The methods presented in Clauses 5, 6 and 7 have to be considered as the starting points of a comprehensive approach for the normal road lighting. In that sense, the models cannot cover all the different road cases; they introduce general parameters and the impact on lighting requirements. Only the real situation and its unique characteristics (geometry of the road, marking, visual environment, difficulty of the navigation task, lack of visibility, risks of glares due to existing elements, local weather, specific users such as high rate of elderly or visually impaired people, etc.) can lead to a final determination of the appropriate lighting class applying risk evaluation techniques.

The visual needs of road users under reduced traffic volumes during certain periods of night or under varying weather conditions, and the positive benefits of reduced energy consumption and potential environmental improvements, are some of the considerations which justify the installation of adaptive road lighting. There are a variety of suitable instruments, devices and methods which can be used for the intelligent control of a road lighting installation. The control systems range from very simple to the most sophisticated applications. Annex B is of assistance in choosing the correct lighting level when adaptive lighting is used as it provides a more refined evaluation of the luminance or illuminance levels within the specific lighting class. Whilst the luminance or illuminance levels may be varied to suit reduced traffic volumes, weather conditions or other parameters the quality parameters of the applicable

lighting class specified in EN 13201-2 should be maintained at all times. Renewal or refurbishment of obsolete and uneconomic installations is important. It may be possible to obtain more adapted lighting levels with lower energy consumption using new designs and new technology. The upgrading of lighting and control systems will often give good cost-benefit ratios and short amortisation periods. This document does not give guidelines on the selection of lighting classes for toll stations, tunnels or canals and locks.

EN 13201-2:2003 ; prEN 13201-2 rev (under approval in 2014)

'*Road lighting - Part 2: Performance requirements*.'

This part of this European Standard defines, according to photometric requirements, lighting classes for road lighting aiming at the visual needs of road users, and it considers environmental aspects of road lighting.

Installed intensity classes for the restriction of disability glare and control of obtrusive light and installed glare index classes for the restriction of discomfort glare are defined in annex A of the standard.

EN 13201-3:2003/AC:2007 ; prEN 13201-3 rev (under approval in 2014)

'*Road lighting - Part 3: Calculation of performance*.'

This European Standard defines and describes the conventions and mathematical procedures to be adopted in calculating the photometric performance of road lighting installations designed in accordance with EN 13201-2.

The calculation methods described in EN 13201-3 enable road lighting quality characteristics to be calculated by agreed procedures so that results obtained from different sources will have a uniform basis.

EN 13201-4:2003 ; prEN 13201-4 rev (under approval in 2014)

'*Road lighting - Part 4: Methods of measuring lighting performance*.'

This part of the European standard specifies the procedures for making photometric and related measurements of road lighting installations, and gives advice on the use and selection of luminance meters and illuminance meters.

It aims to establish conventions and procedures for lighting measurements of road lighting installations.

The conventions for observer position and location of measurement points are those adopted in EN 13201-3. Conditions which may lead to inaccuracies are identified and precautions are given to minimize these.

A format for the presentation of measurements is also provided.

prEN 13201-5 (under approval in 2014):

'Road lighting-Part 5: Energy performance indicators.'

This Draft European Standard EN 13201-5 has been submitted to CEN members for voting. In case of a positive result of the voting as required by CEN/CENELEC regulations, this Draft will be published as EN.

This part of this European Standard defines how to calculate the energy performance indicators for road lighting installations using the calculated power density (D) and the calculated energy consumption indicator (ECIy). Power density (D) demonstrates the energy needed for a road lighting installation, while it is fulfilling the relevant lighting requirements specified in EN 13201-2. The energy consumption indicator (ECIy) determines the power consumption during the year, even if the relevant lighting requirements change during the night or seasons.

These indicators may be used to compare the energy performance of different road lighting solutions and technologies for the same road lighting project. The energy performance of road lighting systems with different road geometries or different lighting requirements cannot be compared to each other directly, as the energy performance is influenced by, amongst others, the geometry of the area to be lit, as well as, the lighting requirements. The power density (D) and energy consumption indicators (ECIy) apply for all traffic areas covered by the series of lighting classes M, C and P as defined in EN 13201-2.

Annex B of the standard introduces the installation efficacy and its factors as a measure of the influence of various losses and parameters.

HD 60364-7-714:2012 [29]

'Low-voltage electrical installations - Part 7-714: Requirements for special installations or locations - External lighting installations'.

IEC 60364-7-714:2011 applies to the selection and erection of luminaires and lighting installations forming part of an outdoor fixed installation. The origin of the external lighting installation is the supply delivery point of electrical energy by the supply authority or the origin of the circuit supplying the external lighting installation exclusively. **The requirements apply to**, for example, lighting installations for roads, parks, gardens, places open to the public, sporting areas, illumination of monuments, floodlighting, telephone kiosks, bus shelters, advertising panels, town plans and road signs.

The requirements do not apply to: - public street-lighting installations which are part of the public power grid; - temporary festoon lighting; - road traffic signal systems; - and luminaires which are fixed to the outside of a building and are supplied directly from the internal wiring of that building. This second edition cancels and replaces the first edition, published in 1996, and constitutes a technical revision. The major technical changes with respect to the previous edition are listed below: - clause numbering is aligned with present structure of IEC 60364; - additional protection is required in some cases of equipment incorporating lighting; - more stringent requirements regarding IP degree of protection; - introduction of particular requirements for isolation.

[29] HD / EN / IEC 60364 'Electrical Installations for Buildings' is mainly an attempt to harmonize national electrical wiring standards. The standard has many parts that cover protection, safety, verification and requirements for electrical installations. For lighting in particular sections 714 (External lighting) and 715 (Extra low voltage lighting installations) are relevant.

Note: External lighting **comprises luminaires**, wiring system **and accessories located outside buildings**.

CIE 032:1977

'Lighting in situations requiring special treatment'

This technical report supplements CIE 12.2-1977 Recommendations for the Lighting of Roads for Motorized Traffic. It describes details of technologies and work processes which are required to achieve the objectives put forward in CIE 12.2-1977.

It treats lighting problems which arise from certain discontinuities not mentioned in CIE 12.2-1977 (e.g. humps or multi-level works). It also takes into account the evolution of newer techniques (e.g. new sources, high masts, or catenary lighting).

CIE 033:1977

'Depreciation of installations and their maintenance'

This report is supplementary to CIE 12.2-1977 Recommendations for the Lighting of Roads for Motorized Traffic. The first part contains a survey of the combined effects of permanent or incidental causes which progressively impair the performance of road lighting installations. The second part points out what preventive measures can be taken in designing and installing a system to reduce or slow down the deterioration of materials (columns, lanterns, light sources, auxiliary gear). The last part indicates preventive maintenance operations aimed at protecting materials against deterioration or at restoring, as much as possible, the initial performance of the installation. The different methods of maintenance and replacement of various items are analysed.

CIE 034-1977

'Road lighting lantern and installation data: photometrics, classification and performance'

This technical report is one of a series of supporting documents to CIE 12.2-1977 Recommendations for the Lighting of Roads for Motorized Traffic. It is concerned with the data involved in predicting the performance of an installation, as described in CIE 30.2-1982 Calculation and Measurement of Luminance and Illuminance in Road Lighting.

1. Part 1 of the report describes the preferred form of basic photometric data for road lighting lanterns: intensity tables; isocandela diagrams; polar diagrams; flashed areas.

2. Part 2 outlines additional derived data for an individual lantern which could be of value: description of a lantern in terms of throw, speed and control; utilization factor diagrams; luminance yield diagrams, isoluminance diagrams.

3. Part 3 gives three useful methods of presenting data on the performance of lantern installations: performance tables; performance graphs; layout tables for achieving a specific performance.
4. An Appendix gives information about differences in performance which have been found between installations using lanterns that satisfy the same specification or classification.

CIE 047:1979

'Road lighting for wet conditions'

The use of the luminance distribution on the dry road surface as a criterion of the quality of road lighting of traffic routes has gained acceptance in a number of countries. However, in rainy climates a road surface is moist or wet for a substantial part of the dark hours, thus reducing the quality of lighting. The aim of this report is to give information which facilitates the consideration of wet conditions in the design of road lighting installations. The information covers most aspects of road lighting for wet conditions, but is mainly in the form of a collection of experience. As research on the reflection properties of wet road surfaces is still in progress, this information is not considered final.

CIE 066:1984

'Road surfaces and lighting (joint technical report CIE/PIARC)'

This technical report deals with the relationship between the photometric characteristics (reflection properties) of road surfaces and their construction (compositions and texture). It was drafted by CIE experts on reflection by road surfaces in collaboration with PIARC experts on road construction, and is intended as a guide for road constructors and for lighting designers.

The report is a summary of recommendations contained in CIE technical reports, and gives supplementary information not previously published by CIE or PIARC. Some of this information is provisional. It is hoped that the report will stimulate the collection of additional data that lead to more accurate information.

CIE 093:1992

'Road lighting as an accident countermeasure'

Road accidents at night are disproportionately high in numbers and severity compared to day. The major factor contributing to this problem is darkness because of its great influence on the driver's behaviour and ability. At night man's visual capabilities are impaired and visibility is reduced. Thus road lighting is a potential countermeasure.

Sixty-two lighting and accident studies, from 15 countries, have been rigorously analysed. Some 85% of results show lighting to be beneficial, with about one third of these having statistical significance. These lead to the general conclusion that road lighting on traffic routes will reduce the incidence of night accidents. Depending on the class of road and the accident classification involved, the statistically significant results show reductions of between 13% and 75%.
Depending on the road and traffic classification, cost benefit studies show the accident savings to more than offset the cost of lighting. In the report, warrants for lighting related to accidents and traffic volume are developed. The findings can assist in the preparation of national standards and in decisions on the implementation of road lighting programmes.

CIE 094:1993

'Guide for floodlighting'

The purpose of this Guide from CIE Technical Committee TC 5-06 is to provide information on how to use exterior lighting for the decoration of the night-time urban landscape. Of the many applications of lighting in an urban environment, this Guide deals with those having a purely aesthetic and decorative purpose. Such lighting can be used every night, as is often the case in the lighting of monuments, public art, commercial buildings, or used only periodically on the occasion of a festival or public gathering. The lighting of natural sites, parks, and gardens is also dealt with in this Guide. Permanent lighting for traffic or public safety, although affecting the quality of a city's night time ambience, is not dealt with in the Guide. This Guide provides tools for the exterior lighting designer and ideas for the town architect. For those who have to make the decisions on expenditure, this Guide explains the possibilities of combining outdoor beautification with economical and energy friendly decorative lighting.

This Guide is written for the non-expert reader who is interested only in the broad technicalities of the subject and who wishes to be able to understand what an expert may tell him.

CIE 100:1992

'Fundamentals of the visual task of night driving'

This report presents the principal fundamental information known about the visual task of driving at night and provides insights as to how these principals may be used to make roadways safer and improve traffic flow at night. The first chapter describes the visual task of driving and establishes the elements in the perceptual process, such as visual attention, detection, recognition, decision making and visually guided responses. It then discusses how night driving differs from daylight operations. It deals with questions of fine and coarse spatial vision, vision near detection, threshold and colour vision in night driving situations.

Chapter two identifies and critically evaluates how the night driver acquires information from the roadway scene and discusses what are the important cues needed for vehicular operation.

The third chapter discusses the required sight distances for carrying out the three major subtasks in driving:

positional task: --maintenance of lateral position and of correct heading,

situational task: --avoidance of hazards and executing proper manoeuvers,

navigational task:--route selection and following.

Chapter four discusses visibility models and their potential uses.

The final chapter suggests methods for improving road design for nighttime conditions. Design elements discussed include public and vehicular lighting, the use of retroreflective materials and the use of self-luminous signals.

CIE 115:2010

'Lighting of Roads for Motor and Pedestrian Traffic'

This report is a revision and update of CIE 115-1995 "Recommendations for the Lighting of Roads for Motor and Pedestrian Traffic". Since it was issued in 1995 power consumption and environmental aspects have become more important and at the same time, the improved performance of luminaires and lamps, and especially the introduction of electronic control gear, has made it possible to introduce adaptive lighting for roads for motorised traffic,

conflict areas and areas for pedestrians. A structured model has been developed for the selection of the appropriate lighting classes (M, C, or P), based on the luminance or illuminance concept, taking into account the different parameters relevant for the given visual tasks. Applying for example time dependent variables like traffic volume or weather conditions, the model offers the possibility to use adaptive lighting systems.

The publication replaces CIE 115-1995 "Recommendations for the Lighting of Roads for Motor and Pedestrian Traffic". (The previous version also replaced CIE 023-1973 and CIE 012.2-1977)

CIE 132:1999

'Design methods for lighting of roads'

Several recommendations and technical reports have been published over the past years by the CIE to provide calculation methods for designing road lighting installations, which satisfy certain quality criteria. These quality criteria are intended to ensure the safety, comfort and personal security of road users. These documents are often referred to in the national codes and recommendations of industrialised countries. The calculation methods necessitate the use of a computer.

Experience shows that the high degree of accuracy obtained with the recommended methods of calculation is not always necessary, at least during the first stage of design. In some countries simplified methods have been developed which show similarities. They do not require a computer for application by the user.

The aim of this report is to describe these and similar design methods for lighting installations for all categories of roads. The method to be used depends on the required accuracy and the type of data available to the designer.

CIE 136:2000

'Guide to the lighting of urban areas'

The purpose of this guide is to supplement the lighting recommendations and standards for roads and areas of public use as detailed in the Publication CIE 115-1995. It replaces CIE 92-1992 Guide to the lighting of urban areas.

The recommendations cover the effect of light on night time crime and suggests lighting requirements for residential roads and community areas, industrial roads, central business districts and malls, pedestrian paths and access facilities and cycle tracks.

In addition to proposing levels of luminance and illuminance the recommendations consider aspects such as modelling of people and structures within the environment, the effects of glare and sparkle, suitability of light sources as far as colour appearance and colour rendering are concerned, the effect of the lighting on the environment and the general aesthetics of the lighting equipment used.

CIE 140:2000

'Road Lighting Calculations (Rev. 2)'

The purpose of this report is to update and to replace CIE 30.2-1982 Calculation and measurement of illuminance and luminance in road lighting. It gives the methods which CIE 115-1995 and CIE 136-2000 require for their recommendations.

It includes the calculation of luminance, illuminance, and their associated measures of uniformity, as well as disability glare. The conventions adopted for luminance and illuminance grids are also included.

CIE 144:2001

'Road surface and road marking reflection characteristics'

The purpose of this technical report is to provide the technical basis for the application of reflection characteristics of road surfaces and road markings in road lighting, daylight and vehicle headlamp illumination.

The technical report describes relevant conventions and the influence of measurement angles. For road lighting and daylight the technical report further details reflection tables, a description system, and the classification and luminance of road surfaces and road markings.

Recommendations are given for in situ measurement of characteristics relating to the lightness and the retroreflection of surfaces, some thoughts are provided for characteristics relating to the specularity of road surfaces and road markings.

CIE 154:2003

'The maintenance of outdoor lighting systems'

During the life of a lighting installation, the light available progressively decreases. The reduction rates are a function of environmental, operating and age conditions. In lighting design we must take account of this fall by the use of a maintenance factor and plan suitable maintenance schedules to limit the decay. This guide provides information on suggested maintenance factors and the selection of suitable equipment. It describes the parameters influencing the depreciation process and develops the procedure for estimating the economic maintenance cycles for outdoor electric lighting installations and gives advice on servicing techniques.

CIE 206:2014

'The Effect of Spectral Power Distribution on Lighting for Urban and Pedestrian Areas'

Lighting design for roads in urban and pedestrian areas considers primarily the needs of pedestrians rather than drivers. This report presents a summary of recent research on the implications of lamp spectrum for those tasks considered to be important for pedestrians. These tasks include detection of pavement obstacles, inter-personal judgements such as facial recognition, and judgement of brightness. For pedestrians, brightness is important because brighter lighting tends to produce higher levels of perceived safety in a particular location.

It has been found that in the mesopic region lamps with a higher scotopic/photopic (S/P) ratio appear brighter, and permit better detection of peripheral obstacles, than do lamps with lower S/P-ratios at the same illuminance. This means that lamps with a high S/P-ratio can be used either at the same illuminance to create a higher brightness and better detection of peripheral obstacles or at a lower illuminance but the same brightness and obstacle detection

ability, the latter leading to a reduction in energy consumption. The CIE recommended system of mesopic photometry can be used to predict brightness and peripheral obstacle detection under lamps having different spectra.

Further visual needs include facial recognition and that the appearance of the environment is acceptable. How light spectrum affects the ability to recognize the identity of other people is still uncertain, but there is a suggestion that chromatic information can be of benefit. As for the acceptability of the appearance of the environment, this is more consistently related to the colour rendering of the light source. For these visual needs colour rendering is important in addition to the S/P-ratio, but there are insufficient data with which to fully characterize the effects.

Given these findings it is possible to modify the illuminances used in residential roads when using different light sources. These illuminances should be chosen based on two characteristics of the light source, S/P-ratio and colour rendering index (CRI). The report includes new guidance in the United Kingdom (UK) in which a reduction in the illuminance from the levels recommended in the S-series of lighting classes can be considered when using lamps which have a CIE general colour rendering index greater than or equal to 60; the reduction is calculated using the CIE recommended system of mesopic photometry. The UK guidance assumes that low pressure sodium lighting is the reference for the S-series of lighting classes. Other countries that choose to follow the system adopted in the UK can modify the approach to take account of different benchmark lighting. For example, if the high pressure sodiumlamp (which is in widespread use in Europe) is used as the benchmark, the allowed reduction in illuminance will be less than that allowed in the UK.

Other factors, in addition to the influence of lamp spectrum on vision, may also need to be considered when selecting the most appropriate lighting. These are discussed in the final section of the report, and include effects of lighting on the natural environment, glare, and the impact of changes in the eye that occur with age. The increase in visual effectiveness offered by lamps optimized for use in the mesopic region (i.e. higher S/P ratio) may be lower for older persons than for the rest of the population, and such lamps may lead to increased discomfort glare effects for these older observers. In general, the use of 'white' light in street lighting applications is beneficial, provided that these other factors are also taken into account and are not significantly impacted (e.g. provided glare is not significantly increased).

H.8.3 Tunnel lighting

CEN/ CR 14380:2003:

'Lighting applications - Tunnel lighting'

This standard is valid for all road tunnels and underpasses which are used by the motorised traffic, and which are decided to be lighted.

EN 16276:2013:

'*Evacuation Lighting in Road Tunnels*'

This European Standard specifies evacuation lighting in road tunnels longer than 500 m and with an AADT (Annual Average Daily Traffic) higher than 500 vehicles to facilitate the safe

evacuation of vehicle occupants in evacuation situations such as fire. It addresses the fundamental issues of evacuation lighting for evacuation routes, emergency exits and cross connections, as well as giving some practical advice regarding aspects of installation and maintenance in road tunnels. It is intended to be used in conjunction with CEN/CR 14380:2003 or relevant national standards for road tunnel lighting. The recommendations may be applied to tunnels up to 500 m in length, especially where conditions such as high traffic volume, or severe curvature or gradient apply. It specifies lighting levels and general provisions for evacuation lighting installations that, based on experience, are considered to be necessary for the safety of people driving through road tunnels in case of an incident and particularly in case of fire. However, as there are different types of road tunnels, both in construction and traffic conditions, various types of incident may occur. This standard should be considered as a list of minimum prescriptions for evacuation lighting in tunnels, to be completed by means of specific risk analysis for the particular tunnel. The design of marking and safety signs is not part of this standard.

CIE 061:1984

'Tunnel entrance lighting: A survey of fundamentals for determining the luminance in the threshold zone'

The purpose of this report is to provide information on the lighting requirements for drivers approaching the entrance of a tunnel in daytime. The report is restricted to the first stretch of tunnels, called the threshold zone.

The report begins with a review of the fundamental experiments that were the basis of the 1973 CIE recommendations for tunnel lighting, as far as the threshold zone is concerned (see CIE 23-1973 International Recommendations for Motorway Lighting). New investigations are described with which the original fundamental experiments may be applied more realistically. Results of driving experiments in a real tunnel under various lighting conditions are summarized. To complete the description of methods based on visibility, two recently published methods that dispense with the original fundamental experiments are discussed. Finally, mention is made of an approach not directly based on visibility but on traffic flow. The report does not give a straightforward answer to all problems related to the lighting of threshold zones of tunnels. It summarizes the state of the art and, as such, will form the background for future tunnel lighting recommendations.

CIE 088:2004

'Guide for the lighting of road tunnels and underpasses, 2nd ed.'

After having reviewed and defined the various factors to be taken into consideration with regard to the lighting of tunnels and road underpasses, the present document sets out recommendations concerning the daytime and night-time lighting. It also describes the measures to be taken into consideration in order to adapt this lighting to the fluctuations in the external lighting or in the case of failure of the normal electrical power supply of the lighting installations. Attention is also given to maintenance which has to be carried out in order to ensure the lasting quality of the installations.

It is also important to note that while this publication is part of a general activity aimed at improving road safety, safety depends on a large number of factors among which lighting is

only one particular constituent. The contribution of lighting in this context is to enable the road user to perform his visual tasks by ensuring a sufficient visibility of objects.

This publication replaces CIE 88-1990 "Guide for the Lighting of Road Tunnels and Underpasses".

CIE 189:2010

'Calculation of Tunnel Lighting Quality Criteria'

Experience of making road tunnel lighting designs in accordance with publication CIE 88:2004 has shown that there are some aspects of calculation of the different lighting criteria where more specific guidance to the designers is necessary. This document explains how the tunnel environment differs significantly from the open road situation. In particular, the presence of walls along the traffic road involves reflection effects between different surfaces. The variation of luminance level along the tunnel, the changes in the lighting installation along the entrance section of the tunnel and the use of different lighting systems in different parts of the tunnel introduce more complexity in the lighting calculations. The report gives guidance on determining the method for calculating the relevant lighting quality criteria for tunnel situations.

CIE 193:2010

'Emergency Lighting in Road Tunnels'

This report makes recommendations for emergency lighting in road tunnels longer than 500 m, to facilitate the safe evacuation of vehicle occupants in emergency situations such as fire. The recommendations may also be valid for tunnels less than 500 m in length, where conditions such as high traffic volume, or severe curvature or gradient apply. It The report addresses the fundamental issues of emergency lighting for evacuation routes, emergency exits, escape routes and lay-bys, as well as giving some practical advice regarding aspects of installation and maintenance in road tunnels. It recommends lighting levels and general provisions for emergency lighting installations that, based on experience, are considered to be necessary for the safety of people driving through road tunnels in case of an incident and particularly of fire. However, as there are different types of road tunnels, both in construction and traffic conditions and various types of incidents may occur, this report should be considered as a list of minimum recommendations for emergency lighting in tunnels, to be completed by means of specific risk analysis for the particular tunnel.

This report is intended to be used in conjunction with CIE 88 (2nd revision - 2004 or any further revision) or with relevant Regional or National standards, directives and regulations for road tunnel lighting. The latter may include requirements that differ from the recommendations of this report, and take priority over them. Before following the recommendations of the report in a particular location, the existence of any relevant legal requirements should be investigated.

H.8.4 Traffic lights

EN 12352:2006:

'Traffic control equipment - Warning and safety light devices'

This European Standard specifies the requirements for individual electrically operated light devices, called warning lights, emitting a continuous or regular intermittent light of a single colour which, by their colour and position alone, are used to warn, inform or guide road users. It specifies the requirements for visual, structural and operational performances and the relevant test methods to be used. These devices rely upon existing furniture to provide the mounting. This European Standard is not applicable to lighting devices which convey messages by additional means (e.g. variable message signs) or which convey a mandatory instruction (e.g. traffic signals) or which are covered by vehicle lighting regulations. This European Standard does not consider horizontal loads because it is the mounting to which they are fixed, which is not covered by this European Standard, which has to resist applied horizontal loads.

EN 12368:2006 ; FprEN 12368 (under approval)

'Traffic control equipment - Signal heads'

This European Standard applies to signal heads with one or more signal lights of the colours red, yellow and/or green signal lights for road traffic with 200 mm and 300 mm roundels and to optical units to be integrated in signal heads to produce the individual signal lights. It defines the product characteristics for the visual, structural, environmental performances and testing of signal heads and optical units for pedestrian and road traffic use.

EN 50556:2011

'Road traffic signal systems'

CIE S 006.1/E-1998 (ISO 16508:1999)

'Road traffic lights - Photometric properties of 200 mm roundel signals'

National and international standards for road traffic signal lights usually specify requirements for the luminous intensity of the lights to ensure that the signals will be visible in adequate time for an approaching driver to safely and efficiently respond to the signal on roads where speeds are low.

The official guidance of the CIE for traffic signal luminous intensity (CIE 79-1988: A Guide for the Design of Road Traffic Lights) has been widely followed as providing sound direction for standard development. This guidance was based on a comprehensive review of the subject published as a CIE Technical Report (CIE 48-1980: Light Signals for Road Traffic Control).

The CIE undertook a major review of its recommendations in the period 1989 to 1994 (see CIE 107-1994: Review of the official recommendations of the CIE for the colours of signal lights and CIE DS004.2-1996: Colours of light signals) and this Standard is based on that review. Technical Committee 4-29 (Standard on Road Traffic Lights) of Division 4 of the CIE (Lighting and Signalling for Transport) was responsible for the review and the drafting of this Standard. This Standard deals with the colour, luminous intensity and luminous intensity distribution for

200 mm road traffic signals. The serious problem of sun phantom, which can affect the correct recognition of the light, is included in the Standard.

It should be noted that this Standard considers only a few of the topics covered in CIE 79-1988. These are the topics for which supporting research and practical experience were strong enough to support standardisation. For topics not covered in this Standard, such as guidance concerning higher speed roadways and traffic lights using symbols, the user is advised to follow the guidance provided in CIE 79-1988.

This Standard has been approved by the CIE and replaces the recommendations made on 200 mm roundel signals in CIE 79-1988. It has been approved by ISO as a joint ISO/CIE standard.

CIE 079:1988

'A guide for the design of road traffic lights'

This document, drafted in collaboration with the Permanent International Association of Road Congresses (PIARC) is a Guide concerned with photometric and colourimetric matters that are related to the design of road traffic lights. Its main purpose is to provide a basis for relevant national standards and codes of practice, but it should also be of direct use to road traffic authorities and manufacturers of the lights. It is derived from the Technical Report CIE 48-1980 (TC-1.6) Light Signals for Road Traffic Control, which contains the experimental evidence on which the Guide is based. The guide has taken account of more recent findings, but essentially it is supplement to CIE 48-1980. The visibility of a signal light depends on many factors, the most important of which are the colour, luminous intensity and luminous intensity distribution of the light. The Guide deals with these factors as well as with various symbols and "cut-out" figures that are used with traffic lights. The information given in the Guide is classified at four levels of confidence, which depend upon supporting research or practical experience. These levels are called: * Recommendations * Proposals * Advice * Suggestions The Guide contains detailed information regarding the colour for traffic lights. Current CIE practice is followed, although in some cases restricted chromaticity regions are recommended. Details are given in the luminous intensities and the luminous intensity distributions. In most cases, day and night regimes will be required. Additionally, data regarding luminance and uniformity of luminance are given. Remarks are made regarding sun phantom, measurement of lights, screening of lights, the influence of disturbing factors and the standardization of appearance. The Guide contains information on a number of particular lights, lights on high speed roads, the size and shape of arrows and their symbols, notably for lights for cyclists and pedestrians, low mounted lights, lane indicators, general warning lights, lights for special purposes, and optically programmed lights.

H.8.5 Sky glow and obtrusive light

CIE 001-1980

'Guidelines for minimizing urban sky glow near astronomical observatories (Joint Publication IAU/CIE)'

The increase of outdoor lighting in urban areas has resulted in levels of sky glow which seriously threaten astronomical observatories, even where these have purposely been located more than 100 km from large cities. The International Astronomical Union (IAU) and the CIE have worked together to prepare these guidelines in order to stimulate collective action that minimizes the degradation of the astronomical environment near cities.

The problem and its solutions are stated in a manner that provides a basis for understanding, cooperation, and action by astronomers, lighting engineers and public authorities. The report explains the effect of man-made sky glow, the degree of glow likely to be produced by lighting near an observatory, the level above which sky glow should not be allowed to rise, and how it can be contained by good lighting practice and public ordinances.

CIE 126:1997

'Guidelines for minimizing sky glow'

In most countries of the world, astronomical observations are disturbed by the light from outdoor lighting installations. Part of the light is scattered in the atmosphere and forms a luminous halo. The phenomenon is called 'sky glow'. This Technical Report gives general guidance for lighting designers and policy makers on the reduction of the sky glow. The report discusses briefly the theoretical aspects of sky glow and it gives recommendations about maximum permissible values for lighting installations in relation to the needs of astronomical observations - casual sky viewing included. These values must be regarded as limiting values. Lighting designers should do all possible to meet the lowest specifications for the design unless the specific installation requires relaxation. Other uses of the open air areas at night will usually result in less stringent sky-glow requirements. Practical implementation of the general guidance is left to National Regulations.

CIE 150:2003

'Guide on the limitation of the effects of obtrusive light from outdoor lighting installations'

The purpose of this Guide is to help formulate guidelines for assessing the environmental impacts of outdoor lighting and to give recommended limits for relevant lighting parameters to contain the obtrusive effects of outdoor lighting within tolerable levels. As the obtrusive effects of outdoor lighting are best controlled initially by appropriate design, the guidance given is primarily applicable to new installations; however, some advice is also provided on remedial measures which may be taken for existing installations.

This Guide refers to the potentially adverse effects of outdoor lighting on both natural and man-made environments for people in most aspects of daily life, from residents, sightseers, transport users to environmentalists and astronomers. (Astronomers also see CIE 126-1997)

The daytime appearance of the lighting installation is important. The size and nature of the lighting support structures may be intrusive by day although this subject is not addressed in this Guide.

H.9 Standards, guides etc. for indoor lighting

EN 12464-1:2011

'Light and Lighting-Part 1: Lighting of indoor work places.'

This European Standard specifies **lighting requirements for humans in indoor work places**, which meet the needs for visual comfort and performance of people having normal ophthalmic (visual) capacity. All usual visual tasks are considered, including Display Screen Equipment (DSE).

This European Standard specifies requirements for lighting solutions for most indoor work places and their associated areas in terms of quantity and quality of illumination. In addition recommendations are given for good lighting practice. This European Standard does not specify lighting requirements with respect to the safety and health of people at work and has not been prepared in the field of application of Article 137 of the EC treaty, although the lighting requirements, as specified in this European Standard, usually fulfil safety needs. Lighting requirements with respect to the safety and health of workers at work can be contained in Directives based on Article 137 of the EC treaty, in national legislation of member states implementing these directives or in other national legislation of member states.

This European Standard neither provides specific solutions, nor restricts the designers´ freedom from exploring new techniques nor restricts the use of innovative equipment. The illumination can be provided by daylight, artificial lighting or a combination of both. This European Standard is not applicable for the lighting of outdoor work places and underground mining or emergency lighting. For outdoor work places, see EN 12464-2 and for emergency lighting, see EN 1838 and EN 13032-3.

EN 15193:2007/AC:2010 ; prEN 15193 rev (under drafting)

'*Energy performance of buildings – Energy requirements for lighting*'

This European Standard **specifies the calculation methodology for the evaluation of the amount of energy used for indoor lighting inside the building** and provides a numeric indicator for lighting energy requirements used for certification purposes. This European Standard can be used for existing buildings and for the design of new or renovated buildings. It also provides reference schemes to base the targets for energy allocated for lighting usage. This European Standard also provides a methodology for the calculation of instantaneous lighting energy use for the estimation of the total energy performance of the building. Parasitic powers not included in the luminaire are excluded.

In this European Standard, the buildings are classified in the following categories: offices, education buildings, hospitals, hotels, restaurants, sports facilities, wholesale and retail services and manufacturing factories.

In some locations outside lighting may be fed with power from the building. This lighting may be used for illumination of the façade, open-air car park lighting, security lighting, garden lighting etc. These lighting systems may consume significant energy and if they are fed from the building, this load will not be included in the Lighting Energy Numeric Indicator or into the values used for heating and cooling load estimate. If metering of the lighting load is employed, these loads may be included in the measured lighting energy.

Identified gaps[30]:

The European Commission initiated the CENSE-project to improve acceptance and use of the CEN standards, which were developed to analyse the energy performance of buildings, including lighting, according to the EPBD [31]. The project's goal is to identify problems concerning the standards' contents and their implementation via questionnaires and workshops and to formulate recommendations for improvement.

Within the framework of the CENSE-project the standard EN 15193, covering the energy requirements for lighting, was investigated. The questionnaire's evaluation shows that though lighting requirements have been defined in most European countries, only few countries did actually put the CEN standard into force; also, awareness of practitioners is still low. In general, the standard is regarded as a useful umbrella document and its methods are considered to be applicable and helpful. Nevertheless, parts of the standard are rated being not easy to understand. Although many essential parameters in the determination of lighting energy needs are covered, some additional aspects should be addressed in a revised version. Providing, for instance, methods to rate lighting controls in more detail, to determine the installed power of new lighting installations and to rate the impact of sunshading devices on the lighting energy demand might help to further improve the standard's quality and acceptance.

A simple means to raise acceptance seems to lie in a review focusing on structure and editing in order to clarify and simplify parts of the document. Particularly the presentation of equations should be reorganized, for instance by adding a list of the variables used to each equation and by describing connections to other equations, making them more understandable. An example of technical aspects still to be addressed is artificial lighting, which is only taken care of in existing buildings in the current version of the standard. Consequently, an additional approach covering the lighting design in new buildings needs to be developed, and a simplified method should be included. Also the effect of lighting controls should be considered in the calculation method as well as the impact of glare and sunshading protection on lighting energy demand. By providing extra material with simplified explanations and background information, the readers' ability to understand and apply the standard could be further enhanced as well as their awareness of the methods underlying available computer software.

The standard EN 15193 seems to be too complicated for the users. This results in different and country dependent standards implementing the Energy Performance of Buildings Directive. The current situation in many EU Member States is that they only use parts of European standards illustrated in Figure 78:

[30] Report on the Application of CEN Standard EN 15193 EN 15193: Energy Performance of Buildings - Energy Requirements for Lighting, Anna Staudt, Jan de Boer and Hans Erhorn

[31] Directive 2010/31/EU Energy Performance of Buildings (EPBD) http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32010L0031

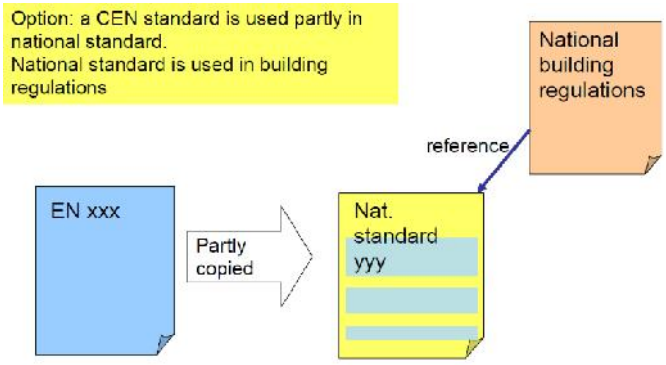


Figure 78 Actual situation in many EU Member States How they use the EPBD standards[32]

An example of such local standards to calculate energy requirements for artificial lighting in buildings is 'DIN V 18599: 'Teil 4: Nutz- und Endenergiebedarf für Beleuchtung.' The German standardization process (DIN 18599) refined the European approach (EN 15193) in some aspects.

According to this standard the installed, electrical power of the artificial lighting system can be determined with a simple tabular method, a simplified utilization factor approach or of course a detailed lighting design. Which method to apply depends on the design phase (i.e. availability of data) and the effort affordable to spend. As depicted in Figure 79 the methods are designed such, that accuracy will increase with growing effort.

Please note that the preparatory study lot 8 on office lighting used and compared the utilization factor method and the lighting design with simulation approach.

Some lighting calculation programs can implement this standard (DIN 18599) in their calculations e.g. Dialux, EnerCalC.

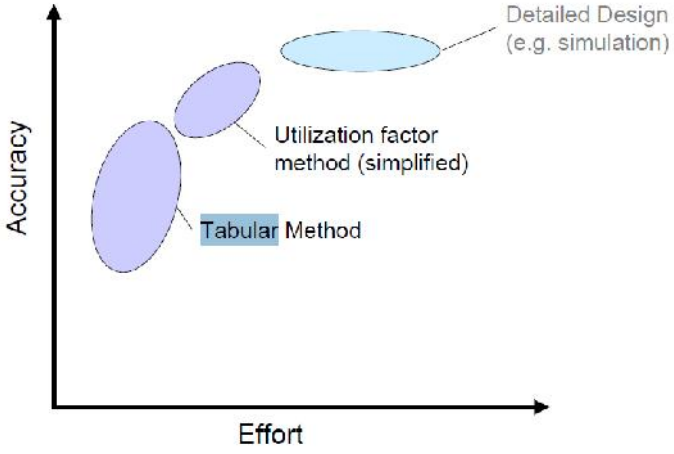


Figure 79 Possible different methods to obtain the installed, electric power

[32] Source: CENSE project workshop presentation 'Standardisation work on EPBD CEN- standards towards better energy performance of buildings and their further development in CEN & ISO' (23/3/201).

DIN V 18599 - 4

'Energy efficiency of buildings - Calculation of the net, final and primary energy demand for heating, cooling, ventilation, domestic hot water and lighting - Part 4: Net and final energy demand for lighting.'

DIN V 18599-4 specifies the approved method of verifying the monthly and annual energy use for lighting in non-residential buildings. The method includes the division of a building into zones as required for lighting technology purposes, determination of the specific "electrical evaluation power" of the artificial lighting system, as well as considerations on the way in which daylight is utilized and the effects of presence detection systems. To achieve lighting energy efficiency, suitable lighting and lighting control systems shall be employed and the available daylight shall be utilized to the best possible extent. The method described here only deals with the lighting systems needed to achieve minimum lighting requirements. According to the provisions of DIN EN 12464-1, a lighting system shall be designed in such a way that the lighting requirements of a specific space are met without needlessly increasing the energy use. At the same time, the energy use shall not be reduced to the detriment of the quality of the lighting conditions. DIN V 18599-4 has been approved by NA 005-56-20 GA "Gemeinschaftsarbeitsausschuss NABau/FNL/NHRS: Energetische Bewertung von Gebäuden" ("Joint Working Committee NABau/FNL/NHRS: Energy performance of buildings") and published as a prestandard.

EN 15251:2007

'Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics'

This European Standard specifies the indoor environmental parameters which have an impact on the energy performance of buildings. - The standard specifies how to establish indoor environmental input parameters for building system design and energy performance calculations. - The standard specifies methods for long term evaluation of the indoor environment obtained as a result of calculations or measurements. - The standard specifies criteria for measurements which can be used if required to measure compliance by inspection. - The standard identifies parameters to be used by monitoring and displaying the indoor environment in existing buildings. - This standard is applicable mainly in non-industrial buildings where the criteria for indoor environment are set by human occupancy and where the production or process does not have a major impact on indoor environment. The standard is thus applicable to the following building types: single family houses, apartment buildings, offices, educational buildings, hospitals, hotels and restaurants, sports facilities, wholesale and retail trade service buildings. - The standard specifies how different categories of criteria for the indoor environment can be used. But does not require certain criteria to be used. This is up to national regulations or individual project specifications. - The recommended criteria in this standard can also be used in national calculation methods, which may be different to the methods referred to here. - The standard does not prescribe design methods, but give input parameters to the design of buildings, heating, cooling, ventilation and **lighting systems**. The standard does not include criteria for local discomfort factors like draught, radiant temperature asymmetry, vertical air temperature differences and floor surface temperatures.

CEN/TC 169 (WI=00169067) (under drafting) :

'Energy performance of buildings - Energy requirements for lighting - Part 2: Technical Report to EN 15193-1'

CEN/TS 16163:2014:

'Conservation of Cultural Heritage - Guidelines and procedures for choosing appropriate lighting for indoor exhibitions'

This Technical Specification defines the procedures as well as the means to implement adequate lighting, with regard to the conservation policy. It takes visual, exhibition and conservation aspects into account and it also discusses the implications of the lighting design on the safeguarding of cultural property. This Technical Specification gives recommendations on values of minimum and maximum illumination levels. It aims to provide a tool for setting up a common European policy and a guide to help curators, conservators and project managers to assess the correct lighting that can assure the safeguarding of the exhibits. This Technical Specification covers lighting for heritage objects on exhibition in both public and private sites and does not consider lighting in other cultural heritage contexts such as open-air collections, etc.

HD 60364-5-559:2005/corrigendum Oct. 2007 [33]:

'Electrical installations of buildings - Part 5-55: Selection and erection of electrical equipment - Other equipment - Clause 559: Luminaires and lighting installations'

Applies to the selection and erection of luminaires and lighting installations intended to be part of the fixed installation. Requirements for specific types of lighting installations are covered in various sections of EN 60364-7 (e.g. sections 713, 714 and 715). Does not apply to temporary festoon lighting. NOTE: Safety requirements for luminaires are covered by EN 60598.

HD 60364-5-559:2012 [34]:

'Low-voltage electrical installations - Part 5-559: Selection and erection of electrical equipment - Luminaires and lighting installations'

IEC 60364-5-55:2011 covers requirements for the selection and erection of low-voltage generating sets and for the selection and erection of luminaires and lighting installations intended to be part of the fixed installation. This second edition cancels and replaces the first edition, published in 2001, its Amendment 1 (2001) and its Amendment 2 (2008). The major technical changes with respect to the previous edition are: - additional requirements for connection of luminaires to the fixed wiring; - modification of requirements regarding the fixing of luminaires; - inclusion of alternative solutions for connecting devices used for through wiring and for connection of luminaires to the supply; - withdrawal of Clause 556, as IEC 60364-5-56 now covers this matter.

[33] See note 29
[34] See note 29

CIE S 008/E:2001 (ISO 8995-1:2002*/Cor.1 2005(E)*)

'Lighting of Work Places - Part 1: Indoor'

CIE published its "Guide on interior lighting" 2nd edition in 1986. Since then lighting practice changed considerably, and it became necessary to prepare a new guide, this time as a CIE Standard.
Good lighting requires equal attention to the quantity and quality of the lighting. While the provision of sufficient illuminance on the task is necessary, in many instances the visibility depends on the way in which the light is applied, the colour characteristics of the light source and surfaces together with the amount of glare the system gives. In this standard opportunity was taken to specify for various work places and task types not just the illuminance but also the limiting discomfort glare and minimum colour rendering index of the source. Parameters to create comfortable visual conditions are proposed in the body of this standard. The recommended values are considered to represent a reasonable balance, having regard to the requirements for safe, healthy and efficient work performance. The values can be achieved with practical energy efficient solutions.

There are also visual ergonomic parameters such as perceptual ability and the characteristics and attributes of the task, which determine the quality of the operator's visual skills, and hence performance levels. In some cases enhancement of these influencing factors can improve performance without the need to raise illuminance. For example by improving the contrast of the task attributes, enlarging the task by the use of up to date visual aids (glasses) and by the provision of special lighting systems with local directional lighting capability.

The Standard provides guidance for illuminance, glare limitation and colour quality for general building areas, agriculture buildings, the cement, concrete and brick industry, ceramic and glass industry, chemical, plastics and rubber industry, electrical industry, food industry, foundries and metal casting plants, hairdresser, jewelry manufacturing, laundries and dry cleaning, leather industry, metal working and processing, paper industry, power stations, printers, iron and steel works, textile industry, vehicle construction, wood working and furniture industry, offices, retailing, restaurants and hotels, places of entertainment, libraries, indoor public car parks, educational buildings, health care premises, airports, and churches.

CIE 040:1978

'Calculations for interior lighting: Basic method'

This report presents a method which can serve as a basis for interior lighting design calculations. The method does not rely on standard light distributions for luminaires, is not restricted to regular arrangements of luminaires, and can be used in situations where the interior is a rectangular parallelepiped, the task plane can be regarded as one of the room surfaces, the room surfaces, reflect uniformly and according to Lambert's law, the direct flux on the task plane does not vary significantly when the luminaires are rotated about their vertical axis.

CIE 052:1982

'Calculations for interior lighting: Applied method'

A method is presented that deals with average illuminances of the working plane, walls, ceiling. It represents a design method (determination of light distribution and arrangement of

luminaires with required or specified illuminances) as well as a verification method (calculation of illuminances of a design or an existing installation). The method differs from most existing methods by its ability to take into account the influence of the luminaire arrangement. The method is based on CIE 40-1978 Calculations for Interior Lighting: Basic Methods.

CIE 097:2005

'Maintenance of indoor electric lighting systems'

During the life of a lighting installation, the light available for the task progressively decreases due to accumulation of dirt on surface and aging of equipment. The rate of reduction is influenced by the equipment choice and the environmental and operating conditions. In lighting scheme design we must take account of this fall by the use of a maintenance factor and plan suitable maintenance schedules to limit the decay. Lighting standard "ISO 8995/CIE S 008-2001 Lighting of Indoor Workplaces" in Section 4.8, recommends a minimum maintenance factor. It states that "The lighting scheme should be designed with overall maintenance factor calculated for the selected lighting equipment, space environment and specified maintenance schedule". A high maintenance factor together with an effective maintenance programme promotes energy efficient design of lighting schemes and limits the installed lighting power requirements.

This revision of the guide describes the parameters influencing the depreciation process and develops the procedure for estimating the maintenance factor for indoor electric lighting systems. It provides information on the selection of equipment and the estimation of economic maintenance cycles and gives advice on servicing techniques. It shows some examples of data but for accurate data it recommends that data should be obtained from the manufacturers.

CIE 161:2004

'Lighting design methods for obstructed interiors'

Traditional lighting calculation methods assume a clear room volume allowance for the influence of room contents. Objects located between light source and task will act to block direct light and will result in some light being absorbed by the object and some reflected from its surface. This may cause both local and general reductions in planar illuminance over a whole installation. This report draws together design related material on the subject. It is intended as specialist reference for use in conjunction with relevant design guidance. It contains information on the magnitudes of likely losses in different types of building interior and design guidance to ameliorate the effects of these light losses.

A major part of the report is concerned with calculation methods for obstructed interior lit by general lighting systems. Modifications to traditional lighting design calculation methods to acknowledge the influence of room contents, above and below the working plane are described. Advice on the application of computer programs for lighting design and analysis to solution of problems involving obstructed interiors is given.

H.10 Standards, guides etc. for sports lighting

EN 12193:2007

'Light and lighting - Sports lighting.'

This standard specifies lighting for those **indoor and outdoor sports events** most practised in Europe. It provides lighting values for the design and control of sports lighting installations in terms of illuminances, uniformity, glare restriction and colour properties of the light sources. All requirements are meant to be as minimum requirements. It also gives methods by which these values are measured. For the limitation of glare, it also points out restrictions on the location of the luminaires for specific applications. For emergency lighting this standard refers to the requirements of EN 1838.

CIE 042:1978

'Lighting for tennis'

This report presents a summary of experience in the lighting of tennis courts. Recommendations are made for daylight and artificial light in indoor tennis courts. Guidance is given for the selection of lamps, luminaires and lighting systems. The same subjects are considered for the artificial lighting of outdoor tennis courts.

CIE 045:1979

'Lighting for ice sports'

This report presents a survey of experience in lighting for ice sports, particularly for skating, figure skating, ice hockey, and curling. The report specifies general lighting requirements with regard to illuminance, uniformity, modeling, glare control, colour and colour rendering. It provides guidance for selecting lamps and luminaires, and for the arrangement and installation of a lighting system.

CIE 057:1983

'Lighting for football'

This report gives practical guidance for football floodlighting, from training grounds to stadia with spectator accommodation. The proposals can be applied to association football, rugby and hockey pitches, and many of the national variations of these sports.

CIE 058:1983

'Lighting for sports halls'

This report distinguishes between sports halls designed to use artificial lighting at all times and those where daylight provides the required illumination for significant periods of time. It specifies general lighting requirements for specific sports, or combinations of activities, with regard to illuminance, uniformity, glare control and colour. It comments on the arrangement,

mechanical protection, installation of lighting fixtures, and their maintenance. The wide variety of lighting design techniques employed in sports halls is dictated by the structure of the building. The designer must, in each case, devise his own unique solution to meet the performance requirements which are specified in this report.

CIE 062:1984

'Lighting for swimming pools'

The report covers the problems of, and the approach to solutions for, daylighting and electric lighting of indoor and outdoor swimming pools. The main emphasis is on rectangular pools designed for recreational swimming, as well as training and competition pools. Private pools for special uses and private or public leisure pools are not covered specifically. However, many of the general principles and recommendations are applicable for these areas as well. The report also includes information on the special problems posed by colour television coverage of outdoor and indoor swimming events. The wide variety of lighting techniques used is dictated by the structure of the buildings; the balance of daylight and electric lighting; and economic as well as practical considerations, such as installation and maintenance. The lighting designer must, in close collaboration with the architect, devise individual solution that meet the performance requirements proposed in this report for each and every project.

CIE 067:1986

'Guide for the photometric specification and measurement of sports lighting installations'

The purpose of this report is to establish standard procedures for the calculation, measurement, and reporting of the illuminance characteristics of interior and exterior sports lighting installations. These procedures make it possible to compare the performance of alternative lighting systems on a common basis at the design stage of the project, and to relate it directly to on-site illuminance measurements of the completed lighting installation. A number of alternative approaches are given which allow the user or specifier to select a procedure suited to a particular project.

CIE 083:1989

'Guide for the lighting of sports events for colour television and film systems'

The present Guide is an extended and revised edition of CIE 28-1975 The lighting of sports events for colour TV broadcasting.

The recording, transmission and reproduction of sporting action has expanded rapidly in recent years. The number of different sports covered has increased and indeed many sports have increased in popularity as a result of TV exposure. To a greater extent, also, television and film are operating under artificial lighting: outdoor sports are being played in the evenings under floodlights and more indoor sports are attracting the attention of television.

The electronic television camera and associated video recording is now the principal medium of the cameraman. This report therefore, concentrates on the lighting requirements for colour television, but indicates where these requirements will differ for film recordings. The aim of this report is to give a broad survey of the technical characteristics of the television and film

reproduction process and explain why different lighting levels are needed for different sports and for different camera situations.

Detailed quantitative guidance is given on the quality aspects to be fulfilled for colour television and colour film coverage of a wide variety of sports events. The quality aspects dealt with are: * vertical illuminance level and uniformity, * relation between horizontal and vertical illuminance, * uniformity of horizontal illuminance, * flicker, * colour temperature and colour rendering of the lighting, * light level on the surrounding spectators areas.

CIE 169:2005

'Practical design guidelines for the lighting of sport events for colour'

This technical report gives practical guidance to those concerned with the designing and planning of sports facilities where lighting is required to meet the needs of colour television and filming.
The report should be read in conjunction with CIE 83-1989, which defines the quantitative lighting requirements. This report is arranged in three main sections:

•Firstly, there is general guidance on sports lighting design including luminaires and lamp types, calculation methods, and electrical installation.

•The second section lists 51 sports with specific advice on the lighting of each.

•The third section gives references to relevant standards and in particular publications in which new sports lighting installations may be described.

H.11 Standards, guides etc. for emergency lighting

EN 1838:2013:

'*Lighting applications - Emergency lighting*.'

This standard specifies the luminous requirements for emergency lighting systems installed in premises or locations where such systems are required. It is principally applicable to locations where the public or workers have access.

EN 13032-3:2007

'Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 3: Presentation of data for emergency lighting of work places.'

This standard specifies the required data for lamps and luminaires to verify conformity with EN 1838. This standard does not define the data requirements for signage, as these can be found in EN 1838.

EN 50171:2001 ; prEN 50171:2013 (under approval)

'*Central power supply systems*.'

This European Standard specifies the general requirements for central power supply systems for an independent energy supply to essential safety equipment. This standard covers systems

permanently connected to AC. supply voltages not exceeding 1 000 V and that use batteries as the alternative power source. The central power supplies are intended to **energise emergency escape lighting** in the case of failure of the normal supply, and maybe suitable for energising other essential safety equipment for example: - electrical circuits of automatic fire extinguishing installations, - paging systems and signalling safety installations, - smoke extraction equipment, - carbon monoxide warning systems, - specific safety installations related to specific buildings e.g. high-risk areas. Schematic representations of typical central power supply equipment are depicted in clause 4. When a UPS system is used to feed these essential safety systems, it must comply with EN 50091-1 and its relevant parts, and the additional requirements of this standard. The power supply system for fire alarms covered by EN 54 are excluded.

EN 50172:2004:

'*Emergency escape lighting systems*.'

This Standard specifies the provision of illumination of escape routes and safety signs in the event of failure of the normal supply, and specifies the minimum provision of such emergency lighting based on the size, type and usage of the premises. This standard relates to the provision of electric emergency escape lighting in all work places and premises open to the public. This Standard does not cover private domestic premises but its provisions are applicable to common access routes within multi-storey dwellings. This Standard is also applicable to standby lighting used as emergency escape lighting. There are emerging way guidance techniques that, when applied to escape routes in addition to conventional emergency lighting luminaires, can enhance its effectiveness in an emergency.

This standard covers a variety of topics, including emergency escape lighting, the design of emergency lighting, as well as the required system records and log book. It also gives best practice recommendation on the servicing and testing of emergency lighting systems.

CIE S 020/E:2007 (ISO 30061:2007)

'Emergency Lighting'

This standard specifies the luminous requirements for emergency lighting systems installed in premises or locations where such systems are required. It is principally applicable to locations where the public or workers have access. The primary objective of emergency lighting is the provision of visual conditions that can alleviate panic and facilitate safer evacuation of buildings' occupants during the failure of normal power supply/lighting, in clear (non-smoke) and smoke filled conditions. The emergency lighting scheme design should be based on worst conditions (e.g. minimum light output, maximum glare limits) of the luminaires during operating life. The requirements given in this standard are a minimum for design purposes and are calculated for the full rated duration period and end of design life of the equipment. A special chapter for smoke is included. Safety signs may also fulfil further functions within maintained operation.

H.12 Standards, guides etc. for gears, ballasts, drivers

EN 50294:1998/A2:2003

'*Measurement Method of Total Input Power of Ballast-Lamp Circuits*'.

This Standard gives the measurement method of the total input power for ballast-lamp circuits when operating with their associated fluorescent lamp(s). This standard applies to electrical ballast-lamp circuits comprised solely of the ballast and of the lamp(s). NOTE: Requirements for testing individual ballasts during production are not included. It specifies the measurement method for the total input power for all ballasts sold for domestic and normal commercial purposes operating with the following fluorescent lamps: linear lamps with power equal to or greater than 15 W; single ended (compact) lamps with power equal to or greater than 18 W; other general purpose lamps. This standard does not apply to: ballasts which form an integral part of the lamp; ballast-lamp circuits with capacitors connected in series; controllable wire-wound magnetic ballasts; luminaires which rely on additional optical performance aspects.

The standard mandates that a ballast lumen factor be declared by the manufacturer - this has to be in the range 0.925 to 1.0 for magnetic ballasts and between 0.925 and 1.075 for electronic ballasts.

The test method for ferromagnetic and electronic ballasts is quite different and each is described below:

For magnetic ballasts, the test ballast is operated with a reference lamp. In addition the reference lamp is operated with a reference ballast. The total input power and the lamp power are measured for each circuit in parallel. Finally, the total input power for the test ballast/lamp circuit is corrected for the ballast lumen factor (BLF), this correction is done by measurement of the lamp power compared to the reference lamp. Please note that for the reference ballast a normalized ballast lumen factor of 0.95 has been chosen (this suggests that manufacturers tend to under-run lamps on average on magnetic ballasts). A similar method exists for electronic ballasts, in this case a reference ballast lumen factor of 1 is chosen. The total input power for the test ballast/lamp circuit is corrected for the ballast lumen factor (BLF), this correction is done by measurement of the lamp luminous flux compared to the reference lamp.

Please note that for T5 fluorescent lamps no magnetic reference ballast exists, therefore an electronic reference ballast with known BLF needs to be obtained (Klinger (2006)), e.g. from a lamp manufacturer.

It is important to realize that in this approach the losses of the lamp filament preheating are accounted as ballast losses, because magnetic ballasts have switch-off lamp filament preheating enforced by the principle and also the most advanced T5 ballasts that are used as reference ballast do so.

EN 50564:2011

'Electrical and electronic household and office equipment - Measurement of low power consumption'

IEC 62301:2011 specifies methods of measurement of electrical power consumption in standby mode(s) and other low power modes (off mode and network mode), as applicable. It is applicable to electrical products with a rated input voltage or voltage range that lies wholly

or partly in the range 100 V a.c. to 250 V a.c. for single phase products and 130 V a.c. to 480 V a.c. for other products. The objective of this standard is to provide a method of test to determine the power consumption of a range of products in relevant low power modes (see 3.4), generally where the product is not in active mode (i.e. not performing a primary function). This standard does not specify safety requirements. It does not specify minimum performance requirements nor does it set maximum limits on power or energy consumption.

EN 60155:1995/A2:2007

'*Glow-starters for fluorescent lamps*'

EN 60730-2-3:2007

'Automatic electrical controls for household and similar use - Part 2-3: Particular requirements for thermal protectors for ballasts for tubular fluorescent lamps'

This part of IEC 60730 applies to the evaluation of thermal protectors for ballasts for tubular fluorescent lamps. This standard applies to thermal protectors using NTC or PTC thermistors, additional requirements for which are contained in Annex J. Requirements concerning the testing of the combination of ballasts and thermal protectors are given in IEC 61347-1.

EN 60730-2-7:2010

'Automatic electrical controls for household and similar use - Part 2-7: Particular requirements for timers and time switches'

IEC 60730-2-7:2008 applies to timers and time switches for household and similar use that may use electricity, gas, oil, solid fuel, solar thermal energy, etc. or a combination thereof, including heating, air conditioning and similar applications.

EN 60921:2004/A1:2006

'*Ballasts for tubular fluorescent lamps – Performance requirements*'.

This standard specifies performance requirements for ballasts, excluding resistance types, for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz, associated with tubular fluorescent lamps with pre-heated cathodes operated with or without a starter or starting device and having rated wattages, dimensions and characteristics as specified in IEC 60081 and 60901. It applies to complete ballasts and their component parts such as resistors, transformers and capacitors. (It only applies to **ferromagnetic ballasts**; electronic ballasts are covered under IEC60929.)

EN 60923:2005/A1:2006

'*Auxiliaries for lamps. Ballasts for discharge lamps (excluding tubular fluorescent lamps). Performance requirements*.'

This International Standard specifies performance requirements for **ballasts for discharge lamps** such as high-pressure mercury vapour, low-pressure sodium vapour, high-pressure sodium vapour and metal halide lamps. Clauses 12 through 15 each detail specific requirements for a particular type of ballast. This standard covers inductive type ballasts for

use on a.c. supplies up to 1 000 V at 50 Hz to 60 Hz associated with discharge lamps, having rated wattage, dimensions and characteristics as specified in the relevant IEC lamp standards.

EN 60925:1991/A2:2001

'D.C. supplied electronic ballasts for tubular fluorescent lamps - Performance requirements'

Specifies general performance requirements for electronic ballasts for use on d.c. supplies having rated voltages not exceeding 250 V associated with tubular fluorescent lamps. Specifies also particular performance requirements for d.c. electronic ballasts for public transport lighting, general lighting and aircraft lighting.

EN 60927:2007/A1:2013

'*Auxiliaries for lamps - Starting devices (other than glow starters) - Performance requirements*.'

This International Standard specifies performance requirements for **starting devices** (starters and ignitors) **for tubular fluorescent and other discharge lamps** for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz, which produce starting pulses not greater than 5 kV. This standard is used in conjunction with EN 60926.

EN 60929:2011/AC:2011

'*AC-supplied electronic ballasts for tubular fluorescent lamps – Performance requirements*'.

This International Standard specifies performance requirements for **electronic ballasts** for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz with operating frequencies deviating from the supply frequency, associated with tubular fluorescent lamps as specified in IEC 60081 and IEC 60901 and other tubular fluorescent lamps for high frequency operation. (It only applies to electronic ballasts; ferromagnetic ballasts are covered under IEC60921.)

EN 61047:2004

'D.C. or A.C. supplied electronic step-down converters for filament lamps. Performance requirements'.

This International Standard specifies performance requirements for electronic step-down convertors for use on d.c. supplies up to 250 V and a.c. supplies up to 1 000 V at 50 Hz or 60 Hz with operating frequencies deviating from the supply frequency, associated with tungsten halogen lamps as specified in EN 60357 and other filament lamps.

EN 61048:2006/FprA1:2013 (amendment under approval)**:**

'*Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General and safety requirements*'

This International Standard states the requirements for both self-healing and non-selfhealing continuously rated a.c. capacitors of up to and including 2,5 kVAr, and not less than 0,1 µF, having a rated voltage not exceeding 1 000 V, which are intended for use in discharge lamp circuits operating at 50 Hz or 60 Hz and at altitudes up to 3000m.

EN 61049:1993

'*Capacitors for Use in Tubular Fluorescent and Other Discharge Lamp - Circuits Performance Requirements*'.

Specifies the requirements for both self-healing and non-self-healing continuously rated a.c. capacitors of up to and including 2,5 kVAr, and not less than 0,1 F, having a rated voltage not exceeding 1 000 V, which are intended for use in discharge lamp circuits operating at 50 Hz or 60 Hz and at altitudes up to 3 000 m. Does not cover radio-interference suppressor capacitors, the requirements for which are given in IEC 60384-14. This publication supersedes IEC 60566.

EN 61050:1992/A1:1995

'Transformers for tubular discharge lamps having a no-load output voltage exceeding 1 kV (generally called neon-transformers) - General and safety requirements'

Applicable to independent and built-in single-phase transformers with separate input and output windings, for use on a.c. supply up to 1000 V at 50 Hz or 60 Hz, to supply and stabilize cold cathode tubular lamps (or assemblies of such lamps) having a no-load rated output voltage exceeding 1000 V but not exceeding 10 000 V and intended for lighting and for electric advertising signs, light signals and similar purposes.

EN 61347-1:2008/FprA3:2013 (amendment under approval)**:**

'***Lamp control gear - Part 1: General and safety requirements'***

Specifies general and safety requirements for lamp control gear for use on d.c. supplies up to 250 V and/or a.c. supplies up to 1 000 V at 50 Hz or 60 Hz.

EN 61347-2-1:2001/A2:2014

'***Lamp control gear - Part 2-1: Particular requirements for starting devices (other than glow starters)'***

This part of EN 61347 specifies particular safety requirements for starting devices (starters other than glow starters and ignitors) for fluorescent and other discharge lamps for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz which produce starting pulses not greater than 100 kV and which are used in combination with lamps and ballasts covered in EN 60081, EN 60188, EN 60192, EN 60662, EN 60901, EN 61167, EN 61195, EN 61199, EN 61347-2-8 and EN 61347-2-9. It does not apply to glow starters or starting devices which are incorporated in discharge lamps or which are manually operated. Preheat transformers for fluorescent lamps are covered by EN 61347-2-8.

EN 61347-2-2:2012

'***Lamp control gear - Part 2-2: Particular requirements for d.c. or a.c. supplied electronic step-down convertors for filament lamps'***

Specifies particular safety requirements for electronic step-down convertors for use on d.c. supplies of up to 250 V or a.c. supplies of up to 1 000 V, at 50 Hz or 60 Hz and with rated

output voltage 50 V r.m.s. at a frequency deviating from the supply frequency, or 120 V ripple free d.c. between conductors and between any conductor and earth, associated with tungsten-halogen lamps as specified in IEC 60357 and other filament lamps.

EN 61347-2-3:2011/AC:2011

'***Lamp control gear - Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps'***

Specifies particular safety requirements for electronic control gear for use on a.c. and d.c. supplies up to 1 000 V at 50 Hz or 60 Hz with operating frequencies deviating from the supply frequency, associated with fluorescent lamps as specified in IEC 60081 and IEC 60901, and other fluorescent lamps for high-frequency operation. Rectifying test conditions when dimming; - construction requirements; - measurement circuits and limits for HF leakage currents; - standard exclusively for a.c. and d.c. central supplied electronic control gear for general lighting and centrally- supplied emergency control gear.

EN 61347-2-4:2001/corrigendum Dec. 2010**:**

'***Lamp control gear - Part 2-4: Particular requirements for d.c. supplied electronic ballasts for general lighting'***

This part of EN 61347 specifies particular safety requirements for d.c. supplied electronic ballasts intended for operation from transient and surge-free power sources, operated directly from batteries without charging equipment as used in leisure equipment, for example, caravans, etc.

EN 61347-2-7:2012

'Lamp controlgear - Part 2-7: Particular requirements for battery supplied electronic controlgear for emergency lighting (self-contained)'

Specifies particular safety requirements for battery supplied electronic controlgear for maintained and non-maintained emergency lighting purposes. It includes specific requirements for electronic controlgear and control units for self-contained luminaires for emergency lighting as specified by IEC 60598-2-22.

EN 61347-2-8:2001/corrigendum Dec. 2010**:**

'***Lamp control gear - Part 2-8: Particular requirements for ballasts for fluorescent lamps'***

This part of EN 61347 specifies safety requirements for ballasts, excluding resistance types, for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz, associated with fluorescent lamps with or without pre-heated cathodes operated with or without a starter or starting device and having rated wattages, dimensions and characteristics as specified in EN 60081 and 60901.

EN 61347-2-9:2013

'***Lamp control gear – Part 2-9: Particular requirements for electromagnetic control gear for discharge lamps (excluding fluorescent lamps)'***

Specifies particular safety requirements for electromagnetic control gear for discharge lamps such as high-pressure mercury vapour, low-pressure sodium vapour, high-pressure sodium vapour and metal halide lamps. The standard covers inductive-type electromagnetic control gear for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz, associated with discharge lamps, having rated wattages, dimensions and characteristics as specified in IEC 60188, IEC 60192 and IEC 60662.

EN 61347-2-10:2001/A1:2009/corrigendum Dec. 2010:

'Lamp controlgear - Part 2-10: Particular requirements for electronic invertors and convertors for high-frequency operation of cold start tubular discharge lamps (neon tubes)'

This part of EN 61347 specifies general and safety requirements for lamp control gear for use on d.c. supplies up to 250 V and/or a.c. supplies up to 1 000 V at 50 Hz or 60 Hz. This standard also covers lamp control gear for lamps which are not yet standardized. Tests dealt with in this standard are type tests. Requirements for testing individual lamp control gear during production are not included. This part 1 is to be used in conjunction with the appropriate part 2, which contains clauses to supplement or modify the corresponding clauses in part 1, to provide the relevant requirements for each type of product.

EN 61347-2-11:2001/corrigendum Dec. 2010**:**

'***Lamp control gear. - Part 2-11: Particular requirements for miscellaneous electronic circuits used with luminaires.'***

This part of EN 61347 specifies general and safety requirements for miscellaneous electronic circuits used with luminaires for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz and/or d.c. supplies up to 250 V. This part does not apply to circuits or devices for which specific IEC standards are published.

EN 61347-2-12:2005/A1:2010

'***Lamp control gear - Part 2-12: Particular requirements for d.c. or a.c. supplied electronic ballasts for discharge lamps (excluding fluorescent lamps)'***

This part of EN 61347 specifies particular general and safety requirements for d.c. or a.c. supplied electronic ballasts. The supply comprises a.c. voltages up to 1000 V at 50 Hz/60 Hz. The type of ballast is an convertor that may contain igniting and stabilising elements for operation of a discharge lamp at d.c. or at a frequency that can deviate from the supply frequency. The lamps associated with the ballast are specified in EN 60188 (High pressure mercury vapour lamps), EN 60192 (Low pressure sodium vapour lamps), EN 60662 (High pressure sodium vapour lamps), EN 61167 (Metal halide lamps) and else for general purpose lighting. Ballasts for fluorescent lamps and for lamps for special applications like for theatre and for vehicles are excluded.

EN 61347-2-13:2006/corrigendum Dec. 2010 **; FprEN 61347-2-13:2012** under approval

'Lamp controlgear - Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules'

This part of IEC 61347 specifies particular safety requirements for electronic controlgear for use on d.c. supplies up to 250 V and a.c. supplies up to 1 000 V at 50 Hz or 60 Hz and at an output frequency which can deviate from the supply frequency, associated with LED modules.

EN 62442-1:2011/AC:2012

'*Energy performance of lamp control gear - Part 1: Control gear for fluorescent lamps - Method of measurement to determine the total input power of control gear circuits and the efficiency of the control gear'*

Defines a measurement and calculation method of the total input power for controlgear - lamp circuits when operating with their **associated fluorescent lamp(s)**. The calculation method for the efficiency of the lamp controlgear is also defined. This International Standard applies to electrical controlgear lamp circuits consisting only of the controlgear and the lamp(s). It is intended for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz.

FprEN 62442-2:2014 (under approval):

'*Energy performance of lamp controlgear - Part 2: Controlgear for high intensity discharge lamps (excluding fluorescent lamps) - Method of measurement to determine the efficiency of controlgear '*

IEC 62442-2:2014 defines a measurement method of the power losses of electromagnetic controlgear, the total input power and the standby power of electronic controlgear for high intensity discharged lamps (excluding fluorescent lamps). Also a calculation method of the efficiency for controlgear for high intensity discharged lamp(s) is defined.

FprEN 62442-3:2014 (under approval)**:**

'*Energy performance of lamp controlgear - Part 3: Controlgear for halogen lamps and LED modules - Method of measurement to determine the efficiency of the controlgear '*

IEC 62442-3:2014 defines a measurement method for the power losses of magnetic transformers and the power losses with the standby power of electronic convertor for halogen lamps and LED modules. Also a calculation method of the efficiency for the mentioned controlgear for halogen lamps and LED modules is defined.

FprEN 62811:2014 (under approval):

'AC and/or DC-supplied electronic controlgear for discharge lamps (excluding fluorescent lamps) - Performance requirements for low frequency squarewave operation'

H.13 Standards, guides etc. for lighting control

EN 15232:2012 ; prEN 15232 rev (under drafting)**:**

'Energy performance of buildings - Impact of Building Automation, Controls and Building Management.'

This European Standard specifies:

- a structured list of Building Automation and Control System (BACS) and Technical Building Management (TBM) functions which have an impact on the energy performance of buildings;
- a method to define minimum requirements regarding BACS and TBM functions to be implemented in buildings of different complexities;
- a factor based method to get a first estimation of the impact of these functions on typical buildings;
- detailed methods to assess the impact of these functions on a given building. These methods enable to introduce the impact of these functions in the calculations of energy performance ratings and indicators calculated by the relevant standards.

This European Standard is defined for:

- building owners, architects or engineers, defining the functions to be implemented for a given new building or for the renovation of an existing building;
- public authorities, defining minimum requirements for BACS and TBM functions for new buildings as well as for renovation, as defined in the relevant standard;
- public authorities, defining inspection procedures of technical systems as well as inspectors applying these procedures to check if the level of BACS and TBM functions implemented is appropriate;

- public authorities, defining calculation methods which take into account the impact of BACS and TBM functions on the energy performance of buildings as well as software developers implementing these calculation methods and designers using them;
- designers, checking that the impact of all BACS and TBM functions are taken into account when assessing the energy performance of a building.

EN 50428:2005

'Switches for household and similar fixed electrical installations - Collateral standard - Switches and related accessories for use in home and building electronic systems (HBES)'

EN 50490:2008

'Electrical installations for lighting and beaconing of aerodromes - Technical requirements for aeronautical ground lighting control and monitoring systems - Units for selective switching and monitoring of individual lamps'

This European Standard is intended to give general minimum frame requirements for units that are independent of the technology used for switching and/or monitoring of individual or group of lamps in an AGL series circuit. This European Standard • applies to the units that are

directly electrically connected to the primary or secondary side of an AGL series circuit and are needed to provide the selective switching and/or monitoring of lamps, • does not cover communication protocols and application procedures, • does not treat system aspects that influence the AGL operation. NOTE These units may be used forming part of either a SMGCS or A-SMGCS to guide and/or control the surface movement of aircraft by means of visual aids.

EN 50491-3:2009

'General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Part 3: Electrical safety requirements'

This European Standard provides the electrical safety requirements for all devices connected to HBES/BACS. This European Standard is applicable to – operator stations and other human system interface devices, – devices for management functions, – control devices, automation stations and application specific controllers, – field devices, – cabling and interconnection of devices. This European Standard covers the following requirements and compliance criteria: – protection from hazards in the device; – protection from overvoltages on the network; – protection from touch current; – protection from hazards caused by different type of circuits; – protection of the communication wiring from overheating caused by excessive current.

Standard EN 50491 has several parts that are not all listed here, but some of the other parts may have aspects relevant for lighting control.

EN 60669-1:1999/IS1:2009:

'*Switches for household and similar fixed-electrical installations - Part 1: General requirements'*

Applies to manually operated general purpose switches for a.c. only, with a rated voltage not exceeding 440 V and a rated current not exceeding 63 A.

EN 60669-2-1:2004/A12:2010 ; FprA2:2013 (under approval):

'*Switches for household and similar fixed electrical installations - Part 2-1: Particular requirements - Electronic switches'*

Applies to electronic switches and to associated electronic extension units for household and similar fixed electrical installations either indoors or outdoors.

EN 60669-2-2:2006

'*Switches for household and similar fixed electrical installations Particular requirements. Electromagnetic remote-control switches (RCS)'*

This part of IEC 60669 applies to electromagnetic remote-control switches (hereinafter referred to as RCS) with a rated voltage not exceeding 440 V and a rated current not exceeding 63 A, intended for household and similar fixed electrical installations, either indoors or outdoors.

EN 60669-2-3:2006

'Switches for household and similar fixed electrical installations. Particular requirements Time-delay switches (TDS)'

This part of IEC 60669 applies to time-delay switches (hereinafter referred to as TDS) with a rated voltage not exceeding 440 V and a rated current not exceeding 63 A, intended for household and similar fixed electrical installations, either indoors or outdoors, operated by hand and/or by remote control.

EN 60669-2-4:2005

'Switches for household and similar fixed electrical installations - Part 2-4: Particular requirements - Isolating switches'

This part of EN 60669 applies to manually operated general purpose isolating switches with a rated voltage not exceeding 440 V and a rated current not exceeding 125 A, intended for household and similar fixed electrical installations, either indoors or outdoors.

EN 60669-2-5:2014

'Switches for household and similar fixed electrical installations - Part 2-5: Particular requirements - Switches and related accessories for use in home and building electronic systems (HBES)'

IEC 60669-2-5:2013 applies to HBES switches with a working voltage not exceeding 250 V a.c. and a rated current up to and including 16 A for household and similar fixed electrical installations either indoors or outdoors and to associated electronic extension units.

EN 60669-2-6:2012

'Switches for household and similar fixed electrical installations - Part 2-6: Particular requirements - Fireman's switches for exterior and interior signs and luminaires'

IEC 60669-2-6:2012 is applicable to fireman's switches used for the breaking of the low-voltage circuits for exterior and interior signs and luminaires e.g. neon signs for a.c. only with a rated voltage not exceeding 440 V and a rated current not exceeding 125 A.

EN 62386-101:2009 ; FprEN 62386-101:2013 (under approval)

'Digital addressable lighting interface - Part 101: General requirements – System.'

IEC 62386-101:2009 specifies a protocol for control by digital signals of electronic lighting equipment used on a.c. or d.c. supplies. This Part 101 is intended to be used in conjunction with Part 102, which contains general requirements for the relevant product type (control gear), and with the appropriate part 2XX (particular requirements for control gear) containing clauses to supplement or modify the corresponding clauses in Parts 101 and 102 in order to provide the relevant requirements for each type of product. This International Standard, together with IEC 62386-102 and IEC 62386-201, replaces Clause E.4, "Control by digital signals", and Annex G, "Test procedures".

EN 62386-102:2009 ; **FprEN 62386-102:2013** (under approval)

'Digital addressable lighting interface. General requirements. Control gear.'

IEC 62386-102:2009 specifies a protocol and methods of test for the control by digital signals of electronic control gear for use on a.c. or d.c. supplies. This Part 102 is intended to be used in conjunction with Part 101, which contains general requirements for the relevant product type (system), and with the appropriate part 2XX (particular requirements for control gear) containing clauses to supplement or modify the corresponding clauses in Parts 101 and 102 in order to provide the relevant requirements for each type of product.

FprEN 62386-103:2013 (under approval):

'*Digital addressable lighting interface. Part 103. General requirements. Control devices*.'

EN 62386-201:2009 ; **FprEN 62386-201:2014** under approval

'*Digital addressable lighting interface. Particular requirements for control gear. Fluorescent lamps (device type 0)*.'

Specifies a protocol and methods of test for the control by digital signals of electronic control gear for use on a.c. or d.c. supplies, associated with **fluorescent lamps**. This part 201 is intended to be used in conjunction with IEC 62386-101 and IEC 62386-102, which contain general requirements for the relevant product type (control gear or control devices).

EN 62386-202:2009

'*Digital addressable lighting interface. Particular requirements for control gear. Self-contained emergency lighting (device type 1)*. '

IEC 62386-202:2009 specifies a protocol and test procedures for the control by digital signals of electronic control gear for use on a.c. or d.c. supplies, associated with **self-contained emergency lighting**. This Part 202 is intended to be used in conjunction with IEC 62386-101 and IEC 62386-102, which contain general requirements for the relevant product type (control gear or control devices).

EN 62386-203:2009

'*Digital addressable lighting interface. Particular requirements for control gear. Discharge lamps (excluding fluorescent lamps) (device type 2)*.'

Specifies a protocol and test procedures for the control of electronic control gear by digital signals used on a.c. or d.c. supplies, associated with **discharge lamps (excluding fluorescent lamps)**. This Part 203 is intended to be used in conjunction with IEC 62386-101 and IEC 62386-102, which contain general requirements for the relevant product type (control gear or control devices).

EN 62386-204:2009

'*Digital addressable lighting interface. Particular requirements for control gear. Low voltage halogen lamps (device type 3)*.'

Specifies a protocol and methods of test for the control by digital signals of electronic control gear for use on a.c. or d.c. supplies, associated with **low voltage halogen lamps**. This part 204 is intended to be used in conjunction with IEC 62386-101 and IEC 62386-102, which contain general requirements for the relevant product type (control gear or control devices).

EN 62386-205:2009

'*Digital addressable lighting interface. Particular requirements for control gear. Supply voltage controller for incandescent lamps (device type 4)*.'

Specifies a protocol and test procedures for the control by digital signals of electronic control gear associated with **incandescent lamps**. This Part 205 is intended to be used in conjunction with IEC 62386-101 and IEC 62386-102, which contain general requirements for the relevant product type (control gear or control devices).

EN 62386-206:2009

'*Digital addressable lighting interface. Particular requirements for control gear. Conversion from digital signal into d.c. voltage (device type 5)*.'

IEC 62386-206:2009 specifies a protocol and test methods for the control by digital signals of electronic control gear, associated with the **conversion from digital signal into d.c. voltage**. This Part 206 is intended to be used in conjunction with IEC 62386-101 and IEC 62386-102, which contain general requirements for the relevant product type (control gear or control devices).

EN 62386-207:2009

'*Digital addressable lighting interface. Particular requirements for control gear. LED modules (device type 6)*.'

IEC 62386-207:2009 specifies a protocol and test procedures for the control by digital signals of electronic control gear for use on a.c. or d.c. supplies, **associated with LED modules**. This Part 207 is intended to be used in conjunction with IEC 62386-101 and IEC 62386-102, which contain general requirements for the relevant product type (control gear or control devices).

EN 62386-208:2009

'*Digital addressable lighting interface. Particular requirements for control gear. Switching function (device type 7)*.'

IEC 62386-208:2009 specifies a protocol and test methods for the control by digital signals of electronic **control gear that switches its output only on and off**. This Part 208 is intended to be used in conjunction with IEC 62386-101 and IEC 62386-102, which contain general requirements for the relevant product type (control gear or control devices).

EN 62386-209:2011

'Digital addressable lighting interface - Part 209: Particular requirements for control gear - Colour control (device type 8).'

IEC 62386-209:2011 specifies a protocol and test procedures for the control by digital signals of electronic **control gear that can change their light colour**. This publication contains .pdf files, which reproduce the test sequences illustrated in Figures 5 to 127. These files are intended to be used as a complement and do not form an integral part of the publication. This publication is to be read in conjunction with IEC 62386-101:2009 and IEC 62386-102:2009.

EN 62386-210:2011

'Digital addressable lighting interface Particular requirements for control gear. Sequencer (device type 9).'

IEC 62386-210:2011 specifies a protocol and test procedures for the control by digital signals of electronic **control gear working as automatic sequencers**.

FprEN 62733:2014 (under approval):

'Programmable components in electronic lamp controlgear - General and safety requirements'

H.14 Standards, guides etc. related to safety-aspects of lighting

EN 50102:1995/A1:1998/corrigendum Jul. 2002

'Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)'

This standard refers to the classification of the degrees of protection provided by enclosures against external mechanical impacts when the rated voltage of the protected equipment is not greater than 72,5 kV. This standard is only applicable to enclosures of equipment where the specific standard establishes degrees of protection of the enclosure against mechanical impacts (expressed in this standard as impacts). The object of this standard is to give: the definitions for degrees of protection provided by enclosures of electrical equipment as regards protection of the equipment inside the enclosure against harmful effects of mechanical impacts; the designations for the degrees of protection; the requirements for each designation; the tests to be performed to verify that enclosures meets the requirements of this standard.

EN 60432-1:2000/A2:2012

'Incandescent lamps - Safety specifications - Part 1: Tungsten filament lamps for domestic and similar general lighting purposes'

Specifies the safety and interchangeability requirements of tungsten filament incandescent lamps for general lighting service, having a rated wattage up to and including 200 W or a rated voltage from 50 V to 250 V inclusive.

EN 60432-2:2000/A2:2012

'*Incandescent lamps - Safety specifications - Part 2: Tungsten halogen lamps for domestic and similar general lighting purposes*.'

Specifies the safety and the related interchangeability requirements of tungsten halogen lamps for general lighting service. Covers those tungsten halogen lamps that are used as direct replacements for conventional tungsten filament lamps as well as new tungsten halogen lamps which have no correspondence in EN 60432-1, but for which the safety and interchangeability requirements are treated by this standard in conjunction with EN 60432-1.

EN 60432-3:2013

'*Incandescent lamps - Safety specifications - Part 3: Tungsten-halogen lamps (non-vehicle)*'

Specifies the safety requirements for single-capped and double-capped tungsten halogen lamps, having rated voltages of up to 250 V, used for the following applications: · Projection (including cinematograph and still projection) · Photographic (including studio) · Floodlighting · Special purpose · General purpose · Stage lighting

The main changes in the 2013 edition with respect to the previous edition are as follows: - adapting the cold fill pressure requirements and tests for self-shielded lamps to the state of the technology, - introduction of requirements to fully cover photobiological safety according to IEC 62471.

EN 60529:1991/A2:2013

'*Degrees of protection provided by enclosures (IP Code)*'

Applies to the classification of degrees of protection provided by enclosures for electrical equipment with a rated voltage not exceeding 72,5 kV. Has the status of a basic safety publication in accordance with IEC Guide 104.

Degree of protection code IP: X*1X2*
X1 indicates the degree that persons are protected against contact with moving parts (other than smooth rotating shafts, etc.) and the degree that equipment is protected against solid foreign bodies intruding into an enclosure;
X1 = 0 means *no special protection*
X1 = 1 means *protection against penetration by large foreign bodies, d>50 mm*. *No protection against intentional access*
X1 = 2 means *protection against small foreign bodies, d>12mm, exclusion of fingers or similar objects*
X1 = 3 means *protection against small foreign bodies, d>2.5 mm, exclusion of tools, wires or similar objects*
X1 = 4 means *protection against grainy foreign bodies, d>1 mm, exclusion of tools, wires or similar objects*
X1 = 5 means *protection against dust deposits (dust protected), complete exclusion of access*

X1 = 6 means *totally protection against dust deposits (dust protected), complete exclusion of access.*

X2 indicates the degree of protection of the equipment inside the enclosure against the harmful entry of various forms of moisture (e.g. dripping, spraying, submersion, etc.);
X2 = 0 means *no special protection*
X2 = 1 means *protection against drops of water falling vertically*
X2 = 2 means *protection against water falling at an angle (water drop), inclined at 15° to the normal operating position*
X2 = 3 means *protection against water spray, up to 60° from the vertical*
X2 = 4 means *protection against water splashes from any direction*
X2 = 5 means *protection against water jet from any direction*
X2 = 6 means *protection against heavy sea or strong water jet*
X2 = 7 means *protection against submersion in water at a certain pressure and for a certain period*
X2 = 8 means *protection against continuous submersion in water.*

Example: IP65 means totally protection against dust deposits (dust protected), complete exclusion of access and protection against water jet from any direction.

EN 60968:2013/A11:201X ; FprEN 60968:2013 under approval

'*Self-ballasted lamps for general lighting services - Safety requirements*.'

This International Standard specifies the safety and interchangeability requirements, together with the test methods and conditions, required to show compliance of tubular fluorescent and other gas-discharge lamps with integrated means for controlling starting and stable operation (self-ballasted lamps), intended for domestic and similar general lighting purposes, having: - a rated wattage up to 60 W; - a rated voltage of 100 V to 250 V; - Edison screw or bayonet caps. The requirements of this standard relate only to type testing.

EN 61195:1999/FprA2:2014 (amendment under approval):

'Double-capped fluorescent lamps - Safety specifications'

Specifies the safety requirements for double-capped fluorescent lamps for general lighting purposes of all groups having Fa6, Fa8, G5, G13 and R17d caps. Also specifies the method a manufacturer should use to show compliance with the requirements of this standard.

EN 61199:2011/FprA2:2014 (amendment under approval)**:**

'*Single-capped fluorescent lamps - Safety specifications*'

IEC 61199:2011 specifies the safety requirements for single-capped fluorescent lamps for general lighting purposes of all groups having caps according to Table 1. It also specifies the method a manufacturer should use to show compliance with the requirements of this standard on the basis of whole production appraisal in association with his test records on finished products. This method can also be applied for certification purposes. Details of a batch test procedure which can be used to make limited assessment of batches are also given

in this standard. The last edition introduces requirements for high frequency operation, a new temperature measurement position, and some new cap-holder fits.

EN 61558-2-9:2011

'Safety of transformers, reactors, power supply units and combinations thereof - Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps for tungsten filament lamps'

Deals with the safety of transformers for class III handlamps for tungsten filament lamps and power supply units incorporating transformers for class III handlamps for tungsten filament lamps. Transformers incorporating electronic circuits are also covered by this standard. This part has the status of a group safety publication in accordance with IEC Guide 104.

EN 62031:2008/FprA2:2014 (amendment under approval)**:**

'*LED modules for general lighting - Safety specifications'*

This International Standard specifies general and safety requirements for light-emitting diode (LED) modules: - LED modules without integral control gear for operation under constant voltage, constant current or constant power; - self-ballasted LED modules for use on d.c. supplies up to 250 V or a.c. supplies up to 1 000 V at 50 Hz or 60 Hz.

EN 62035:2000/A2:2012 ; prEN 62035:201X (under approval) **;** IEC 62035:2014

'*Discharge lamps (excluding fluorescent lamps) - Safety specifications*.'

Specifies the safety requirements for discharge lamps (excluding fluorescent lamps) for general lighting purposes. This International Standard is applicable to low-pressure sodium vapour lamps and to high-intensity discharge (HID) lamps, i.e. high-pressure mercury vapour lamps (including blended lamps), high-pressure sodium vapour lamps and metal halide lamps. It applies to single- and double-capped lamps.

EN 62532:2011

'*Fluorescent induction lamps - Safety specifications*.'

This standard specifies the safety requirements for fluorescent induction lamps for general lighting purposes. It also specifies the method a manufacturer should use to show compliance with the requirements of this standard on the basis of whole production appraisal in association with his test records on finished products. This method can also be applied for certification purposes. Details of a batch test procedure, which can be used to make limited assessment of batches, are also given in this standard.

EN 62560:2012/FprA1:2013 (amendment under approval)**:**

'***Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specifications'***

Specifies the safety and interchangeability requirements, together with the test methods and conditions required to show compliance of LED-lamps with integrated means for stable

operation (self-ballasted LED-lamps), intended for domestic and similar general lighting purposes, having: - a rated wattage up to 60 W; - a rated voltage of > 50 V up to 250 V; - caps according to Table 1.

EN 62471:2008 ; FprEN 62471-5:2014 (under approval):

'*Photobiological safety of lamps and lamp systems*'

This standard gives guidance for evaluating the photobiological safety of lamps and lamp systems including luminaires. Specifically it specifies the exposure limits, reference measurement technique and classification scheme for the evaluation and control of photobiological hazards from all electrically powered incoherent broadband sources of optical radiation, including LEDs but excluding lasers, in the wavelength range from 200 nm through 3000 nm. This standard was prepared as Standard CIE S 009:2002 by the International Commission on Illumination.

CIE S 009 E:2002 / IEC 62471:2006

'*Photobiological safety of lamps and lamp systems* '

Lamps were developed and produced in large quantities and became commonplace in an era when industry-wide safety standards were not the norm. The evaluation and control of optical radiation hazards from lamps and lamp systems is a far more complicated subject than similar tasks for a single-wavelength laser system.

The required radiometric measurements are quite involved, for they do not deal with the simple optics of a point source, but rather with an extended source that may or may not be altered by diffusers or projection optics. Also the wavelength distribution of the lamp may be altered by ancillary optical elements, diffusers, lenses, and the like, as well as variations in operating conditions.

To evaluate a broad-band optical source, such as an arc lamp, an incandescent lamp, a fluorescent lamp, an array of lamps or a lamp system, it is first necessary to determine the spectral distribution of optical radiation emitted from the source at the point or points of nearest human access. This accessible emission spectral distribution of interest for a lighting system may differ from that actually being emitted by the lamp alone due to the filtration by any optical elements (e.g., projection optics) in the light path. Secondly, the size, or projected size, of the source must be characterized in the retinal hazard spectral region.

Thirdly, it may be necessary to determine the variation of irradiance and effective radiance with distance. The performance of the necessary measurements is normally not an easy task without sophisticated instruments. Thus it was decided to include reference measurement techniques for lamps and lamp systems in this standard. The measurement techniques along with the described risk group classification scheme will provide common ground for both lamp manufacturers and users to define the specific photobiological hazards of any given lamp and/or lamp system.

Finally, there are well known optical radiation hazards associated with some lamps and lamp systems. The purpose of this standard is to provide a standardized technique for evaluation of potential radiation hazards that may be associated with various lamps and lamp systems.

CIE 138:2000

'CIE Collection in photobiology and photochemistry 2000'

This volume contains short Technical Reports prepared by various Technical Committees within Division 6.

138/1 Blue Light Photochemical Retinal Hazard

The results of studies of acute photochemical retinal injury, frequently referred to as the "blue light hazard (BLH)" are described in this technical report. The BLH results from a photochemical injury to the human retina and is termed by ophthalmologists "photoretinitis." The studies were performed by a number of scientists, these works provided the basis for threshold limit values (TLV) and the BLH action spectrum recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) in the 1970's, and more recently, after completion of the work of TC 6-14, by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

The potential for photoretinitis resulting from viewing the sun, tungsten-halogen lamps, high intensity discharge lamps, xenon short-arc lamps, welding arcs, etc., is provided in this report. Means and methods to evaluate potential BLH were studied by the CIE committee and one technique employing the ACGIH TLV is proposed for general use.

138/2 Action Spectrum for Photocarcinogenesis (Non - Melanoma Skin Cancers)

138/3 Standardized Protocols for Photocarcinogenesis Safety Testing

138/4 A Proposed Global UV Index

CIE 139:2001

'The influence of daylight and artificial light variations in humans - a bibliography'

In recent years, the study of the psychobiological effects of light has come forth as an important subfield of lighting research. This final report of TC 6-16 consists of an alphabetically ordered bibliography with 1100 entries and a basic list of 120 key words. The bibliography deals with the impact of light, both natural and artificial, upon the biological clock. The effects cited include physiological variations between day and night, during the menstrual cycle, and during the different seasons of the year. Also included are psychological variations in emotional tone and alertness, as well as pre-menstrual tension and seasonal affective disorder.

The selection of references has been restricted almost exclusively to research on humans. The bibliography covers the following topics: * The Biological Clock * Melatonin and Cortisol * Shift Work and Jet Lag * Seasonality in Hormones * Seasonal Affective Disorder * Light Therapy * Other Kinds of Seasonality * Premenstrual Syndrome * Windowless Environments * Lighting Characteristics * Individual and Group Differences * Confounding Factors

CIE 158:2009

'Ocular lighting effects on human physiology and behaviour'

The nonvisual biological and behavioural effects of light in animals and humans are mediated by specific neuroanatomical pathways. Controlled empirical studies have shown that light can be used to treat some clinical disorders and may have broader, nonclinical applications for

problems of shift work and jet lag. Studies are testing how lighting may be incorporated into architectural designs that are optimal for vision as well as physiological and behavioural stimulation.

IEC 62321:2008

'Electrotechnical products - Determination of levels of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers)'

Specifies the determination of the levels of lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (Cr(VI)) contained in inorganic and organic compounds, and two types of brominated flame retardants, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) contained in electrotechnical products. This standard refers to the sample as the object to be processed and measured. The nature of the sample and the manner in which it is acquired is defined by the entity carrying out the tests and not by this standard. It has the status of a horizontal standard in accordance with IEC Guide 108.

IEC 62321-1:2013

'Determination of certain substances in electrotechnical products - Part 1: Introduction and overview'

Refers to the sample as the object to be processed and measured. The nature of the sample and the manner in which it is acquired is defined by the entity carrying out the tests and not by this standard. It provides guidance on the disassembly procedure employed for obtaining a sample. This first edition of IEC 62321-1 is a partial replacement of IEC 62321, forming a structural revision and replacing Clauses 1 to 4.

IEC 62321-2:2013

'Determination of certain substances in electrotechnical products - Part 2: Disassembly, disjunction and mechanical sample preparation'

Provides strategies of sampling along with the mechanical preparation of samples from electrotechnical products, electronic assemblies and electronic components. These samples can be used for analytical testing to determine the levels of certain substances as described in the test methods in other parts of IEC 62321. Restrictions for substances will vary between geographic regions and from time to time. This Standard describes a generic process for obtaining and preparing samples prior to the determination of any substance which are under concern.

IEC 62321-3-1:2013

'Determination of certain substances in electrotechnical products - Part 3-1: Screening - Lead, mercury, cadmium, total chromium and total bromine using X-ray fluorescence spectrometry'

Describes the screening analysis of five substances, specifically lead (Pb), mercury (Hg), cadmium (Cd), total chromium (Cr) and total bromine (Br) in uniform materials found in

electrotechnical products, using the analytical technique of X-ray fluorescence (XRF) spectrometry.

IEC 62321-3-2:2013

'Determination of certain substances in electrotechnical products - 3-2: Screening - Total bromine in polymers and electronics by Combustion - Ion Chromatography'

Specifies the screening analysis of the total bromine (Br) in homogeneous materials found in polymers and electronics by using the analytical technique of combustion ion chromatography (C-IC).

IEC 62321-4:2013

'Determination of certain substances in electrotechnical products - Part 4: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS'

Describes the use of four test methods for mercury in polymers, metals and electronics, namely CV-AAS (cold vapour atomic absorption spectrometry), CV-AFS (cold vapour atomic fluorescence spectrometry) ICP-OES (inductively coupled plasma optical emission spectrometry), and ICP-MS (inductively coupled plasma mass spectrometry) as well as several procedures for preparing the sample solution from which the most appropriate method of analysis can be selected by experts.

IEC 62321-5:2013

'Determination of certain substances in electrotechnical products - Part 5: Cadmium, lead and chromium in polymers and electronics and cadmium and lead in metals by AAS, AFS, ICP-OES and ICP-MS'

Describes the four test methods for lead, cadmium and chromium in polymers, metals and electronics, namely AAS (atomic absorption spectrometry), AFS (atomic fluorescence spectrometry), ICP-OES (inductively coupled plasma optical emission spectrometry), and ICP-MS (inductively coupled plasma mass spectrometry) as well as several procedures for preparing the sample solution from which the most appropriate method of analysis can be selected by experts.

EN 62554:2011

'Sample preparation for measurement of mercury level in fluorescent lamps'

Specifies sample preparation methods for determining mercury levels in new tubular fluorescent lamps (including single capped, double capped, self-ballasted and CCFL for backlighting) containing 0,1 mg mercury or more. The intended resolution of the methods described in this standard is of the order of 5 %. Mercury level measurement of spent lamps is excluded, as during lamp operation, mercury gradually diffuses into the glass wall and reacts with the glass materials. The test method of this standard does not recover mercury that is diffused into or reacted with or otherwise incorporated irreversibly with the glass wall of discharge tubes. This standard does not contain information on measurement. Measurement is specified in IEC 62321.

FprEN 62663-1:2012 (under approval):

'Non-ballasted LED-lamps - Part 1: Safety specifications'

FprEN 62776:2013 (under approval):

'Double-capped LED lamps for general lighting services - Safety specifications'

IEC/TR 62778: 2012

'*Application of IEC/EN 62471 for the assessment of blue light hazard to light sources and luminaires (Technical report)'*

IEC/TR 62778:2012 brings clarification and guidance concerning the assessment of blue light hazard of all lighting products which have the main emission in the visible spectrum (380 nm to 780 nm). By optical and spectral calculations, it is shown what the photobiological safety measurements as described in IEC/EN 62471 tell us about the product and, if this product is intended to be a component in a higher level lighting product, how this information can be transferred from the component product (e.g. the LED package, the LED module, or the lamp) to the higher level lighting product (e.g., the luminaire).

prEN 62838:201X (under drafting):

'Semi-integrated LED lamps for general lighting services with supply voltages not exceeding 50 V a.c. r.m.s. or 120V ripple free d.c. - Safety specification'

FprEN 62868:2013 (under approval):

'Organic light emitting diode (OLED) panels for general lighting - Safety requirements'

CEN/TC 169, (WI=00169063) (under drafting, expected 2015)

'Eye mediated non visual effects of light on humans - Measures of neurophysiological and melanopic photosensitivity'

H.15 Standards, guides etc. related to emission-aspects of lighting

EN 14255-1:2005

'Measurement and assessment of personal exposures to incoherent optical radiation - Ultraviolet radiation emitted by artificial sources in the workplace'

This document specifies procedures for the measurement and assessment of personal exposures to ultraviolet (UV) radiation emitted by artificial sources, where adverse effects can not readily be excluded. NOTE 1 Adverse effects will usually not occur in exposures caused by commonly used artificial lighting. However, exposures to very strong light sources or light sources with extended spectra may cause a health risk nevertheless. This document applies to UV-exposures in indoor and outdoor workplaces. It does not apply to UV-exposures in leisure time. This document does not apply to UV-exposure caused by the sun. NOTE 2 Part 3 of this standard will deal with UV-exposure caused by the sun. This document does not specify UV-exposure limit values. It supports the application of limit values set by national regulations or international recommendations. This document applies to UV-exposures by artificial incoherent sources, which emit spectral lines as well as continuous spectra. This document does not apply to coherent radiation sources. NOTE 3 Coherent optical radiation sources are covered by standards for lasers, like EN 60825-1 etc.. This document applies to UV-exposures in the wavelength band 180 nm to 400 nm. This document does not apply to radiation exposures which concern the retina. NOTE 4 Part 2 of this standard will address these effects. This document does not apply to radiation emissions of products. NOTE 5 For radiation emissions of products other standards apply, such as: EN 60335-2-27 (IEC 60335-2-27) for sunbeds, EN 60335-2-59 (IEC 60335-2-59) for insect killers and EN 12198 for radiation emissions of machinery.

EN 14255-2:2005

'Measurement and assessment of personal exposures to incoherent optical radiation - Visible and infrared radiation emitted by artificial sources in the workplace'

This European Standard specifies procedures for the measurement and assessment of personal exposures to visible (VIS) and infrared (IR) radiation emitted by artificial sources, where adverse effects cannot be readily excluded. NOTE 1 Adverse effects will normally not occur in exposures caused by normal lighting or room heating. This European Standard applies to VIS- and IR- exposures in indoor and outdoor workplaces. It does not apply to VIS- and IR-exposures in leisure time. This European Standard does not apply to VIS- and IR- exposures caused by the sun. NOTE 2 Part 3 of this standard will deal with UV-exposures caused by the sun. This European Standard does not specify VIS- and IR-exposure limit values. It supports the application of limit values set by national regulations or international recommendations. This European Standard applies to VIS- and IR- exposures by artificial incoherent sources, which emit spectral lines as well as continuous spectra. This European Standard does not apply to coherent radiation sources. NOTE 3 Coherent optical radiation sources are covered by standards for lasers, like EN 60825-1 etc. This European Standard applies to visible (VIS) and infrared (IR) radiation exposures in the wavelength band 380 nm to 3 µm. It also applies to radiation exposures that may present a blue-light hazard in the wavelength band 300 nm to 700 nm. This European Standard does not apply to other effects of which the action spectra lie solely within the UV-region 180 nm to 400 nm. NOTE 4 Part 1 of EN 14255 addresses these effects. This European Standard does not apply to radiation emissions of products. NOTE 5 For radiation emissions of products other standards apply, such as EN 12198 for radiation

emissions of machinery, EN 60335-2-27 for household appliances for skin exposures to ultraviolet and infrared radiation and CIE S009 for the safety of lamps and lamp systems. This European Standard does not apply to heat stress, i.e. long term heat

EN 14255-4:2006

'Measurement and assessment of personal exposures to incoherent optical radiation - Terminology and quantities used in UV-, visible and IR-exposure measurements'

This standard specifies the terminology and the quantities that are used in UV-, VIS- and IR-exposure measurements according to parts 1, 2 and 3 of EN 14255. NOTE Parts 1 and 2 were published in 2005, while part 3 is under preparation. This standard can also be applied to the terminology and quantities used in international recommendations from, e.g. ICNIRP, CIE, etc. The purpose of this standard is to unify the definitions of quantities for optical radiation measurements since inconsistencies occur between existing publications from different origins.

EN 55015:2013 ; **FprA1:2014** (fragments 1, 2, 3) (amendments under approval)

'Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment'

CISPR 15:2013 **applies to** the emission (radiated and conducted) of radiofrequency disturbances from:

- all lighting equipment with a primary function of generating and/or distributing light intended for illumination purposes, and intended either for connection to the low voltage electricity supply or for battery operation;
- the lighting part of multi-function equipment where one of the primary functions of this is illumination; - independent auxiliaries exclusively for use with lighting equipment;
- UV and IR radiation equipment;
- neon advertising signs;
- street/flood lighting intended for outdoor use;
- and transport lighting (installed in buses and trains).

Excluded from the scope of this standard are:

- lighting equipment operating in the ISM frequency bands (as defined in Resolution 63 (1979) of the ITU Radio Regulation);
- lighting equipment for aircraft and airports;
- and apparatus for which the electromagnetic compatibility requirements in the radio-frequency range are explicitly formulated in other CISPR standards.

The frequency range covered is 9 kHz to 400 GHz.

EN 55103-1:2009/A1:2012

'Electromagnetic compatibility - Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use - Part 1: Emissions'

EN 55103-2:2009/IS1:2012

'Electromagnetic compatibility - Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use - Part 2: Immunity'

EN 61000-3-2:2006 ; FprA3:2013 (fragment 1, 2, 3) (under approval)

'*Electromagnetic compatibility (EMC) Limits. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)'*

EN 60335-2-27:2013

'Household and similar electrical appliances - Safety - Part 2-27: Particular requirements for appliances for skin exposure to ultraviolet and infrared radiation'

IEC 60335-2-27:2009(E) deals with the safety of electrical appliances incorporating emitters for exposing the skin to ultraviolet or infrared radiation, for household and similar use, their rated voltage being not more than 250 V for single-phase appliances and 480 V for other appliances. Appliances intended to be used in tanning salons, beauty parlours and similar premises, are also within the scope of this standard.

EN 61000-3-3:2013

'Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection'

IEC 61000-3-3:2013 is concerned with the limitation of voltage fluctuations and flicker impressed on the public low-voltage system. It specifies limits of voltage changes which may be produced by an equipment tested under specified conditions and gives guidance on methods of assessment. It is applicable to electrical and electronic equipment having an input current equal to or less than 16 A per phase, intended to be connected to public low-voltage distribution systems of between 220 V and 250 V line to neutral at 50 Hz, and not subject to conditional connection. IEC 61000-3-3 has the status of a product family standard within the IEC 61000 series.

EN 61000-4-1:2007

'*Electromagnetic compatibility (EMC) - Part 4-1: Testing and measurement techniques - Overview of EN 61000-4 series'*

The object of this part of IEC 61000 is to give applicability assistance to the technical committees of IEC or other bodies, users and manufacturers of electrical and electronic equipment on EMC standards within the IEC 61000-4 series on testing and measurement techniques and to provide general recommendations concerning the choice of relevant tests. This standard has the status of a basic EMC publication in accordance with IEC Guide 107.

EN 61000-4-6:2014

'Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields'

IEC 61000-4-6:2013 relates to the conducted immunity requirements of electrical and electronic equipment to electromagnetic disturbances coming from intended radio-frequency (RF) transmitters in the frequency range 150 kHz up to 80 MHz. Equipment not having at least one conducting wire and/or cable (such as mains supply, signal line or earth connection) which can couple the equipment to the disturbing RF fields is excluded from the scope of this publication. The object of this standard is to establish a common reference for evaluating the functional immunity of electrical and electronic equipment when subjected to conducted disturbances induced by RF fields. The test method documented in IEC 61000-4-6:2013 describes a consistent method to assess the immunity of an equipment or system against a defined phenomenon.

EN 61000-4-15:2011

'*Electromagnetic compatibility (EMC) - Part 4-15: Testing and measurement techniques - Flickermeter - Functional and design specifications*'

IEC 61000-4-15:2010 gives a functional and design specification for flicker measuring apparatus intended to indicate the correct flicker perception level for all practical voltage fluctuation waveforms. Information is presented to enable such an instrument to be constructed. A method is given for the evaluation of flicker severity on the basis of the output of flickermeters complying with this standard. The flickermeter specifications in this part of IEC 61000 relate only to measurements of 120 V and 230 V, 50 Hz and 60 Hz inputs. Characteristics of some incandescent lamps for other voltages are sufficiently similar to the values in Table 1 and Table 2, that the use of a correction factor can be applied for those other voltages. Some of these correction factors are provided in the Annex B. Detailed specifications for voltages and frequencies other than those given above, remain under consideration. The object of this part of IEC 61000 is to provide basic information for the design and the instrumentation of an analogue or digital flicker measuring apparatus. It does not give tolerance limit values of flicker severity.

EN 61547:2009

'*Equipment for general lighting purposes - EMC immunity requirements*'

IEC 61547:2009 for electromagnetic immunity requirements applies to lighting equipment which is within the scope of IEC Technical Committee 34, such as lamps, auxiliaries and luminaires, intended either for connecting to a low voltage electricity supply or for battery operation. Excluded from the scope of this standard is equipment for which the immunity requirements are formulated in other IEC or CISPR standards.

EN 62493:2010

'Assessment of lighting equipment related to human exposure to electromagnetic fields'

IEC 62493:2009 applies to the assessment of lighting equipment related to human exposure to electromagnetic fields. The assessment consists of the induced current density for frequencies

from 20 kHz to 10 MHz and the specific absorption rate (SAR) for frequencies from 100 kHz to 300 MHz around lighting equipment. This standard does not apply to built-in components for luminaires such as electronic control gear.

H.16 Standards, guides etc. on the colour and colour rendering of light

CIE 013.3-1995

'Method of measuring and specifying colour rendering properties of light sources'

The CIE recommended in 1965 the procedure of measuring and specifying colour rendering properties of light sources, based on a test colour sample method. This method was updated in 1974 taking the chromatic adaptation shift into account. During the past 20 years several misprints were observed and corrected reprints were published from time to time. CIE 13.3-1995 is the corrected version of CIE 13.2-1974 that has been brought up to date to present spectroradiometric and calculation practice. The technical recommendations have not been changed.

Two computer programs to calculate the CIE colour rendering indices according to the present publication are available for "DOS"-computers to be run in a DOS or in an "MS-WINDOWS" environment as CIE D008.

This Technical Report establishes the CIE recommended method of measuring and specifying colour rendering properties of light sources based on resultant colour shifts of test objects, referred to as the "Test-colour Method". It is the fundamental method for appraisal of colour rendering properties of light sources, and is recommended for type testing as well as for testing individual lamps.

This specification applies to most general purpose illuminants (e.g. tungsten filament lamps, tubular fluorescent lamps, and all other kinds of gaseous discharge electrical lamps except sources of predominantly monochromatic radiation such as low pressure sodium, etc.). This method may also be applied to modified daylight.

The rating consists of a General Colour Rendering Index which may be supplemented by a set of Special Colour Rendering Indices. The derivation of the Special Colour Rendering Indices is based on a general comparison of the length of colour difference vectors in the CIE 1964 Uniform Space.

To apply the recommended Test-Colour Method the resultant colour shifts for suitably chosen test-colour samples must be calculated. A set of eight test-colour samples is specified by their spectral radiance factors for calculating the General Colour Rendering Index. These samples cover the hue circle, are moderate in saturation, and are approximately the same in lightness. Data for six additional test-colour samples representing a strong red, yellow, green and blue as well as complexion and foliage colours are also supplied. From the colour shifts, Colour Rendering Indices may be found.

CIE 015:2004

'Colourimetry, 3rd edition'

This publication, which replaces CIE Publication 15.2 (and is not to be known as 15.3!), includes details of the CIE DE2000 colour difference equation; spectral power distributions for sets of halophosphate lamps, DeLuxe type lamps, three-band lamps, multi-band lamps, high pressure sodium lamps and high pressure metal halide lamps. The nomenclature for the

recommended geometries has changed, and there are even changes to the equations defining the parameters of the CIELAB colour space!

CIE S004/E-2001

'Colours of light signals'

This Standard specifies the allowable colours for steady signal lights and flashing signal lights where the duration of the on period is at least one second.

It is applicable to the colours of signal lights used in sea, road, air and rail transport systems including signal lights on ships, aircraft, motor vehicles and trains, where the recognition of the colours involved is essential.

The Standard can also be used for guidance on the selection of the colours

• of light signals and warning lights on instrument panels in vehicles,

• of light signals and warning lights on instrument panels used for monitoring or control of industrial processes,

• used in visual display terminals when recognition of the colour code is important to intepreting the information displayed.

The Standard does not specify how signal lights should be used in the various transport modes nor does it specify the meanings to be associated with the different colours. Reference must also be made to international, regional and national conventions and regulations for the particular applications.

This Standard is not applicable to the colours of surface colour codes. Guidance on the allowable colours for surface colour codes is given in CIE Publication 39.2-1983 Recommendations for Surface Colours for Visual Signalling .

This Standard has been approved by the National Committees of the CIE and supersedes the recommendations made in CIE Publication 2.2-1975 Colours of Light Signals. Background information to this Standard can be found in the Technical Report CIE 107-1994 A Review of the Official Recommendations of the CIE for the Colours of Signal Lights.

CIE S 014-1/E:2006 (ISO 11664-1:2007)

'*CIE Standard Colourimetric Observers*'

This CIE Standard replaces ISO/CIE 10527:1991. This Standard contains only minor changes from the previous Standard, it has now been clarified that the values of the colour matching functions apply for standard air to make the Standard conform to other CIE photometric and colourimetric data. Colours with different spectral compositions can look alike. An important function of colourimetry is to determine whether a pair of such metameric colours will look alike. It has long been the practice in colourimetry to make use of sets of colour-matching functions to calculate tristimulus values for colours: equality of tristimulus values for a pair of colours indicates that the colour appearances of the two colours match, when they are viewed in the same conditions by an observer for whom the colour-matching functions apply. The use of standard sets of colour-matching functions makes the comparison of tristimulus values obtained at different times and locations possible. This International Standard specifies colour-matching functions for use in colourimetry. Two sets of colour-matching functions are specified: Colour-matching functions for the CIE 1931 standard colourimetric observer.

This set of colour-matching functions is representative of the colour-matching properties of observers with normal colour vision for visual field sizes of angular subtense from about 1° to about 4°, for vision at photopic levels of adaptation. Colour-matching functions for the CIE 1964 supplementary standard colourimetric observer.

This set of colour-matching functions is representative of the colour-matching properties of observers with normal colour vision for visual field sizes of angular subtense greater than about 4°, for vision at sufficiently high photopic levels and with spectral power distributions such that no participation of the rod receptors of the retina is to be expected. The values in the tables of the colour matching functions and chromaticity coordinates of the CIE 1931 and 1964 standard colourimetric observers are identical with those in the previous standard.

CIE S 014-2/E:2006/ISO 11664-2:2007(E)

'CIE Standard llluminants for Colourimetry'

This CIE Standard replaces ISO 10526:1999/CIE S005:1998. It contains only minor changes from the previous standard, mainly concerning the wavelengths that are to be taken as being in standard air, to make the Standard conform to other CIE photometric and colourimetric data. CIE standard illuminants are used in colourimetry to compute the tristimulus values of reflected or transmitted object colours under specified conditions of illumination.

This International Standard specifies two illuminants for use in colourimetry: CIE standard illuminant A This is intended to represent typical, domestic, tungsten-filament lighting. CIE standard illuminant A should be used in all applications of colourimetry involving the use of incandescent lighting, unless there are specific reasons for using a different illuminant.

CIE standard illuminant D65 This is intended to represent average daylight. CIE standard illuminant D65 should be used in all colourimetric calculations requiring representative daylight, unless there are specific reasons for using a different illuminant. Variations in the relative spectral power distribution of daylight are known to occur, particularly in the ultraviolet spectral region, as a function of season, time of day, and geographic location. However, CIE standard illuminant D65 should be used pending the availability of additional information on these variations. The numerical values of the relative spectral distributions of standard illuminants A and D65 defined by this Standard are the same, within an accuracy of six significant digits, as those defined in earlier versions of these illuminants.

CIE S 014-3/E:2011 (ISO 11664-3:2012)

'Colourimetry - Part 3: CIE Tristimulus Values'

This joint ISO/CIE Standard, ISO 11664-3:2012(E)/CIE S 014-3/E:2011, is replacing CIE Standard CIE S 014-3/E:2011

Colour stimuli with different spectral distributions can look alike. An important function of colourimetry is to determine which stimuli look alike to a given observer with a given set of colour-matching functions. This is done by calculating a set of three tristimulus values for each stimulus. Equality of tristimulus values indicates equality of colour appearance under equal irradiation and viewing conditions.

This Standard is based on long-standing CIE recommendations (CIE15:2004 Colourimetry, 3rd edition) for the calculation of tristimulus values. It specifies methods of calculating the tristimulus values of colour stimuli for which the spectral distributions are provided. These

colour stimuli may be produced by self-luminous light sources or by reflecting or transmitting objects.

The standard method is defined as summation at 1 nm intervals over the wavelength range from 360 nm to 830 nm. Alternative abridged methods are defined for larger intervals (up to 5 nm) and shorter ranges (down to 380 nm to 780 nm). The alternative methods are to be used only when appropriate and when the user has reviewed the impact on the final results.

The Standard may be used in conjunction with the CIE 1931 standard colourimetric observer or the CIE 1964 standard colourimetric observer.

CIE S 014-4/E:2007 (ISO 11664-4:2008)

'Colourimetry - Part 4: CIE 1976 L*a*b* Colour Spaces'

The three-dimensional colour space produced by plotting CIE tristimulus values (X,Y,Z) in rectangular coordinates is not visually uniform, nor is the (x,y,Y) space nor the two-dimensional CIE (x,y) chromaticity diagram. Equal distances in these spaces do not represent equally perceptible differences between colour stimuli. For this reason, in 1976, the CIE introduced and recommended two new spaces (known as CIELAB and CIELUV) whose coordinates are non-linear functions of X, Y and Z. The recommendation was put forward in an attempt to unify the then very diverse practice in uniform colour spaces and associated colour difference formulae. Both these more-nearly uniform colour spaces have become well accepted and widely used. Numerical values representing approximately the magnitude of colour differences can be described by simple Euclidean distances in the spaces or by more sophisticated formulae that improve the correlation with the perceived size of differences.

The purpose of this CIE Standard is to define procedures for calculating the coordinates of the CIE 1976 L*a*b* (CIELAB) colour space and the Euclidean colour difference values based on these coordinates. The standard does not cover more sophisticated colour difference formulae based on CIELAB, such as the CMC formula, the CIE94 formula, the DIN99 formula, and the CIEDE2000 formula nor does it cover the alternative uniform colour space, CIELUV.

CIE S 014-5/E:2009 (ISO 11664-5:2009)

'Colourimetry - Part 5: CIE 1976 L*u*v* Colour Space and u', v' Uniform Chromaticity Scale Diagram'

This joint ISO/CIE Standard (replacing CIE S 014-5/E:2009) specifies the method of calculating the coordinates of the CIE 1976 L*u*v* colour space including correlates of lightness, chroma, saturation and hue. It includes two methods for calculating Euclidean distances in this space to represent the relative perceived magnitude of colour differences. It also specifies the method of calculating the coordinates of the u',v' uniform chromaticity scale diagram.

The Standard is applicable to tristimulus values calculated using the colourmatching functions of the CIE 1931 standard colourimetric system or the CIE 1964 standard colourimetric system. The Standard may be used for the specification of colour stimuli perceived as belonging to a reflecting or transmitting object, where a three-dimensional space more uniform than tristimulus space is required. This includes self-luminous displays, like cathode ray tubes, if they are being used to simulate reflecting or transmitting objects and if the stimuli are appropriately normalized. The Standard, as a whole, does not apply to colour stimuli perceived as belonging to an area that appears to be emitting light as a primary light source,

or that appears to be specularly reflecting such light. Only the u',v' chromaticity diagram defined in Section 4.1 and the correlates of hue and saturation defined in Section 4.3 apply to such colour stimuli.

ISO/CIE 11664-6:2014(E)

'Colourimetry – Part 6: CIEDE2000 Colour-Difference Formula'

This joint ISO/CIE International Standard is replacing CIE International Standard CIE S 014-6/E:2013 without changing its technical content.

The three-dimensional colour space produced by plotting CIE tristimulus values (X, Y, Z) in rectangular coordinates is not visually uniform, nor is the (x, y, Y) space nor the two-dimensional CIE (x, y) chromaticity diagram. Equal distances in these spaces and diagrams do not represent equally perceptible differences between colour stimuli. For this reason the CIE has standardized two more-nearly uniform colour spaces (known as CIELAB and CIELUV) whose coordinates are non-linear functions of X, Y and Z. Numerical values representing approximately the relative magnitude of colour differences can be described by simple Euclidean distances in these spaces or by more sophisticated colour-difference formulae that improve the correlation with the relative perceived size of differences. The purpose of this CIE International Standard is to define one such formula, the CIEDE2000 formula, based on CIE Technical Report 142-2001.

The formula is an extension of the CIE 1976 L*a*b* colour-difference formula (ISO 11664-4:2008(E)/CIE S 014-4/E:2007) with corrections for variation in colour-difference perception dependent on lightness, chroma, hue and chroma-hue interaction. Reference conditions define material and viewing environment characteristics to which the formula applies.

The Standard is applicable to input values of CIELAB L*, a*, b* coordinates calculated according to ISO 11664-4:2008(E)/CIE S 014-4/E:2007. The Standard may be used for the specification of the colour difference between two colour stimuli perceived as belonging to reflecting or transmitting objects. This includes displays, if they are being used to simulate reflecting or transmitting objects and if the tristimulus values representing the stimuli are appropriately normalized. The Standard does not apply to colour stimuli perceived as belonging to areas that appear to be emitting light as primary light sources, or that appear to be specularly reflecting such light.

This Standard has been approved by the CIE National Committees and by ISO.

CIE 177:2007

'Colour Rendering of White LED Light Sources'

The Committee recommends the development of a new colour rendering index (or a set of new colour rendering indices) by a Division 1 Technical Committee. This index (or these indices) shall not replace the current CIE colour rendering index immediately. The usage of the new index or indices should provide information supplementary to the current CIE CRI, and replacement of CRI will be considered after successful integration of the new index. The new supplementary colour rendering index (or set of supplementary colour rendering indices) should be applicable to all types of light sources and not only to white LED light sources. Possibilities for an improved description of colour rendering are summarized in the Appendix of this Technical Report.

IEC/TR 62732:2012

'Three-digit code for designation of colour rendering and correlated colour temperature'

Describes how to construct a three-digit code, representing a shorthand string combining the nominal general colour rendering index and the nominal correlated colour temperature.

H.17 Standards, guides etc. on light measurement and photometry

EN 13032-1:2004+A1:2012:

'Light and lighting — Measurement and presentation of photometric data of lamps and luminaires — Part 1: Measurement and file format.'

This European Standard establishes general principles for the measurement of basic photometric data for lighting application purposes. It establishes the measurement criteria needed for the standardisation of basic photometric data and details of the CEN file format for electronic data transfer. This is part 1 of a multi-part standard. Part 1 deals with the basic photometric measurement and file format. Other parts deal with lamps and luminaires data depending on the applications.

Identified gaps:

Despite of this accepted European standard, in practice the sector often uses another file format (EULUMDAT, IES, CIBSE, ..).

A photometry file reduces a luminaire to a point source which can be inaccurate to model a distributed light source such as a large LED panel luminaire (e.g. OLED), therefore more sophisticated file formats are being developed (e.g. IES TM-25-13).

EN 13032-2:2004/AC:2007:

'Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 2: Presentation of data for indoor and outdoor work places.'

This document specifies the required data for lamps and luminaires for the verification of conformity to the requirements of EN 12464-1 and prEN 12464-2. It also specifies data that are commonly used for lighting of indoor and outdoor work places. When these data are provided, they should conform to this document

When the room parameters, the luminaire data (according to EN 13032-1(2004)) are known this method allows to calculate the defined functional unit based on the Utilisation Factor (UF) method.

EN 13032-3:2007:

'Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 3: Presentation of data for emergency lighting of work places'

This standard specifies the required data for lamps and luminaires to verify conformity with EN 1838. This standard does not define the data requirements for signage, as these can be found in EN 1838.

prEN 13032-4:201X (under approval in 2014):

'Light and lighting - Measurement and presentation of photometric data - Part 4: LED lamps, modules and luminaires'

This European Standard specifies the requirements for measurement of electrical, photometric, and colourimetric quantities of LED lamps, modules, light engines and luminaires, for operation with AC or DC supply voltages, possibly with associated control gear. Photometric and colourimetric quantities covered in this standard include total luminous flux, luminous efficacy, partial luminous flux, luminous intensity distribution, centre-beam intensities, luminance and luminance distribution, chromaticity coordinates, correlated colour temperature (CCT), Colour Rendering Index (CRI), and spatial uniformity of chromaticity. This standard does not cover LED packages and products based on OLEDs (organic LEDs). NOTE Where the term "LED product, LED device or DUT (device under test)" is used, the term covers LED lamps, modules, light engines or luminaires.

IES TM-25-13:

'*Ray File Format for the Description of the Emission Property of Light Sources*.'

This guideline provides recommendations for a standard ray file format to describe the emission properties of light sources. The ray file format contains information necessary to interface between ray tracing or other optical design, simulation, analysis and metrology software used in lighting applications.

CIE 102:1993

'Recommended file format for electronic transfer of luminaire photometric data'

In order to calculate the light striking a surface or leaving that surface from one or a group of man-made and installed luminaires, it is necessary to know the light intensity distribution at all spherical angles from each luminaire that contributes light to that surface. The advent of personal micro-computers has made it possible for each technical person to perform his own calculations using a suitable application program. It is common practice to record the light intensity at a large number of spherical angles from a specific luminaire (photometric data set) onto magnetic media, such as a computer disk. While the standardization of the size, shape and other technical features between disks and computers has been done by others, it is necessary for the computer program reading data from the disk to know the sequence of data being transmitted about the luminaire, light source, and angles at which the data has been recorded. This is termed the "file format".

While many countries, and companies within countries, have already adopted a specific file format it is necessary to have an international file format so that the photometric data set specific to a particular country can be translated (by computer program) into the international

file format; or that a photometric data set received in the international file format, can be translated (by computer program) into the specific file format used in a particular country or a specific application program developed by an individual or company.

The CIE Recommended File Format is not intended to be used for manual calculations to determine the specific light intensity at a specific angle, but rather to be easily read, without error, into a computer program, either for translation into another format, or for calculation of the results of a lighting installation.

CIE S 010/E:2004 (ISO 23539:2005)

'*Photometry - The CIE system of physical photometry*'

The visual brightness of a light source depends not only on the amount of radiation it emits but also on its spectral composition and on the visual response function of the observer viewing it. Because human visual response varies at different light levels and from person to person, precise photometry requires the definition of representative standard observers. The CIE system of physical photometry specifies procedures for the quantitative evaluation of optical radiation in terms of the spectral luminous efficiency functions of two such standard observers. One, V(lambda), represents photopic vision and the other, V'(lambda), scotopic vision. Used in conjunction with the SI photometric base unit, the candela, these functions constitute a system that enables the values of photometric quantities for all types of luminous source to be precisely determined, regardless of the spectral composition of the radiation emitted.

This international Standard specifies the characteristics of the system of physical photometry established by the CIE and accepted as the basis for the measurement of light. It defines the photometric quantities, units and standards that make up the CIE system of physical photometry and that have been officially accepted by the Comité International des Poids et Mesures. They comprise:

•the definition of photometric quantities and units,

•the definition of CIE standard spectral luminous efficiency functions for photopic and scotopic vision,

•the definition of a CIE standard photometric observer that conforms to these functions,

•the definition of maximum luminous efficacies for photopic and scotopic vision.

An informative annex provides a vocabulary of related terms.

CIE 018.2:1983

'The Basis of Physical Photometry, 2nd ed.'

This publication describes the basic conventions and principles of modern physical photometry and explains how physical photometry relates to radiometry on the one hand, and to vision on the other. It outlines the fundamentals of the broad-band spectroradiometric and the visual methods of photometry. The principal physical standards for measuring photometric quantities are described, relevant radiometric quantities are defined, and the results of major international intercomparisons of photometric measurements are summarized.

CIE 041:1978

'Light as a true visual quantity: Principles of measurement'

This Technical Report summarizes visual photometric measurement methods which can provide visually meaningful assessments of light. They can be more complicated than the simple use of of a V(lambda)-corrected physical photometer, and in addition require some understanding of the visual system and how it works. Their advantage is that the assessment of light bears a logical relationship to the human perception of light.

For photopic vision [35] and luminances larger than several cd/m2, ordinary physical photometers corrected to V(lambda) give visually accurate measures for small, centrally fixed, broad-band lights. For other applications, a different luminous efficiency function should be employed. In order to utilize the appropriate function, one must either measure the spectral distribution of radiant power directly or correct the V(lambda) response of the photometer to the appropriate luminous efficiency. An alternative solution is to calculate mathematical formulas specifically developed for this purpose. This method is potentially the most useful since different formulas can be developed for different applications (for example, two degree or ten degree fields).

It is based on established CIE data, and no additional measures need to be developed.For scotopic vision, an assessment of radiant power is made with respect to the scotopic luminous efficiency function V'(lambda) by means of an appropriately corrected physical photometer, by radiance measurement, or by visual photometry. In mesopic photometry, the photopic and scotopic contributions of the light must be assessed. An estimate can be obtained by combining the photopic and scotopic luminances non-linearly. A more precise measure can be obtained by using three or, still better, four quantities based on X10, Y10, Z10, and V'(lambda).

CIE 043:1979

'Photometry of floodlights'

This technical report recommends the adoption of test procedures that will provide acceptable results in measuring and reporting the photometric characteristics of floodlights. The recommendations are intended to provide a basis for uniform national standards, and to guide industrial photometric laboratories in the selection of test apparatus, conduct of tests, and presentation of floodlight performance data.

[35] **Photopic vision** is the vision of the eye under well-lit conditions. In humans and many other animals, photopic vision allows colour perception, mediated by cone cells, and a significantly higher visual acuity and temporal resolution than available with scotopic vision.

The human eye uses three types of cones to sense light in three bands of colour. The biological pigments of the cones have maximum absorption values at wavelengths of about 420 nm (blue), 534 nm (Bluish-Green), resp. 564 nm (Yellowish-Green). Their sensitivity ranges overlap to provide vision throughout the visible spectrum. The maximum efficacy is 683 lm/W at a wavelength of 555 nm (green).

The wavelengths for when you are in photopic vary with the intensity of light. For the blue-green region (500 nm), 50% of the light reaches the image point of the retina.

Adaptation is much faster under photopic vision. Adaptation can occur in 5 minutes for photopic vision but it can take 30 minutes to transition from photopic to scotopic.

Most older adults lose photopic spatial contrast sensitivity. Older adults in their 70s require about three times for more contrast to detect high spatial frequencies than young adults in their 20s.

The human eye uses **scotopic vision** under low-light conditions, and **mesopic vision** in intermediate conditions. (source: http://en.wikipedia.org/wiki/Photopic_vision)

CIE 063:1984

'The spectroradiometric measurement of light sources'

The CIE and other organizations have conducted international comparisons of measurements of the spectral power distribution of light sources, including fluorescent tubes. In these comparisons, some unexpectedly large differences were found between the results reported by different laboratories. CIE specialists concluded that before further large-scale international comparisons of measurements are organized, a method (or a few basic methods) should be agreed upon that would result in better accuracy and, hence, closer agreement between the measurements of participating laboratories. International agreement on such methods would also serve as a guide in setting up new spectroradiometric laboratories.

The first part of the report covers, in a general way, the use of a spectroradiometer for measuring the spectral power distribution of light sources, with particular reference to the determination of photometric and colourimetric properties.

The second part relates to the measurement of individual lamp types, particularly tubular fluorescent lamps. The report is designed to assist workers in industrial standards laboratories, but is not intended for use as a textbook.

CIE 067:1986

'Guide for the photometric specification and measurement of sports lighting installations'

The purpose of this report is to establish standard procedures for the calculation, measurement, and reporting of the illuminance characteristics of interior and exterior sports lighting installations. These procedures make it possible to compare the performance of alternative lighting systems on a common basis at the design stage of the project, and to relate it directly to on-site illuminance measurements of the completed lighting installation. A number of alternative approaches are given which allow the user or specifier to select a procedure suited to a particular project.

CIE 070:1987

'The measurement of absolute luminous intensity distributions'

This report contains the terminology required for measurements of luminous intensity distributions. It summarizes the principles of luminous intensity measurements and the requirements for the photometer heads employed for such measurements. The coordinates systems used for the measurement and representation of luminous intensity distributions are described. Types of goniophotometers, possibilities for angle encoding, characteristics of the photo-electronic system, and data acquisition and processing for measurements of luminous intensity distributions are discussed in detail.

Other subjects covered are power supply, measurement conditions and execution, correction, and representation of luminous intensity distribution measurements. The various sections contain sufficient data on the required characterization of goniophotometers. The report is based on, and supplementary to, CIE 53-1982 Methods of Characterizing the Performance of Radiometers and Photometers.

CIE 084:1989

'Measurement of luminous flux'

This technical report defines the terminology required for luminous flux measurements. It then deals with the principles of luminous flux measurements and describes methods for the evaluation of the illuminance distribution, the measurement of luminous flux by means of an integrating sphere photometer and the determination of luminous flux via luminance, luminous intensity and luminance measurements.

The report is based on and replaces CIE 25-1973, Procedures for the measurement of luminous flux of discharge lamps and for their calibration as working standards, and on the conclusions of the CIE-Symposium on light and radiation measurement '81. The terminology follows that in the International Lighting Vocabulary.

CIE 121:1996

'The photometry and goniophotometry of luminaires'

This technical report provides general requirements for the photometry of lamps and luminaires of most types and includes the following information:

* standard test conditions under which the tests should be carried out, with acceptable practical tolerances;
* selection procedures for lamps and luminaires;

* procedures for measurement of the photometric characteristics of lamps and luminaires and assessment of the possible sources of error;

* correction factors and service conversion factors;

* presentation of test results.

The report is considered to be sufficiently comprehensive to form a practical guide for industrial laboratories and contains sufficient information to replace publication CIE 24-1973 Photometry of indoor type luminaires and CIE 27-1973 Photometry of luminaires for street lighting.

CIE will publish supplementary reports covering these types of luminaires more specifically.

CIE 194:2011

'On Site Measurement of the Photometric Properties of Road and Tunnel Lighting'

This Technical Report gives the information which designers and users of automatic systems intended to measure the photometric properties of road and tunnel lighting systems need in order to understand the performance of such systems. The main aim of this guide is to clearly define and describe the technical limitations and characteristics of these measurement systems. In this way the advantages and disadvantages of the technical solutions adopted in different systems can be assessed. Their measurement uncertainty can be evaluated and discrepancies understood when the measurement results are compared with those obtained by manual systems or by theoretical evaluations from mathematical algorithms and/or computer simulations. The guide concentrates on systems that measure horizontal

illuminance and luminance on road surfaces but much of the guidance is relevant to other quantities and measurement conditions. The guide is divided into two parts:

- Review of essential photometric quantities where differences between their physical or normative definition, their mathematical evaluation and their measurable approximation are highlighted (Clause 2 and Clause 3);
- Review of the types and characteristics of instruments, the conditions and methodologies of measurements, the evaluation of uncertainty in measurement results and data elaboration (Clause 5, Clause 6 and Clause 7).

H.18 Standards, guides etc. for glare

CIE 031-1976

'Glare and uniformity in road lighting installations'

Glare in road lighting is distinguished as discomfort and disability glare. Discomfort glare is quantitatively described by a glare control mark which can be calculated from the photometric and geometric quantities of a lighting installation. The evaluation of disability glare is based upon the Holladay formula and expressed by calculating the increment in the threshold of detection of the luminance difference between a relevant object and the road surface. The uniformity of the road surface luminance is characterized by the overall uniformity and the longitudinal uniformity.

CIE 055:1983

'Discomfort glare in the interior working environment'

A state of the art review of discomfort glare in the interior working environment is given, and a CIE mathematical model, or system, is proposed for the prediction of discomfort glare from lighting installations. The first part of the report contains a review of basic principles and methods of glare control and glare prediction systems used in various countries. The second part contains a critical review of research and major current prediction systems. This leads to the proposed CIE system, which incorporates current knowledge insofar as possible.

While this report is not intended to be the final statement on the subject, there has been considerable research to warrant its publication by the CIE. The report will assist countries in revising established systems, and other countries in adopting a particular system. It will also assist lighting students, as well as architects, consultants, and others associated with lighting, in understanding the phenomenon of discomfort and glare and its control.

CIE 112:1994

'Glare evaluation system for use within outdoor sports and area lighting'

This technical report describes a practical glare evaluation system for outdoor sports- and area lighting. The system can be used both for checking the glare situation of existing installations, provided suitable measuring instrumentation is available, and for predicting the degree of glare at the design stage for new installations, but the validity of the system is restricted to viewing directions below eye level. For the main categories of these applications, general glare

rating limits are specified. The report concerns glare and glare restriction in, or very close to, the lighted area and not the effect of spill light outside this area.

The quality of most lighting installations can be expressed in terms of average lighting levels, uniformities and glare restriction. There has not, until now, been a generally accepted glare evaluation system for outdoor areas. The glare concepts, "threshold increment TI" and "glare control mark G" , commonly used in road lighting for motorised traffic, cannot be applied directly for area lighting. This is because the direction of view of observers is variable and not fixed; the lighting points are not necessarily positioned in regular line arrays; and the mounting heights and lighting levels are often outside the ranges for which the road lighting concepts have validity.

The degree to which a lighting installation causes glare depends upon the luminous intensity distribution and aiming of the luminaires, their number, their arrangement and mounting height and on the brightness of the illuminated area. This report describes and recommends for practical use, a glare evaluation system that takes into account all the above factors. The system is based on extensive field tests and has shown its applicability in different installations of adequate uniformity due to common specifications. It is assumed that the problem of intolerable glare experienced, when looking up and straight into a luminaire, is kept to a minimum by paying careful attention to the siting of the luminaires relative to the main directions of view. CIE reports on the lighting of the various kinds of floodlighting application fields give guidance in this respect.

Before a glare evaluation concept can be employed as a practical aid in lighting design, it is necessary to agree on standard observer positions and viewing directions. Standard positions and directions are specified with the intention of getting information on both the highest degree of glare and on the size of the area with a relatively high degree of glare.

For the main categories of outdoor area lighting installations, general glare restriction limits are specified.

CIE 117:1995

'Discomfort glare in interior lighting'

The task of the CIE Technical Committee TC 3-13 was to produce a practical discomfort glare evaluation system.

The Unified Glare Rating (UGR) formula described in this technical report, combines features of the Einhorn and the Hopkinson formulae and incorporates the Guth position index. It may be regarded as being composed of the best parts of the major formulae in terms of practicability and of familiarity with the results of glare prediction. The formula recognises the effects on the glare index of observer position and direction of view.

The report also describes, in the appendices, a tabular method, which uses reference values and standard conditions, allowing the production of simple tables, similar to those for utilisation factors, for use in luminaire data sheets.

A rough estimate of discomfort glare is given by the luminance limiting curve (UGR curve) method. The appendices also show how the curves can be constructed and used.

The report recommends a practical CIE discomfort glare evaluation system for use in the next edition of the CIE Guide on Interior Lighting.

CIE 146:2002

'*CIE Equations for Disability Glare*'

Three disability glare equations have been defined to extend the classic Stiles-Holladay equation to take account of the effect of age, the effect of ocular pigmentation and to extend the angular domain over which the equations are valid. They all describe the veiling luminance L veil (in cd/m²:) due to a point glare source at an angle Theta (in degrees) to the line of sight that gives rise to an illuminance E glare (in lx) in the plane of the observer's eye, and they do so with adequate accuracy within their respective validity domains. The CIE Age-adjusted Stiles-Holladay Disability Glare equation has a restricted validity domain of 1° < Theta < 30° that is extended in the low angular region by the CIE Small Angle Disability Glare equation to the domain of 0,1° &let; Theta &let;30°. The CIE General Disability Glare equation further increases the validity domain to the range of 0,1° &let; Theta &let; 100° and also includes an eye pigmentation factor p which plays a role at glare angles greater than 30°. They all include age A (in years) as a factor. The technical report consists of 14 pages with 8 figures.

CIE 147:2002

'*Glare from Small, Large and Complex Sources*'

The UGR, while valid for "normal" sources between 0,005 m² and 1,5 m² assesses "small" sources (<0,005 m²) too severely and is too tolerant for "large" sources (>1,5 m²). This Technical Report gives formulations and recommendations for small and large sources which agree with research results and practical experience. For "complex" sources, such as specular luminaires, it gives a more realistic glare assessment than that based on average luminance over the full luminaire area.

CIE 190:2010

'Calculation and Presentation of Unified Glare Rating Tables for Indoor Lighting Luminaires'

This report has been prepared to assist luminaire suppliers and lighting designers in the production of UGR tables for luminaires in preset arrays at 1:1 spacing to height ratio. This data is needed for the verification of conformity to the limiting UGR by the UGR tabular method specified in clause 6.2 of the Standard ISO 8995-1:2002(E)/ CIE S 008/E:2001 "Lighting of Workplaces - Part 1: Indoor". The limiting UGR values are recommended in clause 5 of this standard. The report makes use of the basic UGR equation, described in CIE 117-1995, gives tables of preset values for the standard conditions and in step by step describes the calculation process needed to generate the uncorrected UGR table. The process is further demonstrated by a worked example of UGR calculation for a disymmetric distribution luminaire in a room 2H x 4H. The report also gives the uncorrected UGR table for this luminaire which can be used to validate software designed for the production of the UGR table.

H.19 Other standards, guides etc. related to lighting

prEN 50625-2-1 (under drafting):

'Collection, logistics & Treatment requirements for WEEE - Part 2-1: Treatment requirements for lamps'

EN 61995-1:2008

'Devices for the connection of luminaires for household and similar purposes - Part 1: General requirements'

This part of EN 61995-1 applies to devices for the connection of luminaires (DCL) intended for household and similar purposes, for the electrical connection of fixed luminaires to final circuits rated at not more than 16 A without providing mechanical support for the luminaire. DCLs are intended for use according to their IP rating per EN 60529.

EN 61995-2:2009

'Devices for the connection of luminaires for household and similar purposes - Part 2: Standard sheets for DCL'

IEC 61995-2:2009 which is to be read in conjunction with IEC 61995-1, applies to devices for the connection of luminaires (DCL) 250 V, 6 A a.c. intended for household and similar purposes, for the electrical connection to final circuits rated not more than 16 A, without providing mechanical support for the luminaire.

HD 60364-7-715:2012 [36]:

'Low-voltage electrical installations - Part 7-715: Requirements for special installations or locations - Extra-low-voltage lighting installations'

IEC 60364-5-55:2011 The particular requirements apply to extra-low-voltage lighting installations supplied from sources with a maximum rated voltage of 50 V a.c. or 120 V d.c. For the definition of an extra-low voltage lighting system reference should be made to IEC 60598-2-23. This second edition cancels and replaces the first edition, published in 1999, and constitutes a technical revision. The major technical changes with respect to the previous edition are: - the clause numbering is aligned with the present structure of IEC 60364; - references to LED modules and their particular installation requirements have been introduced; - and requirements for cross-sectional area of conductors are modified.

prHD 60364-7-719:2011 (under approval) [37]:

'Low-voltage installations - Part 7-719: Requirements for special installations or locations - Lighting installations for advertising signs with a rated output voltage not exceeding 1 000 V, which are illuminated by hot-cathode-fluorescent-lamps, luminous-discharge tubes (neon-tubes), inductive discharge lamps, light emitting diodes (LED) and/or LED modules'

[36] See note 29
[37] See note 29

EN ISO 24502:2010:

'Ergonomics - Accessible design - Specification of age-related luminance contrast for coloured light (ISO 24502:2010)'

ISO 24502:2010 specifies the age-related luminance contrast of any two lights of different colour seen by a person at any age, by taking into account the age-related change of spectral luminous efficiency of the eye. ISO 24502:2010 provides a basic method of calculation that can be applied to the design of lighting, visual signs and displays. It applies to light, self-luminous or reflected, in visual signs and displays seen under moderately bright conditions called photopic vision and whose spectral radiance is known or measurable. It does not apply to light seen under darker conditions called mesopic or scotopic vision. ISO 24502:2010 specifies the luminance contrast for people aged from 10 to 79 years who have had no medical treatment or surgery on their eyes that may affect their spectral luminous efficiency. ISO 24502:2010 does not apply to visual signs and displays seen by people with colour defects whose spectral luminous efficiency is different from those with normal colour vision, nor those seen by people with low vision.

CIE 123:1997

'Low vision - Lighting needs for the partially sighted'

The report brings together a wide range of material from various specialists to produce, for the first time, a comprehensive annotated review of the subject. It also draws conclusions from the various studies and it is hoped that it will provide the basis for further research. It is intended for all those that have dealings with the visually handicapped and the provision of lighting regardless of their professional discipline.

It summarises the features of the major diseases causing partial sight. It also reviews some studies that have been undertaken into the effects of light on refraction, accommodation and ocular movement, and of its effects on visual functions such as visual acuity, contrast sensitivity, visual field and colour vision.

A section is devoted to the lighting aspects of visual aids, such as neutral and selective absorbing glasses, light amplification systems, high power additions, magnifiers, telescopes, closed circuit television systems, etc. Finally, detailed recommendations are made for the adaptation of a range of lighting environments to the needs of the partially sighted.

CIE 196:2011

'CIE Guide to Increasing Accessibility in Light and Lighting'

This CIE Guide provides fundamental knowledge and data on vision of older people and people with disabilities, as well as design considerations based on that data, in order to facilitate consideration of the needs of older people and people with disabilities.

While there is no clear definition for "older people", this Guide presents data that include samples taken mainly from people over 60 years old. In addition, the visual disabilities addressed are low vision and colour vision defects. Care for totally blind people is not considered as light and lighting issues have no relevance for them, although non-visual issues such as tactile or auditory information for increasing accessibility are vitally important.

H.20 Mandates from European Commission to ESO's

Mandates are the mechanism by which the European Commission (EC) and the EFTA Secretariat request the European Standards Organizations (ESOs) to develop and adopt European standards in support of European policies and legislation.

CENELEC Technical Board has accepted the mandates listed below [38]. (Relevant mandates related to lighting but issued before the year 2000 are not listed, see the reference). For additional information see the database of mandates of the European Commission [39].

H.20.1 Mandate on LED lighting (Feb. 2013) [40]

From the work description:

The Commission requests CEN, CENELEC and ETSI to address gaps and open areas still to be covered, enhanced, or transposed from international to European level, on the basis of a complete overview of (i) international and European standards and regulations in place for LEDs and (ii) **LED lighting** related international and European research results and ongoing standardisation activities, that need to be fully taken into account. There is also a need to define adequate measurement and testing methodologies and parameters, which are not yet put in place.

Indicated Key areas:

- LED luminaire lifetime
- Standard definition for acceptable colour shift or power consumption over the lifetime of an LED luminaire
- Enhanced quality of light metric definitions (CRI vs. CQS, PSD for LEDs)
- Standards for flicker and stroboscopic effects
- Standards on test methods for photometric and colourimetric performance of LED lamps, LED luminaires, and LED modules
- CEN standard prEN 13032-4 'Lighting Applications — Measurement and presentation of photometric data of lamps and luminaires — Part 4: LED-lamps, modules and luminaires', to be completed

The mandate further specifies that Standards should also be developed, completed or transposed for:

– quality performance requirements for LED components,
– performance for LED lamps with supply voltage greater than 50V, LED modules and luminaires,
– lifetime prediction of LED modules, LED lamps and LED luminaires (see also "LED luminaire lifetime" above). The standard should initially provide a means of confirming manufacturers' claims, including input power, up to 25 % of lifetime with maximum of 6000 hours. This work should then be followed by a standard with requirements to cover the full lifetime reliability claims,
– performance for LED lamps with supply voltage smaller than or equal to 50V,
– performance for double-capped LED lamps (retrofit),
– OLED performance for the OLED luminaire lifetime requirements,

[38] Information taken from (accessed May 2014) : http://www.cenelec.eu/aboutcenelec/whatwestandfor/supportlegislation/europeanmandates.html
[39] http://ec.europa.eu/enterprise/policies/european-standards/standardisation-requests/index_en.htm
[40] MANDATE ADDRESSED TO CEN, CENELEC AND ETSI TO DEVELOP STANDARDISATION IN THE FIELD OF LIGHT EMITTING DIODES (LEDS), M/519, 12 February 2013, ftp://ftp.cencenelec.eu/CENELEC/EuropeanMandates/M_519.pdf

– binning of LED components (luminous flux, forward voltage),
– control gear measurement of energy efficiency,
– interconnections between components and LED device (e.g. LED package, LED array (module), LED lamp, LED light engine) at the LED luminaire and lighting systems level; interoperability of thermal, electrical, photometrical and mechanical interfaces,
– interconnections between components, and LED module control gear and LED module at the LED systems level,
– interoperability between LED lamps, modules, control gear and LED luminaire and lighting systems and energy management systems (including stand alone control devices) in existing and new installations,
– interconnection between LED lighting systems and other lighting systems in indoor and outdoor environments,
– power factor in terms of the distortion and displacement components.
– LED street lighting application performance.

H.20.2 Mandate in the field of the WEEE directive (Jan. 2013) [41]

To develop one or more European standard(s) for the treatment (including recovery, recycling and preparing for re-use) of waste electrical and electronic equipment, reflecting the state of the art.

The standard(s) shall cover the collection of WEEE where it is crucial that such collection is carried out in specific ways in order to allow for proper treatment. For example, coverage of options for the **proper collection of compact fluorescent lamps (CFLs)** is very relevant for later treatment.

H.20.3 Mandate in the field of the RoHS directive (Oct. 2011) [42]

The formulation of the mandate is quite generic and does not specifically mention lighting products. The Directive is relevant for lighting products however, at least from the point of view of mercury-content of some lamp types.

H.20.4 Mandate in the field of the ECOdesign directive (Oct. 2011) [43]

The general objective of this mandate is to provide European standards to enable the implementation of the Ecodesign Directive 2009/125/EC and its implementing measures.
When Energy labelling requirements are introduced together with Ecodesign requirements for some product groups, this mandate also aims at providing European standards to enable the implementation of the Energy Labelling Directive 2010/30/EU and its supplementing measures.
Consequently, harmonised standards could be requested to provide:
• Methods to measure and test the environmental parameters of energy-related products

[41] MANDATE TO THE EUROPEAN STANDARDISATION ORGANISATIONS FOR STANDARDISATION IN THE FIELD OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (DIRECTIVE 2012/19/EU (WEEE)), M/518, 24 January 2013, ftp://ftp.cencenelec.eu/CENELEC/EuropeanMandates/M_518.pdf

[42] MANDATE TO CEN, CENELEC AND ETSI IN THE FIELD OF THE RESTRICTION OF THE USE OF CERTAIN HAZARDOUS SUBSTANCES IN ELECTRICAL AND ELECTRONIC EQUIPMENT (ROHS RECAST DIRECTIVE 2011/65/EU), M/499, 21 October 2011, ftp://ftp.cencenelec.eu/CENELEC/EuropeanMandates/M_499.pdf

[43] Standardisation mandate to CEN, CENELEC and ETSI under Directive 2009/125/EC relating to harmonised standards in the field of Ecodesign, M/495, 27 July 2011, ftp://ftp.cencenelec.eu/CENELEC/European Mandates/M_495.pdf

- Methods to adequately present and display environmental information on energy-related products
- Methodological guidance how to perform a life-cycle analysis and establish the product‟s eco-profile to assess alternative design options for energy-related products
- Methods to assess the environmental performance of energy-related products

H.20.5 Mandate in the field of lamps and ballasts (Feb. 2011) [44]

The Commission requests CEN, CENELEC and ETSI to elaborate (a) reliable, accurate and reproducible European standard(s), which take(s) into account the generally recognised state of the art, and/or adopt or adapt existing European and International standards for the targeted products, laying down procedures and methods of measuring the following product parameters:

(1) for fluorescent and high-intensity discharge lamps, the spectral radiation, the luminous flux, the power consumption, the lamp lumen maintenance factor, the lamp survival factor, the chromaticity, the correlated colour temperature, the colour rendering, the specific effective radiant ultraviolet power, the lamp caps and the total mercury content;

(2) for ballasts able to operate fluorescent and high-intensity discharge lamps, the input power of the lamp-ballast circuit, including when the operated lamps do not emit any light in normal operating conditions;

(3) for luminaires able to operate fluorescent and high-intensity discharge lamps, the power consumption when the operated lamps do not emit any light in normal operating conditions, the ingress protection grading, the CEN flux code and the photometric file;

(4) for luminaires for office lighting, the luminaire maintenance factor;

(5) for luminaires for street lighting, the luminaire maintenance factor, the utilisation factor and the Upward Light Output Ratio.

The standard(s) has / have also to include the necessary definitions of the parameters to be measured, taking into account the definitions provided in the Regulation (EC) N°245/2009 amended by Regulation (EU) N°347/2010.

For a more detailed description see the reference.

H.20.6 Mandate for standby power (Dec. 2008) [45]

The Commission requests CEN, CENELEC and ETSI to elaborate a reliable, accurate and reproducible standard, which takes into account the generally recognised state of the art, *and/or* adopt or adapt existing European and International standards for EuPs meeting these requirements, laying down procedures and methods of measuring the consumption of electric power of EuPs. The standard has to include at least electrical and electronic household and office equipment in stand-by and in off mode, and, if appropriate, operating conditions with characteristics similar to those of standby and/or off mode.

[44] MANDATE TO CEN, CENELEC AND ETSI FOR STANDARDISATION IN THE FIELD OF FLUORESCENT LAMPS, HIGH-INTENSITY DISCHARGE LAMPS, AND BALLASTS AND LUMINAIRES ABLE TO OPERATE SUCH LAMPS, M/485, 2 February 2011, ftp://ftp.cencenelec.eu/CENELEC/EuropeanMandates/m485en.pdf

[45] Mandate to CEN, CENELEC and ETSI for Standardisation in the field of standby and off modes power consumption measurement for energy using products (EuPs), M/439, 17 December 2008, ftp://ftp.cencenelec.eu/CENELEC/EuropeanMandates/m439en.pdf

H.20.7 Mandate for ECOdesign (Jan. 2004) [46]

CEN/CENELEC/ETSI are asked to draw up a comprehensive standardisation programme with a view to producing standards which will assist the realisation of the objectives of the draft Directive, which are to improve the overall environmental performance of EuP and ensure free movement of compliant equipment in the internal market. Such standards should help the manufacturers to comply with the requirements of the future implementing measures, to be proposed by the Commission after the adoption of the EuP framework Directive by Council and EP. In this context these standards should clearly indicate the relationship between their clauses and the requirements dealt with. Standardisation efforts on the following items should be considered in particular regarding:

- use of materials derived from recycling activities
- use of substances classified as hazardous to health and/or the environment according to Directive 67/548/EEC and taking into account legislation on the marketing and use of specific substances, such as 76/769/EEC or 2002/95/EC.
- use of consumables
- energy consumption throughout the life cycle
- water consumption throughout the life cycle
- Ease for reuse and recycling as expressed through: number of materials and components used, marking of plastics according to ISO, use of standard components, time necessary for disassembly
- Avoidance of technical solutions potentially detrimental to reuse and recycling of components and whole appliances
- Extension of lifetime as expressed through: minimum guaranteed lifetime, minimum time for availability of spare parts
- Amounts of waste generated and amounts of hazardous waste generated
- Emissions to air (greenhouse gases, acidifying agents, volatile organic compounds, ozone depleting substances, persistent organic pollutants, heavy metals, fine particulate and suspended particulate matter)
- Emissions to water (heavy metals, substances with an adverse effect on the oxygen balance, persistent organic pollutants)
- Pollution through physical agents (noise, vibration, radiation, electromagnetic fields)

[46] MANDATE TO CEN/CENELEC/ETSI FOR PROGRAMMING OF STANDARDIZATION WORK IN THE FIELD OF ECO-DESIGN OF ENERGY-USING PRODUCTS, M/341, 7 January 2004, ftp://ftp.cencenelec.eu/CENELEC/EuropeanMandates/m341en.pdf

H.21 Zhaga interface specifications for LED lighting [47]

Zhaga is a consortium of manufacturers of LED Lighting Products, in particular of LED Light Engines (LLE, see definition below) and LED luminaires.

In May 2014 Zhaga had around 45 regular members (with right to vote) and additional hundreds of associate members. Members are spread worldwide and include all major manufacturers of LED lighting products.

The Zhaga consortium develops Interface Specifications that enable the interchangeability of LED lighting products made by different manufacturers. In particular these Specifications, called 'Books' by Zhaga, describe the interfaces between LED Light Engines and LED Luminaires.

The aims of the Zhaga consortium are:

- acceleration of the adoption of LED lighting worldwide;
- increase customer confidence in LED lighting;
- ensure that future better performing LLE's will adequately combine with existing luminaires;
- enable manufacturers of LED luminaires and manufacturers of LED Lighting Engines to develop their products separately while ensuring that they can be correctly matched later;
- enable luminaire manufacturers to choose between LLE's from different producers without the need to change the luminaire design, in order to avoid dependency on a single supplier;
- enable professional Installers to replace the LED Light Engine in an existing luminaire (for example in the case of street lighting);
- enable consumers to replace a socketable LED Light Engine in a consumer luminaire (not all LLE's are intended for substitution by the consumer).

To obtain a Zhaga certification for their products, manufacturers first have to test their products in-house according to the Zhaga specifications, creating a Product Data Set. They then offer their product together with the Data Set to an independent Authorized Testing Centre, which will issue a test report. With this report the manufacturer contacts the Zhaga Logo License Administrator, which will release the product certification together with the Verified Product Data Set. These latter datasets enable installers and consumers to check the compatibility of a specific LLE with a specific Luminaire. Zhaga maintains an on-line database of certified products (163 in total in May 2014). Once licensed, the manufacturers can declare that their products are Zhaga Certified/Compatible and use the Zhaga logo:

Zhaga activities do NOT cover the use of LED lamps as retrofits, i.e. the substitution of non-LED lamps (LFL, CFL, HL, GLS, HID) by LED lamps in the same existing fixtures / holders / luminaires.

In addition **Safety requirements are explicitly out of the scope of the Zhaga Books**: individual manufacturers are responsible that their products comply with applicable international and national safety regulations.

[47] The information in this paragraph has been taken from : http://www.zhagastandard.org/ (accessed May 2014)

The Zhaga Specifications now (May 2014) consists of 8 Books with 3 additional Books in preparation (Figure 80).

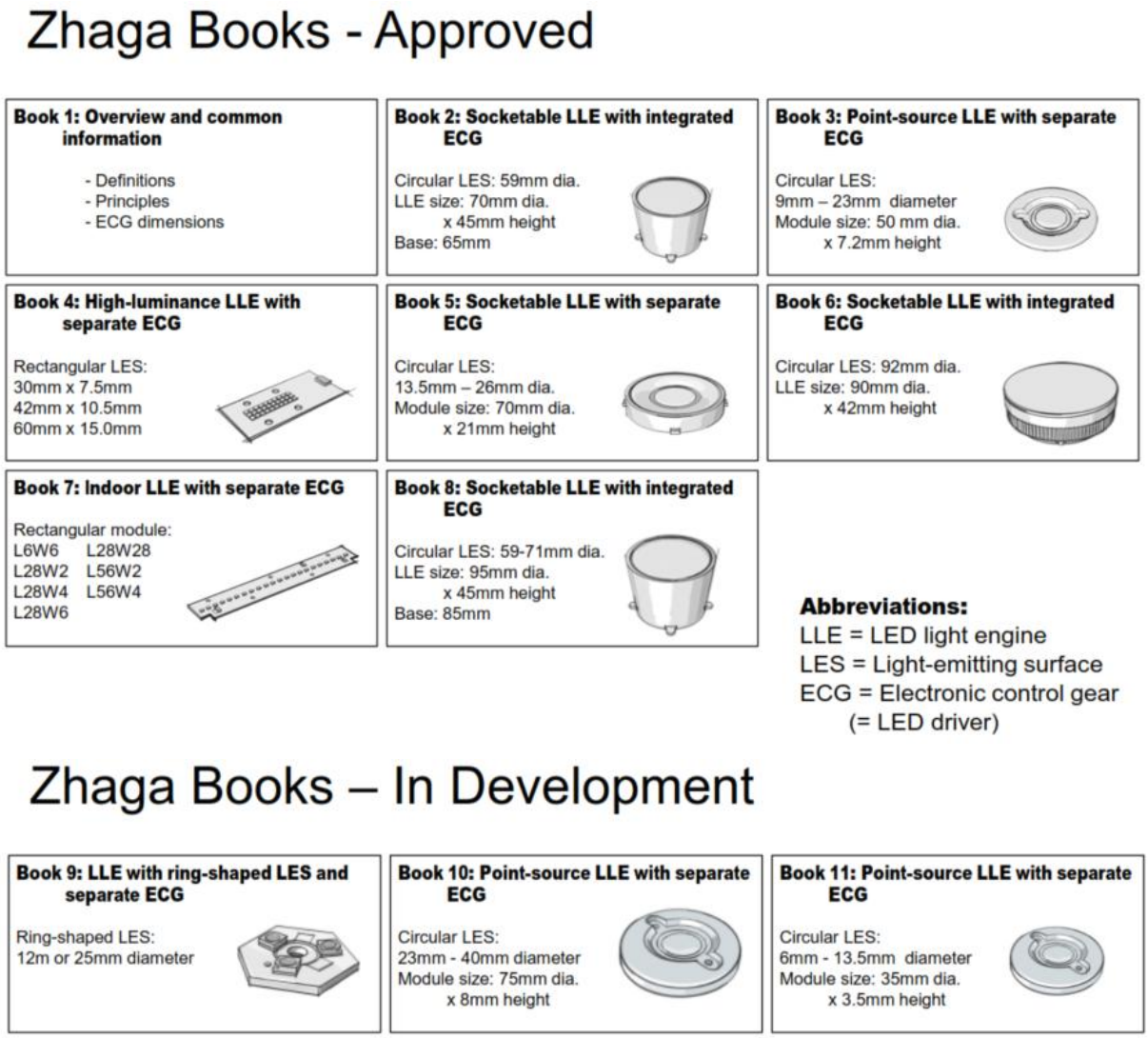


Figure 80 "Books" (Interface Specifications) of the Zhaga Consortium (source: "Overview of Zhaga Books", http://www.zhagastandard.org/specifications/ , accessed May 2014)

Selected Zhaga definitions:

Zhaga defines an **LED Luminaire** as [48]:

> *"a lighting fixture which provides an appropriate environment for one or more LED Light Engines. A Luminaire typically (but not necessarily) is comprised of a heat sink to carry away the heat generated in the LLEs, optical features to reshape the light beam of the LLEs, means to supply electrical power to the LLEs, and means to attach the Luminaire to a wall, ceiling, stand, etcetera."*

An **LED Light Engine** is defined as:

[48] These definitions are described and illustrated in "Zhaga Interface Specification Book 1: Overview and Common Information", accessible through: http://www.zhagastandard.org/specifications/book-1.html

"a combination of one Electronic Control Gear and one or more LED Modules."

An **LED Module** is defined as:

"a light source that is supplied as a single unit. In addition to one or more LEDs, their mechanical support and their electrical connection, it may contain components to improve its optical, thermal, mechanical and electrical properties, but it does not include the Electronic Control Gear"

The **Electronic Control Gear** (ECG, also named LED Driver) is defined as:

"a unit that is located between the External Power and one or more LED Modules to provide the LED Module(s) with an appropriate voltage or current. It may consist of one or more separate components, and may include additional functionality, such as means for dimming, power factor correction, and radio interference suppression."

If the LED Module(s) and the ECG are in the same housing the LLE is said to be with "***Integrated ECG***"; if they are in separate housings the LLE is with "***Separate ECG***".

In addition Zhaga distinguishes between a "***Socketable*** LLE or Module" (which fits into a certified holder) and a "***Non-Socketable*** Module" (which is attached by means of screws).

Zhaga aims at Interchangeability of LLE's, meaning that different LLE's, from the same or different manufacturers, have the same functionality. A distinction is made between Compatibility and Interchangeability. An LLE is "***Compatible*"** with a Luminaire if the combination matches mechanically, electrically and thermally and functions as intended. An LLE is "***Interchangeable***" with another LLE (in a given Luminaire) if they also have comparable photometric and dimming characteristics.

The interface aspects considered by Zhaga to enable interchangeability are:

- Mechanical / geometrical
- Electrical
- Thermal
- Photometric
- Control

As regards the **Photometric Interface**, Zhaga defines a **Light Emitting Surface (LES)** as:

"a surface associated to an LED Light Engine with specific dimensions, position and orientation through which the light is emitted and that has the following characteristics:

- *All substantial light generated by the LED Light Engine is emitted through this surface.*
- *The centre of the Light Emitting Surface coincides with the reference point of the luminous intensity distribution.*
- *The LES is generally described by simple geometrical shapes, e.g. circles or rectangles. It has a physical boundary or is a virtual surface in the surrounding area of the LLE."*

This LES serves as a reference for luminance measurements. The test procedure for the determination of the **total luminous flux** is contained in the Zhaga specifications themselves but refers to the standard **IES-LM-79-08** [49].

[49] [IES-LM-79-08]: IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

Zhaga Book 1 defines **Luminous flux categories** (Table 17), that shall be reported in the Product Data Set. For reporting the luminous flux on the datasheets of LLE's the flux category shall be used: the actual luminous flux in lm is not directly reported.

Book 1 in addition defines the **Luminous Intensity Distribution** and the **Luminous Uniformity**. The luminous intensity distribution is defined in terms of Relative Partial Luminous Fluxes. The Relative Partial Luminous Flux is the percentage of the total luminous flux emitted into the rotationally symmetric solid angle bounded by the polar angles $\gamma 1$ and $\gamma 2$, as shown in Figure 81.

Beam angles shall be defined as in **IEC 61341:2010** and categorised as shown in Table 18.

As regards colours, for the definition of the **Correlated Colour Temperature** the Zhaga specification refers to the standard **ANSI C78.377** [50] and for the **Colour Rendering Index** to **CIE 13.3**.

If the LLE supports **dimming functionality**, it shall comply with the provisions of [**NEMA SSL 7A**] [51].

[50] [ANSI C78.377] American National Standard for electric lamps—Specifications for the Chromaticity of Solid State Lighting Products, ANSI NEMA ANSLG C78.377

[51] [NEMA SSL 7A] Phase Cut Dimming for Solid State Lighting: Basic Compatibility, NEMA SSL 7A-2013.

luminous flux category	Minimum luminous flux [lm]	Typical luminous flux [lm]	Maximum luminous flux [lm]
C001	90	100	200
C002	180	200	300
C003	270	300	400
C004	360	400	600
C006	540	600	800
C008	720	800	1100
C011	990	1100	1500
C015	1350	1500	2000
C020	1800	2000	2500
C025	2250	2500	3000
C030	2700	3000	4000
C040	3600	4000	5000
C050	4500	5000	6000
C060	5400	6000	7000
C070	6300	7000	8000
C080	7200	8000	10000
C100	9000	10000	12500
C125	11250	12500	16000
C160	14400	16000	20000
C200	18000	20000	25000
C250	22500	25000	30000
C300	27000	30000	40000
C400	36000	40000	50000
C500	45000	50000	70000
C700	63000	70000	90000
C900	81000	90000	120000

Table 17 Luminous Flux Categories according to Zhaga Book 1

Beam angle category	Minimum beam angle (°)	Maximum beam angle (°)
6	3	9
12	9	15
17,5	15	21
25	21	29
35	29	41
55	41	70
90	70	110
120	110	150

Table 18 Beam Angle Categories according to Zhaga Book 1

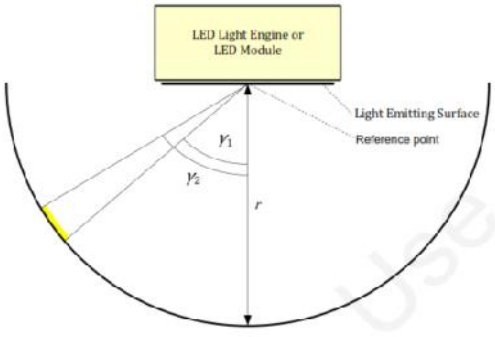


Figure 81 Rotationally symmetric solid angle bounded by polar angles g1 and g2 used for definition of Relative Partial Luminous Flux.

Annex I. TEST METHODS

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Argentina	Ballast	Fluorescent	IRAM 62407	IRAM 62407		Ballasts for fluorescent lamps	
Argentina	Ballast	Fluorescent	IRAM 62407			Ballasts for fluorescent lamps	
Argentina	Lamp	Fluorescent double cap	IRAM 62404-2	IRAM 62404-2	Performance/ measurement	Energy efficiency labelling of electric lamps for general lighting. Part 2: Fluorescent lamps.	
Argentina	Lamp	Fluorescent double cap	IRAM 62404-2		Performance/ measurement	Energy efficiency labelling of electric lamps for general lighting. Part 2: Fluorescent lamps.	
Argentina	Lamp	Incandescent / halogen	IRAM 62404-1	IRAM 62404-1	Performance/ measurement	Energy efficiency labelling of electric lamps for general lighting. Part 1: Incandescent lamps.	
Argentina	Lamp	Incandescent / halogen	IRAM 62404-1		Performance/ measurement	Energy efficiency labelling of electric lamps for general lighting. Part 1: Incandescent lamps.	
Australia	Ballast	Fluorescent	AS/NZS 4783.1:2001	AS/NZS 4783.1:2001		Performance of electrical lighting equipment - Ballasts for fluorescent lamps - Method of measurement to determine energy consumption and performance of ballasts lamp circuits	
Australia	Ballast	Fluorescent	AS/NZS 4783.2:2002 Performance of electrical lighting equipment - Ballasts for fluorescent lamps - Energy labelling and minimum energy performance standard requirements	AS/NZS 4783.1:2001		MEPS DOES apply to the following types of ballasts: • ferromagnetic and electronic ballasts used with linear fluorescent lamps from 15W to 70W; • rated for 50 Hz and 230/240/250V supply (or a range that includes these); • ballasts supplied as separate components or as part of a luminaire. MEPS DOES NOT apply to the following types of ballasts: • primarily for use on DC supplies or batteries; • primarily for the production of light (radiation) outside the visible spectrum; • to exit signs within the scope of AS/NZS 2293; • to hazardous area lighting equipment within the scope of AS/NZS 2380, AS/NZS 60079 and AS/NZS 61241.	
Australia	Ballast	Fluorescent	AS/NZS4783.2: Performance of electrical lighting equipment - Ballasts for fluorescent lamps Part 2: Energy labelling and minimum energy performance standards requirements	AS/NZS 4783.1:2001		The ballasts covered by this Standard are the ferromagnetic or electronic type, that are used with fluorescent lamps with a rated lamp power from 10 W to 70 W, for use on 50 Hz supplies of 230/240/250 V or a range which includes one or more of these voltages. This Standard covers ballasts that are supplied as separate components or as part of a luminaire. This Standard does not cover the following ballast-lamp combinations: (a) Primarily for use on d.c. supply or batteries. (b) Primarily for the production of light outside the visible spectrum, ie. 400 nm to 800 nm. (c) For exit signs within the scope of AS/NZS 2293. (d) Hazardous area lighting equipment, within the scope of AS/NZS 2380, AS/NZS 60079 and AS/NZS 61241 Series of Standards.	
Australia	Ballast	Fluorescent	AS3963-1991	AS3963-1991		a.c. supplied electronic ballasts for tubular fluorescent lamps - Performance requirements	Equivalent to IEC60929

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Australia	Ballast	Fluorescent	AS 2643-1991	AS 2643-1991		Fluorescent lamp ballasts of reactive type - Performance requirements	IEC60921
Australia	Ballast	Fluorescent	AS/NZS 4783.1			Ferromagnetic & electronic ballasts for use with fluorescent lamps of rated lamp power 10-70W (linear fluorescent lamps FD15, FD18, FD30, FD36, FD38, FD58, FD70 and pin-based CFLs)	Local test method and European test method (EN 50294) are harmonised
Australia	Ballast	Incandescent / halogen	AS/NZS 4879.1:2008	AS/NZS 4879.1:2008		Performance of transformers and electronic step-down convertors for ELV lamps	
Australia	Ballast	Incandescent / halogen	AS/NZS 4879.2:2010	AS/NZS 4879.1:2008		Performance of transformers and electronic step-down convertors for ELV lamps - Minimum Energy Performance Standards (MEPS) requirements	
Australia	Ballast	Incandescent / halogen	AS/NZS 4879.1			Ferromagnetic & electronic transformers for extra low voltage lighting systems	Local test method and IEC test method IEC 62442-3 (draft) are effectively harmonised
Australia	Lamp	CFLi	AS/NZS 4847.1:2010	AS/NZS 4847.1:2010	Performance/ measurement	Self ballasted compact fluorescent lamps (CFLs)	
Australia	Lamp	CFLi	AS/NZS 4847.2:2010 Self ballasted lamps for general lighting services - Minimum Energy Performance Standards (MEPS) requirements	AS/NZS 4847.1:2010	Performance/ measurement	Self ballasted compact fluorescent lamps (CFLs) with integrated means for controlling starting and stable operation that are intended for domestic and similar general lighting purposes • applies to self ballasted lamps of all voltages and wattages irrespective of the type of lamp cap. • covers lamps that are supplied as individual lamps or part of a luminaire.	
Australia	Lamp	CFLi	AS/NZS 4847.1		Performance/ measurement	Self-ballasted CFLs	Local test method and IEC test method (IEC 60969) are harmonised
Australia	Lamp	Fluorescent double cap	AS/NZS 4782.3(Int):2006	AS/NZS 4782.3(Int):2006	Performance/ measurement	Double-capped fluorescent lamps - Performance specifications - Procedure for quantitative analysis of mercury present in fluorescent lamps	
Australia	Lamp	Fluorescent double cap	AS/NZS 4782.2:2004 Double-capped fluorescent lamps - Performance specifications - Minimum Energy Performance Standard (MEPS) (10-2004)	AS/NZS 4782.1:2004	Performance/ measurement	This Standard specifies Minimum Energy Performance standard (MEPS) requirements for double-capped (FD and FDH) tubular fluorescent lamps with a nominal length of 550 mm to 1500 mm and having nominal lamp wattage of 16 watts or more, that are within the scope of AS/NZS 4782.1. This Standard covers lamps for general illumination purposes, for use in luminaires and with lamp ballasts connected to a 230 V 50 Hz single phase or similar mains supply. Lamps that are intended for use only with high frequency (electronic) ballasts are also covered.	IEC 60081:2000, Modified
Australia	Lamp	Fluorescent double cap	AS/NZS 4782.1		Performance/ measurement	Double-capped (FD and FDH) tubular fluorescent lamps with nominal length 550-1500mm and nominal lamp power 16W+	Local test method and IEC test method (IEC 60081) are harmonised
Australia	Lamp	Incandescent / halogen	AS/NZS 4934.2(Int):2008 Incandescent lamps for general lighting services - Minimum Energy Performance Standards (MEPS) requirements	AS/NZS 4934.1(Int):2008	Performance/ measurement	General purpose incandescent lamps (tungsten filament and tungsten halogen) The intended timeline for certain lamps being subject to MEPS is as follows: Lamp Types Sales Restriction From • Tungsten incandescent GLS lamps • ELV halogen non reflector 1 November 2009 • >40W Candle, fancy round and decorative lamps • ELV halogen reflector	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						October 2010 • Mains voltage halogen non-reflector 1 January 2011 • Mains voltage reflector lamps including halogen (PAR, ER, R, etc) • >25 W Candle fancy round and decorative lamps October 2012 • Pilot lamps 25W and below To be determined dependent on availability of efficient replacement product	
Australia	Lamp	Incandescent / halogen	AS/NZS 4934.1(Int):2008	AS/NZS 4934.1(Int):2008	Performance/ measurement	Incandescent lamps for general lighting service	
Australia	Lamp	Incandescent / halogen	AS/NZS 4934.1(Int):2008		Performance/ measurement		
Bangladesh	Ballast	Fluorescent	BDS IEC 60921:2005	BDS IEC 60921:2005		Specification for ballasts for tubular fluorescent lamps-performance requirements	
Bangladesh	Ballast	Fluorescent	BDS IEC 60929:2005	BDS IEC 60929:2005		Specification for A.C. supplied electronic ballasts for tubular fluorescent lamps-performance requirements	
Bangladesh	Ballast	Fluorescent	Energy Efficiency and Conservation Rules	BDS IEC 60921:2005 BDS IEC 60929:2005		Ballasts for tubular fluorescent lamps	
Bangladesh	Ballast	Fluorescent	Energy Efficiency and Conservation Rules	BDS IEC 60921:2005 BDS IEC 60929:2005		Ballasts for tubular fluorescent lamps	
Bangladesh	Lamp	CFLi	Energy Efficiency and Conservation Rules	BDS 1761:2006, BDS IEC 60969	Performance/ measurement		
Bangladesh	Lamp	CFLi	Energy Efficiency and Conservation Rules	BDS 1761:2006, BDS IEC 60969	Performance/ measurement		
Bangladesh	Lamp	CFLi	BDS 1761:2006	BDS 1761:2006	Performance/ measurement	Energy efficient rating for self-ballasted lamps	
Bangladesh	Lamp	CFLi	BDS 1734: 2003	BDS 1734: 2003	Performance/ measurement	Self-ballasted lamps. Part of compulsory certification marks scheme	Equivalent to IEC 60969
Bangladesh	Lamp	CFLi	BDS IEC 60969	BDS IEC 60969	Performance/ measurement	Specifications for energy efficiency labelling requirements for compact fluorescent lamps	IEC 60969:2001 ed. 1.2
Bangladesh	Lamp	Fluorescent double cap	BDS IEC 60081: 2006	BDS IEC 60081: 2006	Performance/ measurement	Double capped fluorescent lamps. Part of compulsory certification marks scheme	Equivalent to IEC
Bangladesh	Lamp	Fluorescent single cap	BDS IEC 60901	BDS IEC 60901	Performance/ measurement	Single capped fluorescent lamps	Equivalent to IEC
Bangladesh	Lamp	HID	BDS IEC 60188	BDS IEC 60188	Performance/ measurement	Mercury lamp	Equivalent to IEC
Bangladesh	Lamp	HID	BDS IEC 60192	BDS IEC 60192	Performance/ measurement	Sodium lamp	Equivalent to IEC
Bangladesh	Lamp	Incandescent / halogen	BDS 17: 2006	BDS 17: 2006	Performance/ measurement	Tungsten filament lamps. Part of compulsory certification marks scheme	Equivalent to IEC 60064

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Bangladesh	Lamp	Special purpose	BDS IEC 60983	BDS IEC 60983	Performance/ measurement	Miniature lamp	Equivalent to IEC
Bangladesh	Lamp	Special purpose	BDS 1606	BDS 1606	Performance/ measurement	Lamps for railway stocks	
Brazil	Ballast	Fluorescent	Procel - electronic ballasts for tubular fluorescent lamps	NBR 5114 NBR 5172		Electronic ballasts for tubular fluorescent lamps	
Brazil	Ballast	Fluorescent	NBR 5114 NBR 5172			Electronic ballasts for tubular fluorescent lamps	
Brazil	Ballast	HID	Portaria Inmetro nº 454 de 01/12/2010	NBR 13593 NBR 14305		Electromagnetic ballasts for sodium vapor lamps and metal halide lamps	
Brazil	Ballast	HID	Portaria Interministerial No 959/2010	as defined by INMETRO		Electromagnetic ballasts for high pressure sodium-vapor lamps and metal-halide lamps	
Brazil	Ballast	HID	NBR 13593 NBR 14305			Electromagnetic ballasts for sodium vapor lamps and metal halide lamps	
Brazil	Ballast	HID	Procel - electromagnetic ballasts for sodium vapor lamps	NBR 13593 NBR 14305		Electromagnetic ballasts for sodium vapor lamps	
Brazil	Lamp	CFLi	Portaria Interministerial No 1008/2010	as defined by INMETRO	Performance/ measurement	Compact Fluorescent Lamps	
Brazil	Lamp	CFLi	Portaria Interministerial nº 489 de 08/12/10	CIE 84:1989 IEC 60081 IEC 60901 IEC 60969 NBR 14538 NBR 14539 NBR IEC 60061-1 NBR 14671	Performance/ measurement	Compact fluorescent lamps with integrated ballast	
Brazil	Lamp	CFLi	Procel - CFL	CIE 84:1989 IEC 60081 IEC 60901 IEC 60969 NBR 14538 NBR 14539 NBR IEC 60061-1 NBR 14671	Performance/ measurement	Compact fluorescent lamps	
Brazil	Lamp	CFLi	CIE 84:1989, IEC 60081, IEC 60901, IEC 60969, NBR 14538, NBR 14539, NBR IEC 60061-1, NBR 14671		Performance/ measurement	Compact fluorescent lamps with integrated ballast	
Brazil	Lamp	HID	Portaria Inmetro nº 483 de 07/12/2010	NBR IEC 60662 NBR 13593NBR 5461 NBR IEC 60061-1	Performance/ measurement	High-pressure sodium-vapour lamps	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
				ABNT NBR IEC 60238 ABNT NBR 5426			
Brazil	Lamp	HID	Procel - sodium vapor lamps	NBR IEC 60662, NBR 13593, NBR 5461, NBR IEC 60061-1, ABNT NBR IEC 60238, ABNT NBR 5426	Performance/ measurement	Sodium vapor lamps	
Brazil	Lamp	HID	NBR IEC 60662, NBR 13593, NBR 5461, NBR IEC 60061-1, ABNT NBR IEC 60238, ABNT NBR 5426		Performance/ measurement		
Brazil	Lamp	Incandescent / halogen	Portaria Inmetro nº 283 de 11/08/2008	NBR 14671 NBR IEC 432-1 NBR IEC 432-2 NBR IEC 60061-1	Performance/ measurement	Incandescent lamps	
Brazil	Lamp	Incandescent / halogen	Portaria Inmetro nº 296 de 11/08/08	NBR 14671 NBR IEC 432-1 NBR IEC 432-2 NBR IEC 60061-1	Performance/ measurement	Decorative lamps - incandescent line	
Brazil	Lamp	Incandescent / halogen	Portaria Interministerial No 1007/2010	as defined by INMETRO	Performance/ measurement	Incandescent lamps	
Brazil	Lamp	Incandescent / halogen	NBR 14671, NBR IEC 432-1, NBR IEC 432-2, NBR IEC 60061-1		Performance/ measurement	Decorative lamps - incandescent line	
Brazil	Lamp	Incandescent / halogen	as defined by INMETRO		Performance/ measurement	Incandescent lamps	
Brazil	Lamp	Incandescent / halogen	NBR 14671, NBR IEC 432-1, NBR IEC 432-2, NBR IEC 60061-1		Performance/ measurement	Incandescent lamps	
California	Lamp	Incandescent / halogen	CALIFORNIA CODE OF REGULATIONS, TITLE 20: DIVISION 2, CHAPTER 4, ARTICLE 4, SECTIONS 1601-1608: APPLIANCE EFFICIENCY REGULATIONS (2012 Appliance Efficiency Regulations)	10 CFR Section 430.23(r) (Appendix R to Subpart B of Part 430) (2008)	Performance/ measurement	General service lamps	
California	Lamp	Incandescent / halogen	CALIFORNIA CODE OF REGULATIONS, TITLE 20: DIVISION 2, CHAPTER 4, ARTICLE 4, SECTIONS 1601-1608: APPLIANCE EFFICIENCY	10 CFR Section 430.23(r) (Appendix R to Subpart B of Part 430) (2008)	Performance/ measurement	General service incandescent lamps	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			REGULATIONS (2012 Appliance Efficiency Regulations)				
California	Lamp	Incandescent / halogen	CALIFORNIA CODE OF REGULATIONS, TITLE 20: DIVISION 2, CHAPTER 4, ARTICLE 4, SECTIONS 1601-1608: APPLIANCE EFFICIENCY REGULATIONS (2012 Appliance Efficiency Regulations)	10 CFR Section 430.23(r) (Appendix R to Subpart B of Part 430) (2008)	Performance/ measurement	Modified spectrum incandescent lamps	
California	Lamp	Incandescent / halogen	CALIFORNIA CODE OF REGULATIONS, TITLE 20: DIVISION 2, CHAPTER 4, ARTICLE 4, SECTIONS 1601-1608: APPLIANCE EFFICIENCY REGULATIONS (2012 Appliance Efficiency Regulations)	10 CFR Section 430.23(r) (Appendix R to Subpart B of Part 430) (2008)	Performance/ measurement	Incandescent reflector lamps	
California	Luminaire	Traffic Light	CALIFORNIA CODE OF REGULATIONS, TITLE 20: DIVISION 2, CHAPTER 4, ARTICLE 4, SECTIONS 1601-1608: APPLIANCE EFFICIENCY REGULATIONS (2012 Appliance Efficiency Regulations)	10 CFR Section 431.224 (2008)	Performance/ measurement	Traffic Signal Modules for Pedestrian Control. The power consumption of traffic signal modules for pedestrian control manufactured on or after January 1, 2006.	
California	System		CALIFORNIA CODE OF REGULATIONS, TITLE 20: DIVISION 2, CHAPTER 4, ARTICLE 4, SECTIONS 1601-1608: APPLIANCE EFFICIENCY REGULATIONS (2012 Appliance Efficiency Regulations)	ANSI C82.6-2005 (Metal halide luminaires), 10 CFR 430.23(q) (2008) (Under-cabinet luminaires), and California Joint Appendix JA8 – 2008, "Testing of Light Emitting Diode Light Sources," or IES LM-79-08, "Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products" (LED luminaires using LED lamps and light engines)	Performance/ measurement	"Metal halide luminaires", "under-cabinet luminaires", and "portable luminaires", including portable LED luminaires and portable luminaires with an LED light engine with integral heat sink. "Under-cabinet luminaires" are those designed for mounting in, on, under, or within modular office furniture). "Metal halide luminaires" are light fixture for general lighting application designed to be operated with a metal halide lamp and a ballast for a metal halide lamp. "Portable luminaire" means a luminaire that has a flexible cord and an attachment plug for connection to a nominal 120-volt, 15- or 20-ampere branch circuit; that allows the user to relocate the luminaire without any rewiring; that are typically controlled with a switch located on the luminaire itself or on the power cord; and that are intended for use in accordance with the National Electrical Code, ANSI/NFPA 70-2002. Portable luminaire does not include direct plug-in nightlights, sun and heat lamps, aquarium lamps, medical and dental lights, portable electric hand lamps, signs and commercial advertising displays, photographic lamps, germicidal lamps, or portable luminaires for marine use or for use in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70. Portable luminaire also does not include Christmas tree	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						and decorative lighting outfits or electric candles and candelabras without lamp shades that are covered by the Standard for Christmas Tree and Decorative Outfits, UL 588.	
Cambodia	Lamp	Fluorescent double cap	Prakas No. 1003[1]		Performance/ measurement	Performance specification for double-capped fluorescent lamps	Established by adopting the relevant IEC test method standards
Cambodia	Lamp	Incandescent / halogen	Prakas No. 1003		Performance/ measurement	Performance specification for tungsten filament lamps for general lighting service	Established by adopting the relevant IEC test method standards
Cambodia	Lamp	Incandescent / halogen	Prakas No. 1003		Safety	Safety requirements for tungsten filament	Established by adopting the relevant IEC test method standards
Cambodia	Luminaire		Prakas No. 1003		Performance/ measurement	General requirements for luminaires (lighting chains)	Established by adopting the relevant IEC test method standards
Canada	Ballast	Fluorescent	Fluorescent Lamp Ballasts	CAN/CSA-C654-M91		APPLIES TO fluorescent lamp ballasts (a) used to start and operate fluorescent lamps by providing a starting voltage and current, limiting the current during normal operation, and where necessary to facilitate lamp operation, providing cathode heating (b) designed for input of 120, 277 or 347 volts, and (c) designed to operate with an F32T8, F34T12, F40T10 or F40T12 rapid-start fluorescent lamp or an F96T12IS, F96T12ES, F96T12HO or F96T12HO ES fluorescent lamp but does not include a ballast: (d) designed to be used in an outdoor sign and that is capable of operating with an F96T12HO fluorescent lamp in ambient temperatures at or below -28.9°C, or (e) that, by means of an integrated dimming capability, can reduce the output of the fluorescent lamp by 50% or more NOTE As of April 1, 2010, all ballasts must meet the same minimum energy performance requirements.	
Canada	Ballast	Fluorescent	CAN/CSA-C654-M91			APPLIES TO fluorescent lamp ballasts (a) used to start and operate fluorescent lamps by providing a starting voltage and current, limiting the current during normal operation, and where necessary to facilitate lamp operation, providing cathode heating (b) designed for input of 120, 277 or 347 volts, and (c) designed to operate with an F32T8, F34T12, F40T10 or F40T12 rapid-start fluorescent lamp or an F96T12IS, F96T12ES, F96T12HO or F96T12HO ES fluorescent lamp but does not include a ballast: (d) designed to be used in an outdoor sign and that is capable of operating with an F96T12HO fluorescent lamp in ambient temperatures at or below -28.9°C, or (e) that, by means of an integrated dimming capability, can reduce the output of the fluorescent lamp by 50% or more	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						NOTE As of April 1, 2010, all ballasts must meet the same minimum energy performance requirements.	
Canada	Ballast	Fluorescent	CAN/CSA-C654-M91				
Canada	Lamp	CFLi	EnerGuide Program - Compact Fluorescent Lamps (CFL)	CSA C861-06 for power and luminous flux; IES LM65-01 for life	Performance/ measurement	An integrally-ballasted compact fluorescent lamp with a medium screw base and a nominal voltage or voltage range that lies at least partially between 100 volts and 130 volts	
Canada	Lamp	CFLi	ENERGY STAR® Program Requirements for Compact Fluorescent Lamps (CFLs) Eligibility Criteria – Version 4.0	CSA C861-06 for power and luminous flux; IES LM65-01 for life	Performance/ measurement	This ENERGY STAR criteria for CFLs covers the requirements for self-ballasted CFLs and lamp systems, including: • Medium (Edison) or candelabra screw base compact fluorescent lamps with integral electronic ballasts. • Circline lamps with a maximum diameter of 230 mm (9 in.) and square lamps, with a maximum side length of 200 mm (8 in.) with medium screw with electronic ballasts that are tested and packaged with the lamp. • Medium (Edison) or candelabra screw base fluorescent lamps with integral electronic ballasts, which have a translucent cover over the bare fluorescent tube. The cover may be globe, bullet, pear, torpedo, candle, or any other shape. • Medium (Edison) screw base compact fluorescent lamps with integral electronic ballasts, which have a reflector that may be open or enclosed. The lamp shall be primarily intended to replace wide beam incandescent reflector lamps.	
Canada	Lamp	CFLi	CSA C861-06 for power and luminous flux; IES LM65-01 for life		Performance/ measurement	An integrally-ballasted compact fluorescent lamp with a medium screw base and a nominal voltage or voltage range that lies at least partially between 100 volts and 130 volts	
Canada	Lamp	CFLi	CAN/CSA-C861-95		Performance/ measurement	Performance of compact fluorescent lamps and ballasted adaptors (regulated only by selected Canadian Provinces) The standard specifies a range of performance related requirements such as power input (declared versus actual), starting time, run-up time, crest factor and system efficacy (lumens per watt). The system of measuring total power input and light output is used, although a minimum light output requirement is not specified. The standard CAN/CSA-C861-95 is applicable to E26 medium screw-base compact fluorescent lamps and ballasted adaptors for use on 120V and 60Hz. The test temperature is specified as 25oC. Lamps are seasoned for a minimum of 100 hours before testing. Lamp power and light output is to be stable before measurements are undertaken (minimum of 15 minutes, but could be 4 hours or more). Where a CFL ballast does not have an integrated lamp, a reference lamp is used. Instrumentation and testing is undertaken in accordance with IES LM66. The harmonic content of the supply shall not exceed 3% of the RMS voltage and voltage shall be regulated to within ±0.5% and the supply impedance shall be such that the voltage at the test unit does not vary by more than 2% when in and out of operation. Requirements of the standard include: • Reference to relevant safety standards • Measured input power < 115% of the rated value • Starting time < 6 seconds • Run-up time less than 3 minutes • Crest factor less than 1.7 • System efficacy is specified for total input powers up to 35 watts	References various IES and ANSI standards

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						It should be noted that at the time of writing, only the provinces of Ontario and British Columbia regulated CFLs for energy efficiency (and is under consideration in New Brunswick)	
Canada	Lamp	Fluorescent double cap	CAN/CSA-C819-95		Performance/ measurement	Performance of general service fluorescent lamps (may come into force during 1999, currently reference US standards) Reference lamps and ballasts systems are defined in the standard. The lumen output of a test ballast with an appropriate reference lamp is determined under stabilised conditions. The ballast efficacy factor (BEF) is determined as the ratio of the relative light output of the test ballast/reference lamp combination (in comparison with the reference lamp/ballast system) divided by the total system power. Minimum BEF values as well as a number of other performance requirements are specified in the standard. No minimum ballast lumen factor is specified in the standard. The procedure for Canada is essentially equivalent to that required for the USA. The standard is applicable to four types of fluorescent lamp ballasts; 40T12 rapid start, 96T12 rapid start, 96T12 instant start and F32T8 rapid start, all intended to operate at 60 Hz and either 120V, 277V or 347V. It does not apply to ballast designed for operation of a temperature of lower than –17.8oC. Mandatory reference is made to the safety standard for ballasts. The test is undertaken at 25oC and the supply system voltage, stability and impedance is also specified. Lamps are mounted in a horizontal position and light output and power input is to be stable before lumen and power measurements are undertaken (generally a minimum of 15 minutes). Reference lamps and ballasts are specified in the standard for each of the main lamp types and ballast combinations. The lumen output (or lamp input power in the case of low frequency instant lamp ballasts) and total circuit power with a test ballast and reference lamp is measured. The lumen output (or lamp input power in the case of low frequency instant lamp ballasts) and total circuit power with a reference ballast and lamp is also measured. The relative light output is defined as the ratio of the light output of the test system to the light output of the reference system (expressed as 100 when they are equal). In the case of low frequency instant lamp ballasts, the relative lamp power is defined as the ratio of the lamp power of the test system to the lamp power of the reference system (expressed as 100 when they are equal). The Ballast Efficacy Factor (BEF) is determined as the ratio of the relative light output to the total power input in Watts (except for low frequency instant lamp ballasts, where the BEF is defined as the ratio of the relative lamp power to the total input power in Watts). For example, a single F40T12 lamp with a relative light output of 100 (ie equal to the reference ballast) and a total input power of say 50 Watts will have a BEF of 2.0. No minimum relative light output (or power output) is required under the standard. The standard also mandates that ballasts must have a power factor of greater than 90%. For regulatory purposes, the ballast type, BEF, the number and type of lamps the ballast is designed to operate and the design voltage has to be supplied. Under consideration at time of original reporting. There is extensive use of external references in this standard. The standard is applicable to a limited range of fluorescent lamps as follows: • 1200mm linear rapid start lamps • 600mm U shaped rapid start lamps • 2400mm linear rapid and instant start lamps The standard excludes specialist lighting products such as: • A fluorescent lamp that is specifically marked and marketed for plant-growth use; • A cold-temperature fluorescent lamp; • A coloured fluorescent lamp; • A fluorescent lamp designed to be impact-resistant;	The test procedure for fluorescent lamps is set out in various IES and ANSI standards. The procedure for Canada is essentially equivalent to that required for the USA.

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						• A reflectorised or aperture fluorescent lamp; • A fluorescent lamp designed for use in reprographic equipment; • A fluorescent lamp primarily designed to produce ultraviolet radiation; or • A fluorescent lamp with a colour-rendering index of 82 or greater. The test temperature is specified as 25oC. Luminous flux is determined under standardised conditions with a reference ballast as specified in IES LM9 and tested to IES LM9 or ANSI C82.3 and ANSI C78.375. Requirements of the standard include: • Dimensions to comply with ANSI C78.1 and ANSI C78.3 • Rated life to be >12000 hours when determined in accordance with IES LM40 • Luminous flux is determined in accordance with IES LM9 – a minimum allowable efficacy is specified. • Colour rendering index is to be determined in accordance with CIE 13.3, IES LM16 and IES LM58 – a minimum allowable CRI is specified (depending on the lamp type and size). Requirements for the energy efficiency regulations: • Nominal power; • Shape of product for rapid start (straight or u-shape); • Nominal length & diameter; • Type of base for rapid start (medium bi-pin base or a recessed double-contact base) • Abbreviation under ANSI c78.1 or ANSI c78.3 as applicable • Correlated colour temperature and average colour-rendering index; • Average lamp efficacy.	
Canada	Lamp	Incandescent / halogen	General Service Incandescent Reflector Lamps	CAN/CSA C862-09	Performance/ measurement	An incandescent reflector lamp with a bulb shape as described in ANSI C79.1 (R, PAR, ER or BR) or similar shape that has • an E26/24 single contact or E26/50x39 skirted, medium screw base • a nominal voltage or voltage range that lies at least partially between 100 V and 130 V • a diameter greater than 57 mm (2.25 inches or 18/8 inches), and • a nominal power of 40 W to 205 W but does not include: • a coloured lamp • a BR30 (95 mm) lamp or BR40 (127 mm) lamp with a nominal power of up to 50 W, or 65 W • a R20 (63.5 mm) lamp with a nominal power of not more than 45 W • a silver bowl lamp • a lamp for heat-sensitive applications • an incandescent reflector lamp that: 1. is a rough service lamp: a C-7A or C-11 filament, as described in the IES Handbook, with at least 5 supports exclusive of lead wires, a C-17 filament, as described in the IES Handbook, with 8 supports exclusive of lead wires, a C-22 filament, as described in the IES Handbook, with 16 supports exclusive of lead wires 2. is a vibration service lamp 3. is a modified spectrum lamp 4. is a shatter resistant lamp 5. is a plant lamp 6. is specifically marked and marketed as an infrared lamp, as an appliance lamp, for mine use, as a submersible lamp or for terrarium or vivarium use, for airfield, aircraft or automotive use	
Canada	Lamp	Incandescent / halogen	EnerGuide Program - General Service Lamps	IESNA LM45; IESNA LM49	Performance/ measurement	General service lamp (incandescent), meaning an electrical device that provides functional illumination and has a luminous flux of at least 250 lumens (lm) but no greater than 2600 lm, has a nominal voltage or voltage range that lies at least partially between 100 volts and 130 volts, and is screw-based. This does not include the following: 1. an appliance lamp, 2. a CFL, 3. a coloured lamp, 4. an explosion resistant lamp, namely, a lamp that is designed and certified to operate in a Class I, Division 1 or Class II, Division 1 environment as defined in the IEC standard CEI/IEC 60079-0 (2007) entitled Explosive atmospheres – Part 0: Equipment – General Requirements, 5. an infrared lamp, 6. a lamp that has a G-shape as specified in ANSI C78.20 and ANSI C79.1, with a diameter of 13 cm or more, 7. a showcase lamp, namely, a lamp that has a T-shape as specified in ANSI C78.20 and ANSI C79.1 and a maximum wattage of 40 W or a length exceeding 25 cm and is marketed as a showcase lamp, 8. a lamp that uses solid state technology, namely, a lamp with a light source that comes from light-emitting diodes, 9. a left-	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						hand thread lamp, namely, a lamp with a base that screws into a lamp socket in a counter-clockwise direction, 10. a plant lamp, 11. an incandescent reflector lamp that has a shape specified in ANSI C79.1, 12. a sign service lamp, namely, a vacuum type or gas-filled lamp that has sufficiently low bulb temperature to permit exposed outdoor use on high-speed flashing circuits and is marketed as a sign service lamp, 13. a silver bowl lamp, namely, a lamp that has a reflective coating applied directly to part of the bulb surface that reflects light toward the lamp base and that is marketed as a silver bowl lamp, 14. a traffic signal module, a pedestrian module or a street light, 15. a submersible lamp, 16. a lamp that has a screw base size of E5, E10, E11, E12, E17, E26/50×39, E26/53×39, E29/28, E29/53×39, E39, E39d, EP39 or EX39 as specified in ANSI C81.61, and 17. a lamp that has a B, BA, CA, F, G16-½, G25, G30, S or M-14 shape or other similar shape, as specified in ANSI C78.20 and ANSI C79.1, and a maximum wattage of 40 W Note: The definition of general service lamp excludes rough service lamps, vibration service lamps, shatter resistant lamps or lamps with E26d screw bases as specified in ANSI C81.61 only with regard to minimum energy performance standards. For labelling purposes, these lamps are included in the definition.	
Canada	Lamp	Incandescent / halogen	EnerGuide Program - Incandescent Reflector Lamps	CAN/CSA C862-09	Performance/ measurement	General service incandescent reflector lamps, PAR, R, and BPAR lamps (not required for BR and ER lamps)	
Canada	Lamp	Incandescent / halogen	General Service Lamps	IESNA LM45; IESNA LM49	Performance/ measurement	General service lamp (incandescent), meaning an electrical device that provides functional illumination and has a luminous flux of at least 250 lumens (lm) but no greater than 2600 lm, has a nominal voltage or voltage range that lies at least partially between 100 volts and 130 volts, and is screw-based. This does not include the following: 1. an appliance lamp, 2. a CFL, 3. a coloured lamp, 4. an explosion resistant lamp, namely, a lamp that is designed and certified to operate in a Class I, Division 1 or Class II, Division 1 environment as defined in the IEC standard CEI/IEC 60079-0 (2007) entitled Explosive atmospheres – Part 0: Equipment – General Requirements, 5. an infrared lamp, 6. a lamp that has a G-shape as specified in ANSI C78.20 and ANSI C79.1, with a diameter of 13 cm or more, 7. a showcase lamp, namely, a lamp that has a T-shape as specified in ANSI C78.20 and ANSI C79.1 and a maximum wattage of 40 W or a length exceeding 25 cm and is marketed as a showcase lamp, 8. a lamp that uses solid state technology, namely, a lamp with a light source that comes from light-emitting diodes, 9. a left-hand thread lamp, namely, a lamp with a base that screws into a lamp socket in a counter-clockwise direction, 10. a plant lamp, 11. an incandescent reflector lamp that has a shape specified in ANSI C79.1, 12. a sign service lamp, namely, a vacuum type or gas-filled lamp that has sufficiently low bulb temperature to permit exposed outdoor use on high-speed flashing circuits and is marketed as a sign service lamp, 13. a silver bowl lamp, namely, a lamp that has a reflective coating applied directly to part of the bulb surface that reflects light toward the lamp base and that is marketed as a silver bowl lamp, 14. a traffic signal module, a pedestrian module or a street light, 15. a submersible lamp, 16. a lamp that has a screw base size of E5, E10, E11, E12, E17, E26/50×39, E26/53×39, E29/28, E29/53×39, E39, E39d, EP39 or EX39 as specified in ANSI C81.61, and 17. a lamp that has a B, BA, CA, F, G16-½, G25, G30, S or M-14 shape or other similar shape, as specified in ANSI C78.20 and ANSI C79.1, and a maximum wattage of 40 W Note: The definition of general service lamp excludes rough service lamps, vibration service lamps, shatter resistant lamps or lamps with E26d screw bases as specified in ANSI C81.61 only with regard to minimum energy performance standards. For labelling purposes, these lamps are included in the definition.	
Canada	Lamp	Incandescent / halogen	CAN/CSA-C862-95		Performance/ measurement	Performance of general service incandescent reflector lamps	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Canada	Lamp	Incandescent / halogen	IESNA LM45; IESNA LM49		Performance/ measurement	General service lamp (incandescent), meaning an electrical device that provides functional illumination and has a luminous flux of at least 250 lumens (lm) but no greater than 2600 lm, has a nominal voltage or voltage range that lies at least partially between 100 volts and 130 volts, and is screw-based. This does not include the following: 1. an appliance lamp, 2. a CFL, 3. a coloured lamp, 4. an explosion resistant lamp, namely, a lamp that is designed and certified to operate in a Class I, Division 1 or Class II, Division 1 environment as defined in the IEC standard CEI/IEC 60079-0 (2007) entitled Explosive atmospheres – Part 0: Equipment – General Requirements, 5. an infrared lamp, 6. a lamp that has a G-shape as specified in ANSI C78.20 and ANSI C79.1, with a diameter of 13 cm or more, 7. a showcase lamp, namely, a lamp that has a T-shape as specified in ANSI C78.20 and ANSI C79.1 and a maximum wattage of 40 W or a length exceeding 25 cm and is marketed as a showcase lamp, 8. a lamp that uses solid state technology, namely, a lamp with a light source that comes from light-emitting diodes, 9. a left-hand thread lamp, namely, a lamp with a base that screws into a lamp socket in a counter-clockwise direction, 10. a plant lamp, 11. an incandescent reflector lamp that has a shape specified in ANSI C79.1, 12. a sign service lamp, namely, a vacuum type or gas-filled lamp that has sufficiently low bulb temperature to permit exposed outdoor use on high-speed flashing circuits and is marketed as a sign service lamp, 13. a silver bowl lamp, namely, a lamp that has a reflective coating applied directly to part of the bulb surface that reflects light toward the lamp base and that is marketed as a silver bowl lamp, 14. a traffic signal module, a pedestrian module or a street light, 15. a submersible lamp, 16. a lamp that has a screw base size of E5, E10, E11, E12, E17, E26/50×39, E26/53×39, E29/28, E29/53×39, E39, E39d, EP39 or EX39 as specified in ANSI C81.61, and 17. a lamp that has a B, BA, CA, F, G16-½, G25, G30, S or M-14 shape or other similar shape, as specified in ANSI C78.20 and ANSI C79.1, and a maximum wattage of 40 W Note: The definition of general service lamp excludes rough service lamps, vibration service lamps, shatter resistant lamps or lamps with E26d screw bases as specified in ANSI C81.61 only with regard to minimum energy performance standards. For labelling purposes, these lamps are included in the definition.	
Canada	Lamp	Incandescent / halogen	CAN/CSA C862-09		Performance/ measurement	An incandescent reflector lamp with a bulb shape as described in ANSI C79.1 (R, PAR, ER or BR) or similar shape that has • an E26/24 single contact or E26/50x39 skirted, medium screw base • a nominal voltage or voltage range that lies at least partially between 100 V and 130 V • a diameter greater than 57 mm (2.25 inches or 18/8 inches), and • a nominal power of 40 W to 205 W but does not include: • a coloured lamp • a BR30 (95 mm) lamp or BR40 (127 mm) lamp with a nominal power of up to 50 W, or 65 W • a R20 (63.5 mm) lamp with a nominal power of not more than 45 W • a silver bowl lamp • a lamp for heat-sensitive applications • an incandescent reflector lamp that: 1. is a rough service lamp: a C-7A or C-11 filament, as described in the IES Handbook, with at least 5 supports exclusive of lead wires, a C-17 filament, as described in the IES Handbook, with 8 supports exclusive of lead wires, a C-22 filament, as described in the IES Handbook, with 16 supports exclusive of lead wires 2. is a vibration service lamp 3. is a modified spectrum lamp 4. is a shatter resistant lamp 5. is a plant lamp 6. is specifically marked and marketed as an infrared lamp, as an appliance lamp, for mine use, as a submersible lamp or for terrarium or vivarium use, for airfield, aircraft or automotive use	
Canada	Lamp	LED			Performance/ measurement	hese criteria apply to integral LED lamps, defined as a lamp with LEDs, an integrated LED driver, and an ANSI standardized base designed to connect to the branch circuit via an ANSI standardized lampholder/socket. These criteria include integral LED lamps of non-standard form, and those intended to replace standard general service incandescent lamps, decorative (candelabra style) lamps, and reflector lamps. Other types of replacement lamps may be added in the future as improvements to LED technology make LED use in other replacement lamp	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						types viable.	
Canada	Lamp	LED	IESNA LM-79-08, IESNA LM-80-08, and ANSI C78.377-2008		Performance/ measurement	The ENERGY STAR criteria cover the requirements for SSL products used for general illumination, including those with significant decorative function. If a decorative SSL product serves a significant general illumination function, it falls within the scope of these criteria. The criteria apply to both residential and commercial products. The criteria apply only to products designed to be connected to the electric power grid. In addition, they do not apply to SSL products made for indication (such as traffic lights and exit signs); to products exclusively intended for decoration (such as holiday lights); nor to SSL products intended for retrofit into existing fixtures.	
Canada	Lamp	LED	ENERGY STAR® Qualifying Criteria for Solid State Lighting (SSL) Luminaires Version 1.3	IESNA LM-79-08, IESNA LM-80-08, and ANSI C78.377-2008	Performance/ measurement	The ENERGY STAR criteria cover the requirements for SSL products used for general illumination, including those with significant decorative function. If a decorative SSL product serves a significant general illumination function, it falls within the scope of these criteria. The criteria apply to both residential and commercial products. The criteria apply only to products designed to be connected to the electric power grid. In addition, they do not apply to SSL products made for indication (such as traffic lights and exit signs); to products exclusively intended for decoration (such as holiday lights); nor to SSL products intended for retrofit into existing fixtures.	
Canada	Lamp	LED	ENERGY STAR® Qualifying Criteria for Integral LED Lamps Version 1.4		Performance/ measurement	hese criteria apply to integral LED lamps, defined as a lamp with LEDs, an integrated LED driver, and an ANSI standardized base designed to connect to the branch circuit via an ANSI standardized lampholder/socket. These criteria include integral LED lamps of non-standard form, and those intended to replace standard general service incandescent lamps, decorative (candelabra style) lamps, and reflector lamps. Other types of replacement lamps may be added in the future as improvements to LED technology make LED use in other replacement lamp types viable.	
Canada	Luminaire	Exit Sign	Exit Signs	CAN/CSA-C860-01	Performance/ measurement	APPLIES TO a device used to identify the most direct path of egress for emergency purposes having a legend and optional directional indicator that is illuminated by a light source contained within the assembly, and includes • Type 1 and Type 3 exit signs as described in CSA C860, and • Type 2 exit signs as described in CSA C860, which includes exit signs supplied as a component of a combination emergency lighting unit consisting of an internally lighted exit sign and a battery pack with attached emergency lamps, but does not include exit signs that • flash, • are photo-luminescent, or • are radio-luminescent.	
Canada	Luminaire	Exit Sign	CAN/CSA-C860-01		Performance/ measurement	APPLIES TO a device used to identify the most direct path of egress for emergency purposes having a legend and optional directional indicator that is illuminated by a light source contained within the assembly, and includes • Type 1 and Type 3 exit signs as described in CSA C860, and • Type 2 exit signs as described in CSA C860, which includes exit signs supplied as a component of a combination emergency lighting unit consisting of an internally lighted exit sign and a battery pack with attached emergency lamps,	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						but does not include exit signs that • flash, • are photo-luminescent, or • are radio-luminescent.	
Canada	Luminaire	Road	CAN/CSA-C653-94		Performance/ measurement	Performance standard for roadway lighting luminaires. States that characteristics of roadway luminaires are to be determined in accordance with IES LM31. Grid points for lighting calculations are to be in accordance with IES RP8. CAN/CSA-C653-94 specifies maximum allowable values of watt per square meter (power density) and minimum values of luminance (candelas per square meter) for both high pressure sodium and metal halide street luminaires. At the time of writing, only Ontario, British Columbia, Nova Scottia, New Brunswick – various efficiency levels by state – regulated outdoor lighting systems for energy efficiency	
Canada	Luminaire	Traffic Light	Traffic signal and pedestrian modules	ITE VTCSH Part 2	Performance/ measurement	Regulatory definition Traffic signal module self-contained device that consists of all of the optical components for operation and is designed to • provide drivers with movement information by means of a red or green traffic signal indicator that is 203.2 mm or 304.8 mm in diameter, and • fit into a traffic signal housing Pedestrian module self-contained device that consists of all of the optical components for operation and is designed to • provide pedestrians with movement information by means of a "walking person" or "hand" display but not by means of a countdown message, and • fit into a pedestrian signal housing	
Canada	Luminaire	Traffic Light	ITE VTCSH Part 2		Performance/ measurement	Regulatory definition Traffic signal module self-contained device that consists of all of the optical components for operation and is designed to • provide drivers with movement information by means of a red or green traffic signal indicator that is 203.2 mm or 304.8 mm in diameter, and • fit into a traffic signal housing Pedestrian module self-contained device that consists of all of the optical components for operation and is designed to • provide pedestrians with movement information by means of a "walking person" or "hand" display but not by means of a countdown message, and • fit into a pedestrian signal housing	
Canada	Luminaire		Ceiling fans and ceiling fan light kits	CSA C22.2 No. 9	Performance/ measurement	Ceiling fan light kit equipment that is designed to be attached to a ceiling fan for the purpose of providing light	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Canada	Luminaire		ENERGY STAR® Qualifying Criteria For Ceiling Fans	HVI 915, HVI 916, HVI 920, ANSI/AMCA Standard 210-07, ANSI/AMCA Standard 300-08, AMCA Publication 311-05	Performance/ measurement	A non-portable device designed for home use that is suspended from the ceiling for circulating air via the rotation of fan blades. Some ceiling fans also have an integral or attachable light kit.	
Canada	Luminaire		ENERGY STAR® Qualifying Criteria for Residential Light Fixtures and Replacement GU-24 Base Integrated Lamps Version 4.1		Performance/ measurement	The ENERGY STAR Residential Light Fixture specification covers the requirements for indoor and outdoor light fixtures, recessed downlight retrofit kits and replacement GU-24 base integrated lamps intended primarily for residential type applications. For the purposes of this ENERGY STAR specification, residential applications include single-family and multi-family dwellings (such as houses and apartments), dormitories, public or military housing, assisted-living facilities, motels and hotels, and some light commercial applications. Exclusion of magnetic ballasts: Indoor fluorescent fixtures that use magnetic ballasts cannot be ENERGY STAR qualified under this Version 4.1 specification. Only outdoor fixtures that use high intensity discharge (HID) lamps, such as metal halide and high pressure sodium, may continue to use magnetic ballasts. Inclusion of decorative LEDs: EPA encourages the use of innovative light source technologies such as LEDs. LEDs used as decorative lighting elements in residential lighting fixtures and ceiling fan light kits are allowed as long as the total wattage of the LEDs does not exceed five (5) watts, the average LED system (LED and driver) efficacy is at least 20 lumens per watt, and the LED is used to supplement a primary light source that meets all of the applicable performance characteristics outlined in the Eligibility Criteria. This requirement applies to LED "hybrid" fixtures.	
Canada	Luminaire		ENERGY STAR® Program Requirements for Decorative Light Strings Test Procedure and Eligibility Criteria Version 1.4	ENERGY STAR Program Requirements for Decorative Light Strings version 1.4	Performance/ measurement	A string of lamps that operate on AC power in North America (120 V RMS AC, 60 Hz) or via a power adapter or controller that connects directly to AC power, and is used for decorative residential lighting purposes. The lamps may be replaceable or sealed into the lamp holder/wiring harness, and may be assembled in a net or icicle configuration.	
Canada	Luminaire		Torchieres	CSA C22.2 No. 12	Performance/ measurement	Regulatory definition Portable electric luminaire that has a reflector bowl or similar-shaped reflector that directs light in a predominantly upward direction for the purpose of providing indirect lighting and that may be equipped with one or more additional sockets intended for other lighting functions	
Canada	Luminaire		CAN/CSAC239-94		Performance/ measurement	Performance standard for dusk to dawn luminaires. The standard covers the following aspects: • Mandates a high efficiency lighting source (high pressure sodium, mercury or low pressure sodium) • Various ballast performance requirements (including low temperature start and high power factor) • Photo controllers to be surge protected and comply with performance requirements of ANSI c136.10 with a switch on at 15 lux. At the time of writing, only Ontario, British Columbia (New Brunswick under consideration) regulated outdoor lighting systems for energy efficiency.	
Canada	System		General Service Fluorescent Lamps	CAN/CSA-C819-95 (2001)	Performance/ measurement	APPLIES TO • a rapid-start straight-shaped fluorescent lamp with a nominal overall length of 1200 mm (48 inches), a medium bi-pin base and a nominal power of not less than 28 W • a rapid-start straight-shaped fluorescent lamp with a nominal overall length of 2400 mm (96 inches), a recessed double-contact base, a nominal power of not less than 95 W and a nominal	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						current of 0.8 A; • a rapid-start U-shaped fluorescent lamp with a nominal overall length of not less than 560 mm (22 inches) and not more than 635 mm (25 inches), a medium bi-pin base and a nominal power of not less than 28 W; • an instant-start straight-shaped fluorescent lamp with a nominal overall length of 2400 mm (96 inches), a single-pin base and a nominal power of not less than 52 W; and • any fluorescent lamp that is a physical and electrical equivalent of a lamp described in paragraphs (a), (b), (c) or (d); but does not include: • a fluorescent lamp that is specifically marked and marketed for plant-growth use; • a cold-temperature fluorescent lamp; • a coloured fluorescent lamp; • a fluorescent lamp designed to be impact-resistant; • a reflectorized or aperture fluorescent lamp; • a fluorescent lamp designed for use in reprographic equipment; • a fluorescent lamp primarily designed to produce ultraviolet radiation; or • a fluorescent lamp with a colour-rendering index of 82 or greater.	
Canada	System		CAN/CSA-C819-95 (2001)		Performance/ measurement	APPLIES TO • a rapid-start straight-shaped fluorescent lamp with a nominal overall length of 1200 mm (48 inches), a medium bi-pin base and a nominal power of not less than 28 W • a rapid-start straight-shaped fluorescent lamp with a nominal overall length of 2400 mm (96 inches), a recessed double-contact base, a nominal power of not less than 95 W and a nominal current of 0.8 A; • a rapid-start U-shaped fluorescent lamp with a nominal overall length of not less than 560 mm (22 inches) and not more than 635 mm (25 inches), a medium bi-pin base and a nominal power of not less than 28 W; • an instant-start straight-shaped fluorescent lamp with a nominal overall length of 2400 mm (96 inches), a single-pin base and a nominal power of not less than 52 W; and • any fluorescent lamp that is a physical and electrical equivalent of a lamp described in paragraphs (a), (b), (c) or (d); but does not include: • a fluorescent lamp that is specifically marked and marketed for plant-growth use; • a cold-temperature fluorescent lamp; • a coloured fluorescent lamp; • a fluorescent lamp designed to be impact-resistant; • a reflectorized or aperture fluorescent lamp; • a fluorescent lamp designed for use in reprographic equipment; • a fluorescent lamp primarily designed to produce ultraviolet radiation; or • a fluorescent lamp with a colour-rendering index of 82 or greater.	
Chile	Ballast	Fluorescent	PE No 5/16/2	NCh 3082.Of2008		This protocol provides performance specifications for electronic and electromagnetic ballasts for fluorescent lamps	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Chile	Ballast	Fluorescent	NCh 3082.Of2008			This protocol provides performance specifications for electronic and electromagnetic ballasts for fluorescent lamps	
Chile	Lamp	CFLi	PE No 5/06/2	NCh 3020:2006	Performance/ measurement	This protocol provides specifications for energy efficiency labelling for compact fluorescent lamps (CFLs) for general lighting, with rated power up to 60W, rated voltage between 100V and 250V, Edison or bayonet screw caps.	
Chile	Lamp	CFLi	NCh 3020:2006		Performance/ measurement	This protocol provides specifications for energy efficiency labelling for compact fluorescent lamps (CFLs) for general lighting, with rated power up to 60W, rated voltage between 100V and 250V, Edison or bayonet screw caps.	
Chile	Lamp	Fluorescent double cap	PE No 5/02-01/2	NCh 3020:2006	Performance/ measurement	This protocol provides specifications for energy efficiency labelling for double-capped fluorescent lamps for general lighting.	
Chile	Lamp	Fluorescent double cap	NCh 3020:2006		Performance/ measurement	This protocol provides specifications for energy efficiency labelling for double-capped fluorescent lamps for general lighting.	
Chile	Lamp	Fluorescent single cap	PE No 5/02-02/2	NCh 3020:2006	Performance/ measurement	This protocol provides specifications for energy efficiency labelling for single-capped fluorescent lamps for general lighting.	
Chile	Lamp	Fluorescent single cap	NCh 3020:2006		Performance/ measurement	This protocol provides specifications for energy efficiency labelling for single-capped fluorescent lamps for general lighting.	
Chile	Lamp	Incandescent / halogen	PE_5_15_2_1	IEC 60357: 2002-11	Performance/ measurement	This protocol provides specifications for certifying efficiency of tungsten halogen lamps with dichroic reflector	
Chile	Lamp	Incandescent / halogen	PE_5-15-2	IEC 60357: 2002-11	Performance/ measurement	This protocol provides specifications for certifying efficiency of tungsten halogen lamps, single and double capped, for domestic use and general lighting; with a rated voltage up to 250V.	
Chile	Lamp	Incandescent / halogen	PE No 5/01/2	NCh 3010:2006	Performance/ measurement	This protocol provides performance specifications for tungsten filament incandescent lamps for domestic use and general lighting	
Chile	Lamp	Incandescent / halogen	NCh 3010:2006		Performance/ measurement	This protocol provides performance specifications for tungsten filament incandescent lamps for domestic use and general lighting	
Chile	Lamp	Incandescent / halogen	IEC 60357: 2002-11		Performance/ measurement	This protocol provides specifications for certifying efficiency of tungsten halogen lamps, single and double capped, for domestic use and general lighting; with a rated voltage up to 250V.	
Chile	Lamp	Incandescent / halogen	IEC 60357: 2002-11		Performance/ measurement	This protocol provides specifications for certifying efficiency of tungsten halogen lamps with dichroic reflector	
Chile	Lamp	LED	IEC/PAS 62612:2009-06		Performance/ measurement	This protocol provides specifications for certifying efficiency of LED lamps with integrated ballast	
Chile	Lamp	LED	PE No 5/17/2	IEC/PAS 62612:2009-06	Performance/ measurement	This protocol provides specifications for certifying efficiency of LED lamps with integrated ballast	
China	Ballast	Fluorescent	CQC Mark Certification - Ballasts for tubular fluorescent lamps	GB 17896-2012; GB/T 15144-2009		Applies to independent type of magnetic and eletronic ballasts working under 220V and 50Hz AC, used for tubular fluorescent lamps with rated power range of 18W-40W.	
China	Ballast	Fluorescent	GB 17896-1999			Limited values of energy efficiency and evaluating values of energy conservation of ballasts for tubular fluorescent lamps	
China	Ballast	Fluorescent	GB 17896-2012 Minimum allowable values of energy efficiency and energy efficiency grades of ballasts for tubular fluorescent lamps	GB 17896-2012; GB/T 15144-2009		Applies to independent type of magnetic and eletronic ballasts working under 220V and 50Hz AC, used for tubular fluorescent lamps with rated power range of 4W-120W. Does NOT apply to non-preheating type electronic ballasts.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
China	Ballast	Fluorescent	GB 29143-2012 Minimum allowable values of energy efficiency and energy efficiency grades of ballasts for electrodeless fluorescent lamps	GB 29143		Applies to out-coupling electrodeless ballasts which have rated power between 30W and 400W, use 220V & 50Hz AC power supply and are used for fluorescent lamps.	
China	Ballast	Fluorescent	GB 29143			Applies to out-coupling electrodeless ballasts which have rated power between 30W and 400W, use 220V & 50Hz AC power supply and are used for fluorescent lamps.	
China	Ballast	Fluorescent	GB 17896-2012; GB/T 15144-2009			Applies to independent type of magnetic and eletronic ballasts working under 220V and 50Hz AC, used for tubular fluorescent lamps with rated power range of 18W-40W.	
China	Ballast	Fluorescent	EN 50294 (Chinese equivalent of)			Ballasts supplying lamps of nominal power 4-120W	Local test method and European test method (EN 50294) are harmonised
China	Ballast	HID	CQC Mark Certification - Discharge Lamp Ballast				
China	Ballast	HID	CQC Mark Certification - High Pressure Sodium Vapor Lamps Ballast	GB 19574-2004 GB/T 7451 GB/T 13434 GB 19510.10		Applies to independent and/or built-in magnetic ballasts for high pressure sodium lamps, which work under rated voltage of 220V, rated frequency of 50Hz, and rated power of 70W-1000W.	
China	Ballast	HID	CQC Mark Certification - Metal-Halide Lamps (Ballast)	GB 20053-2006 GB/T 15042 GB 15910.10 QB/T 2511 QB/T 2515		Applies to LC peak lead type of independent and built-in type magnetic ballasts for single capped metal halide lamps with rated 220V, frequency 50Hz and power 175W-1500W.	
China	Ballast	HID	GB 19574-2004 Limited values of energy efficiency and evaluating values of energy conservation of ballast for high-pressure sodium lamps	GB 19574-2004 GB/T 7451 GB/T 13434 GB 19510.10		Applies to independent and/or built-in magnetic ballasts for high pressure sodium lamps, which work under rated voltage of 220V, rated frequency of 50Hz, and rated power of 70W-1000W.	
China	Ballast	HID	GB 20053-2006 Limited values of energy efficiency and rating criteria for ballast of metal-halide lamps	GB 20053-2006 GB/T 15042 GB 15910.10 QB/T 2511 QB/T 2515		Applies to LC peak lead type of independent and built-in type magnetic ballasts for single capped metal halide lamps with rated 220V, frequency 50Hz and power 175W-1500W.	
China	Ballast	HID	GB 19574-2004			Limited values of energy efficiency and evaluating values of energy conservation of ballast for high-pressure sodium lamp	
China	Ballast	HID	GB 20053-2006			Limited values of energy efficiency and rating criteria for ballast of metal-halide lamps	
China	Ballast	HID	GB 19574-2004 GB/T 7451 GB/T 13434 GB 19510.10			Applies to independent and/or built-in magnetic ballasts for high pressure sodium lamps, which work under rated voltage of 220V, rated frequency of 50Hz, and rated power of 70W-1000W.	Local test method and IEC test method are harmonised

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
China	Ballast	HID	GB 20053-2006 GB/T 15042 GB 15910.10 QB/T 2511 QB/T 2515			Applies to LC peak lead type of independent and built-in type magnetic ballasts for single capped metal halide lamps with rated 220V, frequency 50Hz and power 175W-1500W.	Local test method and IEC test method are harmonised
China	Lamp	CFLi	China Energy Label - Self-ballasted Fluorescent Lamps	GB/T 17263-2002 GB 19044-2003	Performance/ measurement	Applies to CFLs of rated voltage of 220V, rated working frequency of 50Hz and rated power lower than 60W, and with caps of screw or bayonet type. These CFLs shall be of general service and ignition control parts and stablization parts are integrated.	
China	Lamp	CFLi	GB 19044-2003		Performance/ measurement	Limited values of energy efficiency and rating criteria of self-ballasted fluorescent lamps for general lighting service	
China	Lamp	CFLi	CQC Mark Certification - Fluorescent Lamps for General Lighting Service (Self-Ballasted)	GB/T 17263-2002 GB 19044-2003	Performance/ measurement	Applies to CFLs of rated voltage of 220V, rated working frequency of 50Hz and rated power lower than 60W, and with caps of screw or bayonet type. These CFLs shall be of general service and ignition control parts and stablization parts are integrated.	
China	Lamp	CFLi	GB 19044-2013 Limited values of energy efficiency and rating criteria of self-ballasted fluorescent lamps for general lighting service	GB 17263	Performance/ measurement	Applies to CFLs of rated voltage of 220V, rated working frequency of 50Hz and rated power lower than 60W, and with caps of screw or bayonet type. These CFLs shall be of general service and ignition control parts and stabilization parts are integrated. Does NOT apply to CFLs with covers.	
China	Lamp	CFLi	GB 17263		Performance/ measurement	Applies to CFLs of rated voltage of 220V, rated working frequency of 50Hz and rated power lower than 60W, and with caps of screw or bayonet type. These CFLs shall be of general service and ignition control parts and stabilization parts are integrated. Does NOT apply to CFLs with covers.	
China	Lamp	CFLi	GB/T17263:2002		Performance/ measurement	Self-ballasted lamps for general lighting services – Performance requirements	Based on IEC 60969-2001 ed. 1.2 with some differences
China	Lamp	CFLi	GB 19044-2013		Performance/ measurement	Self-ballasted, bare CFLs of 220V, 50Hz with nominal power <=60W	Local test method and IEC test method (IEC 60969) are harmonised
China	Lamp	Fluorescent double cap	GB29144-2012 Minimum allowable values of energy efficiency and the energy efficiency grades for self-ballasted electrodeless fluorescent lamps with general lighting service		Performance/ measurement	Fluorescent Lamps for General Lighting Service (Self-ballasted and Electrode-Less)	
China	Lamp	Fluorescent double cap	CQC Mark Certification - Fluorescent Lamps for General Lighting Service (Double-	GB/T 10682-2010 GB 19043-2013	Performance/ measurement	Applies to pre-heating cathode type of double capped fluorescent lamps with rated power from 14W to 65W, which works under AC power frequency and are with starter and/or under high frequency.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			Capped)				
China	Lamp	Fluorescent double cap	GB 19415-2003		Performance/ measurement	Limited values of energy efficiency and evaluating values of energy conservation for single-capped fluorescent lamps	
China	Lamp	Fluorescent double cap	GB19043-2003		Performance/ measurement	Limited values of energy efficiency and evaluating values of energy conservation for double-capped fluorescent lamps	
China	Lamp	Fluorescent double cap	GB/T 10682-2010 GB 19043-2013		Performance/ measurement	Applies to pre-heating cathode type of double capped fluorescent lamps with rated power from 14W to 65W, which works under AC power frequency and are with starter and/or under high frequency.	
China	Lamp	Fluorescent double cap	GB 10682		Performance/ measurement	Double-capped fluorescent lamps 14-65W	Local test method and IEC test method (IEC 60081) are harmonised
China	Lamp	Fluorescent single cap	GB 19415		Performance/ measurement	Single capped fluorescent lamps	Local test method and IEC test method are harmonised
China	Lamp	HID	GB 19573-2004		Performance/ measurement	Limited values of energy efficiency and rating criteria for high-pressure sodium vapour lamps	
China	Lamp	HID	China Energy Label - High Pressure Sodium Lamps	GB 19573-2004 GB/T 13434 GB/T 13259	Performance/ measurement	Applies to High-pressure sodium lamps with transparent glass cover for outdoor lighting service, and power ranges from 50W-1000W with matching ballasts and ignitors, and can be started and operate normally with 92%-106% of rated voltage.	
China	Lamp	HID	CQC Mark Certification - High Pressure Sodium Lamp	GB 19573-2004 GB/T 13434 GB/T 13259	Performance/ measurement	Applies to High-pressure sodium lamps with transparent glass cover for outdoor lighting service, and power ranges from 50W-1000W with matching ballasts and ignitors, and can be started and operate normally with 92%-106% of rated voltage.	
China	Lamp	HID	CQC Mark Certification - Metal Halide Lamp	GB 20054-2006 GB 18661 QB/T 2515	Performance/ measurement	Applies to metal halide lamps, which are with LC peak lead type of independent and built-in type magnetic ballasts and can be started and operate normally with 92%-106% of rated voltage. Power range should be from 50W-1500W.	
China	Lamp	HID	GB 19573-2004 Limited values of energy efficiency and rating criteria for high-pressure sodium vapour lamps	GB 19573-2004 GB/T 13434 GB/T 13259	Performance/ measurement	Applies to High-pressure sodium lamps with transparent glass cover for outdoor lighting service, and power ranges from 50W-1000W with matching ballasts and ignitors, and can be started and operate normally with 92%-106% of rated voltage.	
China	Lamp	HID		GB 20054-2006 GB 18661 QB/T 2515	Performance/ measurement	Applies to Scandium Sodium Series of metal halide lamps, which are with transparent glass cover and power range from 175W-1500W.	
China	Lamp	HID	GB 20054-2006 GB 18661 QB/T 2515		Performance/ measurement	Applies to metal halide lamps, which are with LC peak lead type of independent and built-in type magnetic ballasts and can be started and operate normally with 92%-106% of rated voltage. Power range should be from 50W-1500W.	
China	Lamp	HID	GB 20054-2006		Performance/ measurement	Limited values of energy efficiency and rating criteria for metal-halide lamps	
China	Lamp	HID	GB 19573-2004 GB/T 13434 GB/T 13259		Performance/ measurement	HID Lamps	Local test method and IEC test method are harmonised
China	Lamp	HID	GB 20054-2006 GB 18661 QB/T 2515		Performance/ measurement	Metal halide lamps 175W-1500W	Local test method and IEC test method are harmonised
China	Lamp	LED	FGBHZ[2010]2082 Attachment 3 Technical Requirements for		Performance/ measurement		

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			Solid State Lighting Products (2010).				
China	Lamp	LED	CQC 3128-2010 Energy Conservation Certification Criteria for LED Downlights.		Performance/ measurement		
China	Lamp	LED	CQC 3129-2010 Energy Conservation Certification Criteria for Self-ballasted LED Reflector Lamp.		Performance/ measurement		
China	Lamp	LED	CQC 3130-2010 Energy Conservation Certification Criteria for Non-directional Self-ballasted LED lamps for General Lighting Services.		Performance/ measurement		
China	Lamp	LED	GB 24819-2009		Safety	LED modules for general lighting safety requirements	IEC62031:2008 clone
China	Lamp	LED			Performance/ measurement	Apply to self-ballasted LED modules, having: (1) a rated voltage of up to 250 V DC or up to 50/60 Hz 1000 V AC	
China	Lamp	LED			Performance/ measurement	Apply to self-ballasted LED lamps used for domestic and similar general lighting purpose, having: (1) a rated wattage up to 60 W; (2) a rated voltage of up to 250 V AC or DC; and (3) lamp cap according to relevant GB standards.	
China	Lamp	LED	GB/T24823-2009		Performance/ measurement	LED modules for general lighting - Performance requirements	
China	Lamp	LED	GB/T24824-2009		Performance/ measurement	Measurement methods of LED modules for general lighting	
China	Lamp	LED	GB/T 24823-2009: Performance requirements for LED modules for general lighting		Performance/ measurement	Apply to self-ballasted LED modules, having: (1) a rated voltage of up to 250 V DC or up to 50/60 Hz 1000 V AC	
China	Lamp	LED	GB/T 24908-2010: Performance requirements for self-ballasted LED lamps for general lighting		Performance/ measurement	Apply to self-ballasted LED lamps used for domestic and similar general lighting purpose, having: (1) a rated wattage up to 60 W; (2) a rated voltage of up to 250 V AC or DC; and (3) lamp cap according to relevant GB standards.	
China	Luminaire	Road	CQC 3127-2010 Energy Conservation Certification Criteria for LED Products for Street Lighting & Tunnel Lighting.		Performance/ measurement		
China	System		CQC Mark Certification -	GB/T 17262	Performance/ measurement	Applies to single capped fluorescent lamps with pre-heating cathode and internal ignition device or external ignition device	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			Fluorescent Lamps (Single-Capped)				
China	System		CQC Mark Certification - Luminaire system for street lighting	CQC 3105-2009	Performance/ measurement	Applies to systems with fluorescent and HID lamps as light sources. Does NOT apply to tunnel lighting system or LED lighting system	
China	System		GB 19415-2003 Limited values of energy efficiency and evaluating values of energy conservation for single-capped fluorescent lamps	GB/T 17262	Performance/ measurement	Applies to single capped fluorescent lamps with pre-heating cathode and internal ignition device or external ignition device.	
China	System		GB 29142-2012 Minimum allowable values of energy efficiency and energy efficiency grades for single-capped electrodeless fluorescent lamps	QB/T 2938; GB 29142	Performance/ measurement	Applie to out-coupling and innter-coupling, single-capped, electrode-less fluorescent lamps, with rated power between 30W and 400W	
China	System		GB19043-2013 Minimum allowable values of energy efficiency grades of double-capped fluorescent lamps for general lighting service	GB/T 10682-2010 GB 19043-2013	Performance/ measurement	Applies to pre-heating cathode lamps that work both in AC power frequency circuits with starter and in high frequency circuits. Also applies to pre-heating cathode lamps that work in high frequency circuits	
China	System		GB/T 17262		Performance/ measurement	Applies to single capped fluorescent lamps with pre-heating cathode and internal ignition device or external ignition device	
China	System		GB/T 10682-2010 GB 19043-2013		Performance/ measurement	Applies to pre-heating cathode lamps that work both in AC power frequency circuits with starter and in high frequency circuits. Also applies to pre-heating cathode lamps that work in high frequency circuits	
China	System		QB/T 2938; GB 29142		Performance/ measurement	Applie to out-coupling and innter-coupling, single-capped, electrode-less fluorescent lamps, with rated power between 30W and 400W	
China	System		CQC 3105-2009		Performance/ measurement	Applies to systems with fluorescent and HID lamps as light sources. Does NOT apply to tunnel lighting system or LED lighting system	
Chinese Taipei (Taiwan)	Ballast	Fluorescent	Fluorescent lamp Ballast Efficiency Factor (BEF) Standard	CNS 1375 CNS 691		This standard program is regulated by CNS 1375. Fluorescent lamp Ballast includes conventional ballast and electronic ballast.	
Chinese Taipei (Taiwan)	Ballast	Fluorescent	CNS 1375 CNS 691			This standard program is regulated by CNS 1375. Fluorescent lamp Ballast includes conventional ballast and electronic ballast.	
Chinese Taipei (Taiwan)	Ballast	Fluorescent	CNS3888-85			Method of test for fluorescent lamp ballasts. Most of the tests relate to operation and safety of the ballast. CNS3888 sets out the method of test including start voltage test, secondary voltage test, cathode pre-heat current, output current and power, lamp current waveform, power factor, moisture withstand, temperature	Most of the tests specified in CNS3888 are similar in typeand method specified in IEC60920 and IEC60921

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						rise, insulation resistance and insulation voltage	
Chinese Taipei (Taiwan)	Ballast	Fluorescent	CNS927-96			Ballasts for Fluorescent Lamp. CNS927 sets out acceptance limits for tests conducted under CSN3888. These include construction and performance requirements. The performance requirements are almost identical to those set out in IEC60920 and IEC60921 although there are some very minor deviations for specialised product types and all product classifications are not identical. It is not clear how a ballast power consumption value for rapid start ballasts is determined for the energy efficiency regulations	IEC60920 and IEC60921
Chinese Taipei (Taiwan)	Lamp	CFLi	Greenmark - Fluorescent Lamps	CNS 10839 CNS 3936 CNS 691 CNS 14125 US ENERGY STAR®	Performance/ measurement	In August 1992 the Environment Protection Administration (EPA) launched an eco-label program called "Greenmark". The EPA still adminsters the program via the Greenmark Program Review Committee however implementation of all aspects of the program is contracted to the Environment and Development Foundation (EDF). The program covers a large number of product categories including paper, water-using devices and several energy-using appliances. All energy using appliances must meet energy efficiency criteria to receive the award. Labelling Requirements: 1. Category products are meant to be the preheat type of fluorescent lamp tubes. However, the energy-saving compact fluorescent lamps are excluded from this product category. 2. After two thousand (2000) hours of usage, the luminosity of the product shall maintain at no less than 85% of its initial strength. 3. The tube efficacy shall be greater than 80 lumens/watt. Tube must have a colour rendering index of no less than 80. 4. The mercury (Hg) content of each tube shall not exceed 15 mg. 5. The average concentration of mecury vapor in the working place shall not exceed 0.23 mg/m3. 6. Then name and address of the Green Mark user must be clearly printed on the product or its package. The name and address of the manufacturer must be marked on the product or package as well, if the logo user is not the manufacturer. 7. The product or the package shall bear a label reading "Energy Conservation and Mecury Pollution Reduction	
Chinese Taipei (Taiwan)	Lamp	CFLi	Energy Efficiency Criteria and Labelling Method for Compact Fluorescent Lamps	CNS 14576	Performance/ measurement	The applicable product shall meet the definition of compact fluorescent lamps as defined in CNS 14576.	
Chinese Taipei (Taiwan)	Lamp	CFLi	Self-Ballast Fluorescent Lamps	CNS 10839 CNS 3936 CNS 691 CNS 14125 US ENERGY STAR®	Performance/ measurement	Note: 1.The testing of Luminous efficiency (lm/W) should be in accordance with the Self-ballast Florescent lamp test method provided in CNS 14125. 2.Testing result of the Luminous efficiency F should not be lower than the standard value provided in above table, and has to be more than 95% of the labeled value.	
Chinese Taipei (Taiwan)	Lamp	CFLi	CNS 10839 CNS 3936 CNS 691 CNS 14125 US ENERGY STAR®		Performance/ measurement	Type, Rated power, Luminous efficiency (lm/W) Open lamp <10W : 40 >10W, <15W : 50 >15W, <25W : 60	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						>25W : 65 Hood lamp <15W : 40 >15W,<20W : 48 >20W, <25W : 50 >25W : 55 Note: 1.The testing of Luminous efficiency (lm/W) should be in accordance with the Self-ballast Florescent lamp test method provided in CNS 14125. 2.Testing result of the Luminous efficiency F should not be lower than the standard value provided in above table, and has to be more than 95% of the labeled value.	
Chinese Taipei (Taiwan)	Lamp	CFLi	CNS 14576		Performance/ measurement	The applicable product shall meet the definition of compact fluorescent lamps as defined in CNS 14576.	
Chinese Taipei (Taiwan)	Lamp	CFLi	Energy Efficiency Rating for Self-ballasted Fluorescent Lamps		Performance/ measurement		
Chinese Taipei (Taiwan)	Lamp	CFLi	CFL standard	CNS 10839 CNS 14567	Performance/ measurement	Note: 1. CFL tube light source colour zone should be in accordance with the fluorescent lamp chromaticity classification provided in CNS 10839: Day light colour (D: 5700~7100K), Lamp colour (L:2600~3150K). 2. Natural daylight colour (N: 4600~5400K), cool white colour (CW: 4600~5400K), white colour (W: 3900~4500K), warm white colour (WW 3200~3700K) lamp. The Luminous efficiency ratio should be in accordance with provision of lamp colour tube. 3. Luminous efficiency (lm/W) is the ratio of lamp luminance to lamp power. Test method based on CFL testing method provided in CNS 14576. 4. Testing result of the Luminous efficiency should not be lower than the standard value provided in above table, and has to be more than 95% of the labeled value. 5. If there is no relevant ballast can be used for testing Luminous efficiency, applicable ballast can be used for testing. 6. The colour fluorescent lamp and High Colour Rendering lamp (Ra>95)such as grow lights, bug lights, semiconductor lights, sterilizing light swill be exempt from the testing.	
Chinese Taipei (Taiwan)	Lamp	Fluorescent double cap	Energy Label - Fluorescent Lamps	CNS 691, CNS 10839 and CIE13.3	Performance/ measurement	The energy efficiency for Energy Label qualified fluorescent lamp products shall be tested according to CNS 691, CNS 10839 and CIE13.3	
Chinese Taipei (Taiwan)	Lamp	Fluorescent double cap	CNS 691, CNS 10839 and CIE13.3		Performance/ measurement	The energy efficiency for Energy Label qualified fluorescent lamp products shall be tested according to CNS 691, CNS 10839 and CIE13.3	
Chinese Taipei (Taiwan)	Lamp	Incandescent / halogen	Incandescent light bulb energy consumption efficiency standards	CNS 298 CNS 11006 CNS 5513 CNS 3891	Performance/ measurement	The minimum energy efficiency requirements apply to the products within the scope of CNS 298 Incandescent lamp bulbs for general lighting service, CNS 11006 Small lamp bulbs for household use and CNS 5513. Traffic signal lamps, with which rated lamp wattage equal to or higher than 25W.	
Chinese Taipei (Taiwan)	Lamp	Incandescent / halogen	CNS 298 CNS 11006 CNS 5513 CNS 3891		Performance/ measurement	The minimum energy efficiency requirements apply to the products within the scope of CNS 298 Incandescent lamp bulbs for general lighting service, CNS 11006 Small lamp bulbs for	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						household use and CNS 5513. Traffic signal lamps, with which rated lamp wattage equal to or higher than 25W.	
Chinese Taipei (Taiwan)	Luminaire	Exit Sign	CNS 10207		Performance/ measurement	Exit lights and emergency direction lights - The applicable products shall be exit lights or emergency direction lights which meet the requirements of CNS 10207 and its future amendments.	
Chinese Taipei (Taiwan)	Luminaire	Exit Sign	Energy Conservation Labelling Program Requirements for Exit Lights and Emergency Direction Lights	CNS 10207	Performance/ measurement	Exit lights and emergency direction lights - The applicable products shall be exit lights or emergency direction lights which meet the requirements of CNS 10207 and its future amendments.	
Chinese Taipei (Taiwan)	Luminaire	Traffic Light	Energy Efficiency Criteria and Labelling Method for Energy Label Qualified Street Lights	CNS 9118 Street Lights or CNS 15233 LED Street Lights	Performance/ measurement	Street lights - The product shall meet the definitions of street lights as defined in CNS 9118 Street Lights or CNS 15233 LED Street Lights.	
Chinese Taipei (Taiwan)	Luminaire	Traffic Light	CNS 9118 Street Lights or CNS 15233 LED Street Lights		Performance/ measurement	Street lights - The product shall meet the definitions of street lights as defined in CNS 9118 Street Lights or CNS 15233 LED Street Lights.	
Chinese Taipei (Taiwan)	Luminaire		Energy Conservation Labelling Program Requirements for Indoor Light Fixtures	CNS 14335	Performance/ measurement	Indoor light fixtures - The applicable products shall be indoor light fixtures which meet the requirements of CNS 14335, or recognized by the Bureau of Energy of the Ministry of Economic Affairs as indoor light fixtures.	
CIE	Lamp	All	CIE-13.3		Performance/ measurement	Method for colour rendering properties of sources	
CIE	Lamp	All	CIE-84:1989		Performance/ measurement	Measurement of luminous flux	
CIE	Lamp	All	CIE-TC 6-38		Performance/ measurement	Recommendation on photobiological safety of lamps	
CIE	Lamp	All	CIE-177:2007		Performance/ measurement	New Colour Rendering Index suggestions	
CIE	Lamp	All	CIE-13.3		Performance/ measurement	Method for colour rendering properties of sources	
CIE	Lamp	All	CIE-84:1989		Performance/ measurement	Measurement of luminous flux	
CIE	Lamp	All	CIE-TC 6-38		Performance/ measurement	Recommandation on photobiological safety of lamps	
CIE	Lamp	All	CIE-177:2007		Performance/ measurement	New Colour Rendering Index suggestions	
CIE	Lamp	All	CIE S 009 E:2002 / IEC 62471:2006		Performance/ measurement	'Photobiological safety of lamps and lamp systems '	
CIE	Lamp	All	CIE 013.3:1995		Performance/ measurement	'Method of measuring and specifying colour rendering properties of light sources'	
CIE	Lamp	All	CIE 015:2004		Performance/ measurement	'Colourimetry, 3rd edition'	
CIE	Lamp	All	CIE S004/E-2001		Performance/ measurement	'Colours of light signals'	

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CIE	Lamp	All	CIE S 014-1/E:2006 (ISO 11664-1:2007)		Performance/ measurement	'CIE Standard Colourimetric Observers'	
CIE	Lamp	All	CIE S 014-2/E:2006/ ISO 11664-2:2007(E)		Performance/ measurement	'CIE Standard Illuminants for Colourimetry'	
CIE	Lamp	All	CIE S 014-3/E:2011 (ISO 11664-3:2012)		Performance/ measurement	'Colourimetry - Part 3: CIE Tristimulus Values'	
CIE	Lamp	All	CIE S 014-4/E:2007 (ISO 11664-4:2008)		Performance/ measurement	'Colourimetry - Part 4: CIE 1976 L*a*b* Colour Spaces'	
CIE	Lamp	All	CIE S 014-5/E:2009 (ISO 11664-5:2009)		Performance/ measurement	'Colourimetry - Part 5: CIE 1976 L*u*v* Colour Space and u', v' Uniform Chromaticity Scale Diagram'	
CIE	Lamp	All	ISO/CIE 11664-6:2014(E)		Performance/ measurement	'Colourimetry – Part 6: CIEDE2000 Colour-Difference Formula'	
CIE	Lamp	All	CIE 102:1993		Performance/ measurement	'Recommended file format for electronic transfer of luminaire photometric data'	
CIE	Lamp	All	CIE S 010/E:2004 (ISO 23539:2005)		Performance/ measurement	'Photometry - The CIE system of physical photometry'	
CIE	Lamp	All	CIE 018.2:1983		Performance/ measurement	'The Basis of Physical Photometry, 2nd ed.'	
CIE	Lamp	All	CIE 041:1978		Performance/ measurement	'Light as a true visual quantity: Principles of measurement'	
CIE	Lamp	All	CIE 063:1984		Performance/ measurement	'The spectroradiometric measurement of light sources'	
CIE	Lamp	All	CIE 067:1986		Performance/ measurement	'Guide for the photometric specification and measurement of sports lighting installations'	
CIE	Lamp	All	CIE 070:1987		Performance/ measurement	'The measurement of absolute luminous intensity distributions'	
CIE	Lamp	All	CIE 084:1989		Performance/ measurement	'Measurement of luminous flux'	
CIE	Lamp	HID	CIE 153:2003		Performance/ measurement	'Report on intercomparison of measurements of the luminous flux of high-pressure sodium lamps'	
CIE	Lamp	LED	CIE-127:2007		Performance/ measurement	Reference for measurement of LED components	
CIE	Lamp	LED	CIE-127:2007		Performance/ measurement	Reference for measurement of LED components	
CIE	Lamp	LED	CIE 127:2007		Performance/ measurement	'Measurement of LED's' (2nd ed.)	
CIE	Lamp	LED	CIE 177:2007		Performance/ measurement	'Colour Rendering of White LED Light Sources'	
CIE	Lamp	LED	CIE 205:2013		Performance/ measurement	'Review of Lighting Quality Measures for Interior Lighting with LED Lighting Systems'	
CIE	Lamp	LED	CIE DIS 024/E:2013		Performance/ measurement	'Light Emitting Diodes (LEDs) and LED Assemblies - Terms and Definitions'	
CIE	Lamp	LED	CIE 177:2007		Performance/ measurement	'Colour Rendering of White LED Light Sources'	
CIE	Luminaire		CIE 043:1979		Performance/ measurement	'Photometry of floodlights'	

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CIE	Luminaire		CIE 121:1996		Performance/ measurement	'The photometry and goniophotometry of luminaires'	
CIE	System		CIE S 017/E:2011		Classification	'ILV: International lighting vocabulary, new	
CIE	System		CIE 019.21:1981		Performance/ measurement	'An analytic model for describing the influence of lighting parameters upon visual performance, 2nd ed., Vol.1.: Technical foundations'	
CIE	System		CIE 019.22:1981		Performance/ measurement	'An analytic model for describing the influence of lighting parameters upon visual performance, 2nd ed., Vol.2.: Summary and application guidelines'	
CIE	System		CIE S015/E:2005		Performance/ measurement	'Lighting of Outdoor Work Places'	
CIE	System		CIE S 016/E:2005 (ISO 8995-3:2006)		Safety	'Lighting of Work Places - Part 3: Lighting Requirements for Safety and Security of Outdoor Work Places'	
CIE	System		CIE 128:1998		Performance/ measurement	'Guide to the lighting for open-cast mines'	
CIE	System		CIE 129:1998		Performance/ measurement	'Guide for lighting exterior work areas'	
CIE	System		HD 60364-7-714:2012		Performance/ measurement	'Low-voltage electrical installations - Part 7-714: Requirements for special installations or locations - External lighting installations'	
CIE	System		CIE 032:197		Performance/ measurement	'Lighting in situations requiring special treatment'	
CIE	System		CIE 033:1977		Performance/ measurement	'Depreciation of installations and their maintenance'	
CIE	System		CIE 034-1977		Performance/ measurement	'Road lighting lantern and installation data: photometrics, classification and performance'	
CIE	System		CIE 047:1979		Performance/ measurement	'Road lighting for wet conditions'	
CIE	System		CIE 066:1984		Performance/ measurement	'Road surfaces and lighting (joint technical report CIE/PIARC)'	
CIE	System		CIE 093:1992		Performance/ measurement	'Road lighting as an accident countermeasure'	
CIE	System		CIE 094:1993		Performance/ measurement	'Guide for floodlighting'	
CIE	System		CIE 100:1992		Performance/ measurement	'Fundamentals of the visual task of night driving	
CIE	System		CIE 115:2010		Performance/ measurement	'Lighting of Roads for Motor and Pedestrian Traffic'	
CIE	System		CIE 132:1999		Performance/ measurement	'Design methods for lighting of roads'	
CIE	System		CIE 136:2000		Performance/ measurement	'Guide to the lighting of urban areas'	
CIE	System		CIE 140:2000		Performance/ measurement	'Road Lighting Calculations (Rev. 2)'	
CIE	System		CIE 144:2001		Performance/ measurement	'Road surface and road marking reflection characteristics'	
CIE	System		CIE 154:2003		Performance/ measurement	'The maintenance of outdoor lighting systems'	

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CIE	System		CIE 206:2014		Performance/ measurement	'The Effect of Spectral Power Distribution on Lighting for Urban and Pedestrian Areas'	
CIE	System		CIE 061:19		Performance/ measurement	'Tunnel entrance lighting: A survey of fundamentals for determining the luminance in the threshold zone'	
CIE	System		CIE 088:2004		Performance/ measurement	'Guide for the lighting of road tunnels and underpasses, 2nd ed.'	
CIE	System		CIE 189:2010		Performance/ measurement	'Calculation of Tunnel Lighting Quality Criteria'	
CIE	System		CIE 193:2010		Performance/ measurement	'Emergency Lighting in Road Tunnels'	
CIE	System		CIE S 006.1/E-1998 (ISO 16508:1999)		Performance/ measurement	'Road traffic lights - Photometric properties of 200 mm roundel signals'	
CIE	System		CIE 079:1988		Performance/ measurement	'A guide for the design of road traffic lights'	
CIE	System		CIE 001-1980		Performance/ measurement	'Guidelines for minimizing urban sky glow near astronomical observatories (Joint Publication IAU/CIE)'	
CIE	System		CIE 126:1997		Performance/ measurement	'Guidelines for minimizing sky glow'	
CIE	System		CIE 150:2003		Performance/ measurement	'Guide on the limitation of the effects of obtrusive light from outdoor lighting installations'	
CIE	System		CIE S 008/E:2001 (ISO 8995-1:2002 Cor.1 2005)		Performance/ measurement	'Lighting of Work Places - Part 1: Indoor'	
CIE	System		CIE 040:1978		Performance/ measurement	'Calculations for interior lighting: Basic method'	
CIE	System		CIE 052:1982		Performance/ measurement	'Calculations for interior lighting: Applied method'	
CIE	System		CIE 097:2005		Performance/ measurement	'Maintenance of indoor electric lighting systems'	
CIE	System		CIE 161:2004		Performance/ measurement	'Lighting design methods for obstructed interiors'	
CIE	System		CIE 042:1978		Performance/ measurement	'Lighting for tennis'	
CIE	System		CIE 045:1979		Performance/ measurement	'Lighting for ice sports'	
CIE	System		CIE 057:1983		Performance/ measurement	'Lighting for football'	
CIE	System		CIE 058:1983		Performance/ measurement	'Lighting for sports halls'	
CIE	System		CIE 062:1984		Performance/ measurement	'Lighting for swimming pools'	
CIE	System		CIE 067:1986		Performance/ measurement	'Guide for the photometric specification and measurement of sports lighting installations'	
CIE	System		CIE 083:1989		Performance/ measurement	'Guide for the lighting of sports events for colour television and film systems'	

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CIE	System		CIE 169:2005		Performance/ measurement	'Practical design guidelines for the lighting of sport events for colour'	
CIE	System		CIE S 020/E:2007 (ISO 30061:2007)		Performance/ measurement	'Emergency Lighting'	
CIE	System		CIE 138:2000		Performance/ measurement	'CIE Collection in photobiology and photochemistry 2000'	
CIE	System		CIE 139:2001		Performance/ measurement	'The influence of daylight and artificial light variations in humans - a bibliography'	
CIE	System		CIE 158:2009		Performance/ measurement	'Ocular lighting effects on human physiology and behaviour'	
CIE	System		CIE 194:2011		Performance/ measurement	'On Site Measurement of the Photometric Properties of Road and Tunnel Lighting'	
CIE	System		CIE 031-1976		Performance/ measurement	'Glare and uniformity in road lighting installations'	
CIE	System		CIE 055:1983		Performance/ measurement	'Discomfort glare in the interior working environment'	
CIE	System		CIE 112:1994		Performance/ measurement	'Glare evaluation system for use within outdoor sports and area lighting'	
CIE	System		CIE 117:1995		Performance/ measurement	'Discomfort glare in interior lighting'	
CIE	System		CIE 146:2002		Performance/ measurement	'CIE Equations for Disability Glare'	
CIE	System		CIE 147:2002		Performance/ measurement	'Glare from Small, Large and Complex Sources'	
CIE	System		CIE 190:2010		Performance/ measurement	'Calculation and Presentation of Unified Glare Rating Tables for Indoor Lighting Luminaires'	
CIE	System		CIE 123:1997		Performance/ measurement	'Low vision - Lighting needs for the partially sighted'	
CIE	System		CIE 196:2011		Performance/ measurement	'CIE Guide to Increasing Accessibility in Light and Lighting'	
Costa Rica	Lamp	CFLi	INTE 28-01-07-08		Performance/ measurement	Energy efficiency - compact and circular fluorescent lamps - Performance Ranges	
Costa Rica	Lamp	CFLi	INTE 28-01-08-08		Performance/ measurement	Energy efficiency - compact and circular fluorescent lamps - labelling	
Costa Rica	Lamp	CFLi	INTE 28-01-09-08		Performance/ measurement	Approved method for electrical and photometric measurements of compacted fluorescent single-ended method	
Egypt	Lamp	CFLi	2009/6313 Energy efficiency label of household lamps		Performance/ measurement	This standard applies to energy efficiency label of household lamps - household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. This standard complies with European Directive (98/11/EC).	
Europe	Ballast	Fluorescent	Commission Regulation (EC) No 245/2009 of 18 March 2009 implementing Directive 2005/32/EC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:092:0011:0014:EN:PDF		This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			of the European Parliament and of the Council with regard to ecodesign requirements for for fluorescent lamps without integrated ballast, for high intensity discharg			lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Europe	Ballast	HID	Commission Regulation (EC) No 245/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for for fluorescent lamps without integrated ballast, for high intensity discharg	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:092:0011:0014:EN:PDF		This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Europe	Ballast	LED	EN 61347-2-13:2006/ corrigendum Dec. 2010 ; FprEN 61347-2-13:2012 under approval			'Lamp controlgear - Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules'	
Europe	Ballast	LED	EN 62384:2006/A1:2009			'DC or AC supplied electronic control gear for LED modules. Performance requirements'	
Europe	Ballast	LED	EN 62386-207:2009			'Digital addressable lighting interface. Particular requirements for control gear. LED modules (device type 6).'	
Europe	Ballast	LED	FprEN 62442-3:2014 (under approval)			'Energy performance of lamp controlgear - Part 3: Controlgear for halogen lamps and LED modules - Method of measurement to determine the efficiency of the controlgear '	
Europe	Ballast		EN 50294:1998/A2:2003			'Measurement Method of Total Input Power of Ballast-Lamp Circuits'	
Europe	Ballast		EN 50564:2011			'Electrical and electronic household and office equipment - Measurement of low power consumption' (stand-by, no-load)	
Europe	Ballast		EN 60155:1995/A2:2007			'Glow-starters for fluorescent lamps'	
Europe	Ballast		EN 60730-2-3:2007			'Automatic electrical controls for household and similar use - Part 2-3: Particular requirements for thermal protectors for ballasts for tubular fluorescent lamps'	
Europe	Ballast		EN 60730-2-7:2010			'Automatic electrical controls for household and similar use - Part 2-7: Particular requirements for timers and time switches'	
Europe	Ballast		EN 60921:2004/A1:2006			'Ballasts for tubular fluorescent lamps – Performance requirements'	

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Europe	Ballast		EN 60923:2005/A1:2006			'Auxiliaries for lamps. Ballasts for discharge lamps (excluding tubular fluorescent lamps). Performance requirements.'	
Europe	Ballast		EN 60925:1991/A2:2001			'D.C. supplied electronic ballasts for tubular fluorescent lamps - Performance requirements'	
Europe	Ballast		EN 60927:2007/A1:2013			'Auxiliaries for lamps - Starting devices (other than glow starters) - Performance requirements.'	
Europe	Ballast		EN 60929:2011/AC:2011			'AC-supplied electronic ballasts for tubular fluorescent lamps – Performance requirements'	
Europe	Ballast		EN 61047:2004			'D.C. or A.C. supplied electronic step-down converters for filament lamps. Performance requirements'.	
Europe	Ballast		EN 61048:2006/ FprA1:2013 (amendment under approval)			'Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General and safety requirements'	
Europe	Ballast		EN 61049:1993			'Capacitors for Use in Tubular Fluorescent and Other Discharge Lamp - Circuits Performance Requirements'	
Europe	Ballast		EN 61050:1992/A1:1995			'Transformers for tubular discharge lamps having a no-load output voltage exceeding 1 kV (generally called neon-transformers) - General and safety requirements'	
Europe	Ballast		EN 61347-1:2008/FprA3:2013 (amendment under approval)			'Lamp control gear - Part 1: General and safety requirements'	
Europe	Ballast		EN 61347-2-1:2001/A2:2014			'Lamp control gear - Part 2-1: Particular requirements for starting devices (other than glow starters)'	
Europe	Ballast		EN 61347-2-2:2012			'Lamp control gear - Part 2-2: Particular requirements for d.c. or a.c. supplied electronic step-down convertors for filament lamps'	
Europe	Ballast		EN 61347-2-3:2011/AC:2011			'Lamp control gear - Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps'	
Europe	Ballast		EN 61347-2-4:2001/ corrigendum Dec. 2010			'Lamp control gear - Part 2-4: Particular requirements for d.c. supplied electronic ballasts for general lighting'	
Europe	Ballast		EN 61347-2-7:2012			'Lamp controlgear - Part 2-7: Particular requirements for battery supplied electronic controlgear for emergency lighting (self-contained)	
Europe	Ballast		EN 61347-2-8:2001/ corrigendum Dec. 2010			'Lamp control gear - Part 2-8: Particular requirements for ballasts for fluorescent lamps'	
Europe	Ballast		EN 61347-2-9:2013			'Lamp control gear – Part 2-9: Particular requirements for electromagnetic control gear for discharge lamps (excluding fluorescent lamps)'	
Europe	Ballast		EN 61347-2-10:2001/A1:2009 corrigendum Dec. 2010			'Lamp controlgear - Part 2-10: Particular requirements for electronic invertors and convertors for high-frequency operation of cold start tubular discharge lamps (neon tubes)'	
Europe	Ballast		EN 61347-2-11:2001/ corrigendum Dec. 2010			'Lamp control gear. - Part 2-11: Particular requirements for miscellaneous electronic circuits used with luminaires.'	

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Europe	Ballast		EN 61347-2-12:2005/A1:2010			'Lamp control gear - Part 2-12: Particular requirements for d.c. or a.c. supplied electronic ballasts for discharge lamps (excluding fluorescent lamps)'	
Europe	Ballast		EN 61347-2-13:2006/ corrigendum Dec. 2010 ; FprEN 61347-2-13:2012 under approval			'Lamp controlgear - Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules'	
Europe	Ballast		EN 62442-1:2011/AC:2012			'Energy performance of lamp control gear - Part 1: Control gear for fluorescent lamps - Method of measurement to determine the total input power of control gear circuits and the efficiency of the control gear'	
Europe	Ballast		FprEN 62811:2014 (under approval)			'AC and/or DC-supplied electronic controlgear for discharge lamps (excluding fluorescent lamps) - Performance requirements for low frequency squarewave operation'	
Europe	Ballast		EN 61558-2-9:2011			'Safety of transformers, reactors, power supply units and combinations thereof - Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps for tungsten filament lamps'	
Europe	Controls		EN 15232:2012 ; prEN 15232 rev (under drafting)			'Energy performance of buildings - Impact of Building Automation, Controls and Building Management.'	
Europe	Controls		EN 50428:2005			'Switches for household and similar fixed electrical installations - Collateral standard - Switches and related accessories for use in home and building electronic systems (HBES)'	
Europe	Controls		EN 50490:2008			'Electrical installations for lighting and beaconing of aerodromes - Technical requirements for aeronautical ground lighting control and monitoring systems - Units for selective switching and monitoring of individual lamps'	
Europe	Controls		EN 50491-3:2009 (and other parts of 50491)			'General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Part 3: Electrical safety requirements'	
Europe	Controls		EN 60669-1:1999/IS1:2009			'Switches for household and similar fixed-electrical installations - Part 1: General requirements'	
Europe	Controls		EN 60669-2-1:2004/A12:2010 FprA2:2013 (under approval)			'Switches for household and similar fixed electrical installations - Part 2-1: Particular requirements - Electronic switches'	
Europe	Controls		EN 60669-2-2:2006			'Switches for household and similar fixed electrical installations Particular requirements. Electromagnetic remote-control switches (RCS)'	
Europe	Controls		EN 60669-2-3:2006			'Switches for household and similar fixed electrical installations. Particular requirements Time-delay switches (TDS)'	
Europe	Controls		EN 60669-2-4:2005			'Switches for household and similar fixed electrical installations - Part 2-4: Particular requirements - Isolating switches'	
Europe	Controls		EN 60669-2-5:2014			'Switches for household and similar fixed electrical installations - Part 2-5: Particular requirements - Switches and related accessories for use in home and building electronic systems (HBES)'	
Europe	Controls		EN 60669-2-6:2012			'Switches for household and similar fixed electrical installations - Part 2-6: Particular requirements - Fireman's switches for exterior and interior signs and luminaires'	
Europe	Controls		EN 62386-101:2009 ; FprEN 62386-101:2013 (under approval)			'Digital addressable lighting interface - Part 101: General requirements – System.'	

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Europe	Controls		EN 62386-102:2009 ; FprEN 62386-102:2013 (under approval)			'Digital addressable lighting interface. General requirements. Control gear.'	
Europe	Controls		FprEN 62386-103:2013 (under approval)			'Digital addressable lighting interface. Part 103. General requirements. Control devices.'	
Europe	Controls		EN 62386-201:2009 ; FprEN 62386-201:2014 (under approval)			'Digital addressable lighting interface. Particular requirements for control gear. Fluorescent lamps (device type 0).'	
Europe	Controls		EN 62386-202:2009			'Digital addressable lighting interface. Particular requirements for control gear. Self-contained emergency lighting (device type 1). '	
Europe	Controls		EN 62386-203:2009			'Digital addressable lighting interface. Particular requirements for control gear. Discharge lamps (excluding fluorescent lamps) (device type 2).'	
Europe	Controls		EN 62386-204:2009			'Digital addressable lighting interface. Particular requirements for control gear. Low voltage halogen lamps (device type 3).'	
Europe	Controls		EN 62386-205:2009			'Digital addressable lighting interface. Particular requirements for control gear. Supply voltage controller for incandescent lamps (device type 4).'	
Europe	Controls		EN 62386-206:2009			'Digital addressable lighting interface. Particular requirements for control gear. Conversion from digital signal into d.c. voltage (device type 5).'	
Europe	Controls		EN 62386-207:2009			'Digital addressable lighting interface. Particular requirements for control gear. LED modules (device type 6).'	
Europe	Controls		EN 62386-208:2009			'Digital addressable lighting interface. Particular requirements for control gear. Switching function (device type 7).'	
Europe	Controls		EN 62386-209:2011			'Digital addressable lighting interface - Part 209: Particular requirements for control gear - Colour control (device type 8).'	
Europe	Controls		EN 62386-210:2011			'Digital addressable lighting interface Particular requirements for control gear. Sequencer (device type 9).'	
Europe	Controls		FprEN 62733:2014 (under approval)			'Programmable components in electronic lamp controlgear - General and safety requirements'	
Europe	EMC		EN 55015:2013 ; FprA1:2014 (under approval)		EMC	'Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment'	
Europe	EMC		EN 55103-1:2009/A1:2012		EMC	'Electromagnetic compatibility - Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use - Part 1: Emissions'	
Europe	EMC		EN 55103-2:2009/IS1:2012		EMC	'Electromagnetic compatibility - Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use - Part 2: Immunity'	
Europe	EMC		EN 60335-2-27:2013		EMC	'Household and similar electrical appliances - Safety - Part 2-27: Particular requirements for appliances for skin exposure to ultraviolet and infrared radiation'	
Europe	EMC		EN 61000-3-2:2006 ; FprA3:2013 (under approval)		EMC	'Electromagnetic compatibility (EMC) Limits. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)'	
Europe	EMC		EN 61000-3-3:2013		EMC	'Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection'	

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Europe	EMC		EN 61000-4-1:2007		EMC	'Electromagnetic compatibility (EMC) - Part 4-1: Testing and measurement techniques - Overview of EN 61000-4 series'	
Europe	EMC		EN 61000-4-6:2014		EMC	'Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields'	
Europe	EMC		EN 61000-4-15:2011		EMC	'Electromagnetic compatibility (EMC) - Part 4-15: Testing and measurement techniques - Flickermeter - Functional and design specifications'	
Europe	EMC		EN 61547:2009		EMC	'Equipment for general lighting purposes - EMC immunity requirements'	
Europe	EMC		EN 62493:2010		EMC	'Assessment of lighting equipment related to human exposure to electromagnetic fields'	
Europe	EMC		EN 61000-3-2		EMC	Electromagnetic compatibility : classes according to harmonic distorsion of sector currents	
Europe	EMC		EN 61000-3-3		EMC	Electromagnetic compatibility	
Europe	EMC		EN 61547		EMC	EMC immunity prescriptions	
Europe	EMC		EN 55015		EMC	Radioelectric disturbances produced by lighting devices	
Europe	EMC		2004/108/CE		EMC	EMC European directive - Radioelectric disturbances	
Europe	EMC		CE marking		EMC	CE markings requires compliance to : EMC directive, Low Voltage directive, EuP directive, photobiological safety directive, directive on human exposure to electromagntic fields	
Europe	Lamp	All	EN 61231:2010/ A1:2013		Classification	'International lamp coding system (ILCOS)'	
Europe	Lamp	All	EN 50285:1999		Performance/ measurement	'Energy efficiency of electric lamps for household use - Measurement methods.'	
Europe	Lamp	All	EN 60630:1998/ FprA7:2014 (under approval)		Classification	'Maximum lamp outlines for incandescent lamps'	
Europe	Lamp	All	EN 62471:2008 ; FprEN 62471-5:2014 (under approval)		Safety	'Photobiological safety of lamps and lamp systems'	
Europe	Lamp	All	EN 13032-1:2004+A1:2012		Performance/ measurement	'Light and lighting — Measurement and presentation of photometric data of lamps and luminaires — Part 1: Measurement and file format.'	
Europe	Lamp	All	EN 13032-2:2004/AC:2007		Performance/ measurement	'Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 2: Presentation of data for indoor and outdoor work places.'	
Europe	Lamp	All	EN 13032-3:2007		Performance/ measurement	'Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 3: Presentation of data for emergency lighting of work places'	
Europe	Lamp	All	prEN 13032-4:201X (under approval in 2014)		Performance/ measurement	'Light and lighting - Measurement and presentation of photometric data - Part 4: LED lamps, modules and luminaires'	
Europe	Lamp	All	A2:2012 ; prEN 62035:201X (under approval) ; IEC 62035:2014		Safety		

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Europe	Lamp	All	prEN 50625-2-1 (under drafting)		Safety	'Collection, logistics & Treatment requirements for WEEE - Part 2-1: Treatment requirements for lamps'	
Europe	Lamp	All	EN 62471		Safety	Photobiological safety - reference document in Europe	
Europe	Lamp	All	EN 13032-1		Performance/ measurement	Photometry : Measurement of Intensity,luminance,flux of lamps and luminaires	
Europe	Lamp	All	EN 50285		Performance/ measurement	Labelling of lamps for flux, energy efficiency and lifetime - application of EU directive 92/75/CEE	
Europe	Lamp	All	98/11/CE		Performance/ measurement	Energy class of domestic lamps, flux, electrical power and nominal lifetime	
Europe	Lamp	CFLi	EN 60969:1993/ A2:2000 ; FprEN 60969:2013 (under approval)		Performance/ measurement	'Self-ballasted lamps for general lighting services – Performance requirements'	
Europe	Lamp	CFLi	EN 60968:2013/A11:201X ; FprEN 60968:2013 (under approval)		Safety	'Self-ballasted lamps for general lighting services - Safety requirements.'	
Europe	Lamp	CFLi	COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources	EN 50285	Performance/ measurement	The product group "light bulbs" shall comprise: "single-ended light bulbs": all light bulbs which provide general purpose lighting and have single-ended, bayonet, screw or pin fittings. The light bulbs shall be connectable to the public electricity supply. "double-ended light bulbs": all light bulbs which provide general purpose lighting and have fittings at both ends. This includes, principally, all linear fluorescent tubes. The light bulbs shall be connectable to the public electricity supply. The following types of lamps are not included in the product group: compact fluorescent lamps with a magnetic ballast, projector lamps, photographic lighting and solarium tubes.	
Europe	Lamp	CFLi	Commission Delegated Regulation (EU) No 874/2012 of 12 July 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires		Performance/ measurement	This Regulation establishes requirements for labelling of and providing supplementary product information on electrical lamps such as: (a) filament lamps; (b) fluorescent lamps; (c) high-intensity discharge lamps; (d) LED lamps and LED modules. This Regulation also establishes requirements for labelling luminaires designed to operate such lamps and marketed to end users, including when they are integrated into other products that are not dependent on energy input in fulfilling their primary purpose during use (such as furniture). 2. The following products shall be excluded from the scope of this Regulation: (a) lamps and LED modules with a luminous flux of less than 30 lumens; (b) lamps and LED modules marketed for operation with batteries; (c) lamps and LED modules marketed for applications where their primary purpose is not lighting, such as: (i) emission of light as an agent in chemical or biological processes (such as polimerisation, photodynamic therapy, horticulture, petcare, anti-insect products); (ii) image capture and image projection (such as camera flashlights, photocopiers, video projectors); (iii) heating (such as infrared lamps); (iv) signalling (such as airfield lamps). These lamps and LED modules are not excluded when they are marketed for lighting; (d) lamps and LED modules marketed as part of a luminaire and not intended to be removed by the end-user, except when they are offered for sale, hire or hire purchase or displayed separately to the end user, for example as spare parts; (e) lamps and LED modules marketed as part of a product whose primary purpose is not lighting. However, if they are offered for sale, hire or hire purchase or displayed separately, for example as spare parts, they shall be included within the scope of this Regulation; (f) lamps and LED modules that do not comply with requirements becoming	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						applicable in 2013 and 2014 according to Regulations implementing Directive 2009/125/EC of the European Parliament and of the Council [4]; (g) luminaires that are designed to operate exclusively with the lamps and LED modules listed in points (a) to (c).	
Europe	Lamp	CFLi	Commission Regulation (EC) No 244/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps (amended by: Commission Regulation (EC) No 859/2009 as regards the ecodesign requirements on ultra-violet radiation of non-directional household lamps)		Performance/ measurement	The regulation covers incandescent, halogen, and compact fluorescent lamps. This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. The requirements set out in this Regulation shall not apply to the following household and special purpose lamps: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3.	
Europe	Lamp	Fluorescent double cap	EN 62554:2011		Performance/ measurement	'Sample preparation for measurement of mercury level in fluorescent lamps'	
Europe	Lamp	Fluorescent double cap	EN 60081:1998/A4:2010 / A5:2013		Performance/ measurement	'Double-capped fluorescent lamps - Performance specifications.'	
Europe	Lamp	Fluorescent double cap	EN 61195:1999/ FprA2:2014 (amendment under approval)		Safety	'Double-capped fluorescent lamps - Safety specifications'	
Europe	Lamp	Fluorescent single cap	EN 60901:1996/ A4:2008 FprA6:2012 (under approval)		Performance/ measurement	'Single-capped fluorescent lamps – Performance specifications'	
Europe	Lamp	Fluorescent single cap	EN 61199:2011/ FprA2:2014 (amendment under approval)		Safety	'Single-capped fluorescent lamps - Safety specifications'	
Europe	Lamp	HID	EN 60188:2001		Performance/ measurement	'High-pressure mercury vapour lamps - Performance specifications'	
Europe	Lamp	HID	EN 60192:2001		Performance/ measurement	'Low pressure sodium vapour lamps - Performance specifications'	
Europe	Lamp	HID	EN 60662:1993/A10:1997 EN 60662:2012		Performance/ measurement	'High-pressure sodium vapour lamps. Performance specifications'	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Europe	Lamp	HID	EN 61167:2011/ FprA1:2013 under approval		Performance/ measurement	'Metal halide lamps - Performance specifications.'	
Europe	Lamp	HID	EN 62035:2000/ A1:2003		Safety	'Discharge lamps (excluding fluorescent lamps) - Safety specifications.'	
Europe	Lamp	HID	Commission Regulation (EC) No 245/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for for fluorescent lamps without integrated ballast, for high intensity discharg		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The following lamps shall be exempted from the provisions of this Regulation: (a) lamps that are not white light sources as defined in Annex II; this exemption does not apply to high pressure sodium lamps; (b) lamps that are directional light sources as defined in Annex II; (c) lamps intended for use in other applications than general lighting and lamps incorporated into other products not providing a general lighting function; (d) lamps having: - 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, - 11 % or more of total radiation of the range 250-780 nm in the range of 630-780 nm, - 5 % or more of total radiation of the range 250-780 nm in the range of 640-700 nm, and - the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) double capped fluorescent lamps having: - a diameter of 7 mm (T2) and less, - a diameter of 16 mm (T5) and lamp power P = 13 W or P > 80 W, - a diameter of 38 mm (T12), lamp cap G-13 Medium BiPin base, +/– 5 m (+magenta, –green) colour compensating filter value limit (cc). CIE coordinates x=0,330 y=0,335 and x=0,415 y=0,377, and - a diameter of 38 mm (T12) and equipped with an external ignition strip; (f) single capped fluorescent lamps having a diameter of 16 mm (T5) 2G11 4 pin base, Tc = 3200 K with chromaticity coordinates x=0,415 y=0,377 and Tc = 5500 K with chromaticity coordinates x=0,330 y=0,335; (g) high intensity discharge lamps with Tc > 7000 K; (h) high intensity discharge lamps having a specific effective UV output > 2 mW/klm; and (i) high intensity discharge lamps not having lamp cap E27, E40, PGZ12. The following luminaires shall be exempted: (a) emergency lighting luminaires and emergency sign luminaires within the meaning of Council Directive 2006/95/EC of the European Parliament and of the Council; (b) luminaires covered by the requirements of Directives 94/9/EC of the European Parliament and of the Council, Directive 1999/92/EC of the European Parliament and of the Council, Directive 2006/42/EC of the European Parliament and of the Council, Council Directive 93/42/EEC, Council Directive 88/378/EEC and luminaires integrated into equipment covered by these requirements.	
Europe	Lamp	HID	Commission Regulation (EC) No 244/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps (amended by: Commission	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2009R0244:20090901:EN:PDF	Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB);	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			Regulation (EC) No 85			(e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Europe	Lamp	Incandescent / halogen	EN 60064:1995/ A5:2009		Performance/ measurement	'Tungsten filament lamps for domestic and similar general lighting purposes - Performance requirements'.	
Europe	Lamp	Incandescent / halogen	EN 60357:2003/ A3:2011		Performance/ measurement	'Tungsten halogen lamps (non-vehicle) - Performance specifications'	
Europe	Lamp	Incandescent / halogen	Commission Regulation (EC) No 244/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps (amended by: Commission Regulation (EC) No 859/2009 as regards the ecodesign requirements on ultra-violet radiation of non-directional household lamps)		Performance/ measurement	The regulation covers incandescent, halogen, and compact fluorescent lamps. This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. The requirements set out in this Regulation shall not apply to the following household and special purpose lamps: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3.	
Europe	Lamp	Incandescent / halogen	COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources	EN 50285	Performance/ measurement	The product group "light bulbs" shall comprise: "single-ended light bulbs": all light bulbs which provide general purpose lighting and have single-ended, bayonet, screw or pin fittings. The light bulbs shall be connectable to the public electricity supply. "double-ended light bulbs": all light bulbs which provide general purpose lighting and have fittings at both ends. This includes, principally, all linear fluorescent tubes. The light bulbs shall be connectable to the public electricity supply. The following types of lamps are not included in the product group: compact fluorescent lamps with a magnetic ballast, projector lamps, photographic lighting and solarium tubes.	
Europe	Lamp	Incandescent / halogen	COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources	EN 50285	Performance/ measurement	The product group "light bulbs" shall comprise: "single-ended light bulbs": all light bulbs which provide general purpose lighting and have single-ended, bayonet, screw or pin fittings. The light bulbs shall be connectable to the public electricity supply. "double-ended light bulbs": all light bulbs which provide general purpose lighting and have fittings at both ends. This includes, principally, all linear fluorescent tubes. The light bulbs shall be connectable to the public electricity supply. The following types of lamps are not included in the product group: compact fluorescent lamps with a magnetic ballast, projector lamps, photographic lighting and solarium tubes.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Europe	Lamp	Incandescent / halogen	Commission Delegated Regulation (EU) No 874/2012 of 12 July 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires		Performance/ measurement	This Regulation establishes requirements for labelling of and providing supplementary product information on electrical lamps such as: (a) filament lamps; (b) fluorescent lamps; (c) high-intensity discharge lamps; (d) LED lamps and LED modules. This Regulation also establishes requirements for labelling luminaires designed to operate such lamps and marketed to end users, including when they are integrated into other products that are not dependent on energy input in fulfilling their primary purpose during use (such as furniture). 2. The following products shall be excluded from the scope of this Regulation: (a) lamps and LED modules with a luminous flux of less than 30 lumens; (b) lamps and LED modules marketed for operation with batteries; (c) lamps and LED modules marketed for applications where their primary purpose is not lighting, such as: (i) emission of light as an agent in chemical or biological processes (such as polimerisation, photodynamic therapy, horticulture, petcare, anti-insect products); (ii) image capture and image projection (such as camera flashlights, photocopiers, video projectors); (iii) heating (such as infrared lamps); (iv) signalling (such as airfield lamps). These lamps and LED modules are not excluded when they are marketed for lighting; (d) lamps and LED modules marketed as part of a luminaire and not intended to be removed by the end-user, except when they are offered for sale, hire or hire purchase or displayed separately to the end user, for example as spare parts; (e) lamps and LED modules marketed as part of a product whose primary purpose is not lighting. However, if they are offered for sale, hire or hire purchase or displayed separately, for example as spare parts, they shall be included within the scope of this Regulation; (f) lamps and LED modules that do not comply with requirements becoming applicable in 2013 and 2014 according to Regulations implementing Directive 2009/125/EC of the European Parliament and of the Council [4]; (g) luminaires that are designed to operate exclusively with the lamps and LED modules listed in points (a) to (c).	
Europe	Lamp	Incandescent / halogen	Commission Regulation (EC) No 244/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps (amended by: Commission Regulation (EC) No 859/2009 as regards the ecodesign requirements on ultra-violet radiation of non-directional household lamps)		Performance/ measurement	The regulation covers incandescent, halogen, and compact fluorescent lamps. This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. The requirements set out in this Regulation shall not apply to the following household and special purpose lamps: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3.	
Europe	Lamp	Incandsecent / halogen	EN 60432-1:2000/A2:2012		Safety	'Incandescent lamps - Safety specifications - Part 1: Tungsten filament lamps for domestic and similar general lighting purposes'	
Europe	Lamp	Incandsecent / halogen	EN 60432-2:2000/A2:2012		Safety	'Incandescent lamps - Safety specifications - Part 2: Tungsten halogen lamps for domestic and similar general lighting purposes.'	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Europe	Lamp	Incandsecent / halogen	EN 60432-3:2013		Safety	'Incandescent lamps - Safety specifications - Part 3: Tungsten-halogen lamps (non-vehicle)'	
Europe	Lamp	Induction	EN 62639:2012		Performance/ measurement	'Fluorescent induction lamps - Performance specifications.'	
Europe	Lamp	Induction	EN 62532:2011		Safety	'Fluorescent induction lamps - Safety specifications.'	
Europe	Lamp	LED	EN 61347-2-13		Performance/ measurement	Alimentation, continuous or alternative of LED modules	
Europe	Lamp	LED	EN 62384		Performance/ measurement	Minimum performance of LED module alimentation (Power factor must be indicated), related electrical stress tests	
Europe	Lamp	LED	EN 62386-207		Performance/ measurement	Control protocols of LED (DALI etc)	
Europe	Lamp	LED	Draft, EN 13032-4 Lighting Applications — Measurement and presentation of photometric data of lamps and luminaires — Part 4: LED lamps, modules and luminaires (joint work with CIE TC2-71).		Performance/ measurement		
Europe	Lamp	LED	prEN 13032-4:201X (under approval)		Performance/ measurement	'Light and lighting - Measurement and presentation of photometric data - Part 4: LED lamps, modules and luminaires'	
Europe	Lamp	LED	EN 62031:2008/ FprA2:2014 (amendment under approval)		Safety	'LED modules for general lighting - Safety specifications'	
Europe	Lamp	LED	FprEN 62504:2014 (under approval)		Classification	'General lighting - Light emitting diode (LED) products and related equipment - Terms and definitions'	
Europe	Lamp	LED	EN 62560:2012/FprA1:2013 (amendment under approval)		Safety	'Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specifications'	
Europe	Lamp	LED	EN 62612:2013		Performance/ measurement	'Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements'	
Europe	Lamp	LED	FprEN 62663-1:2012 (under approval)		Safety	'Non-ballasted LED-lamps - Part 1: Safety specifications'	
Europe	Lamp	LED	prEN 62663-2:201X (under drafting)		Performance/ measurement	'Non-ballasted LED lamps - Performance requirements'	
Europe	Lamp	LED	FprEN 62776:2013 (under approval)		Safety	'Double-capped LED lamps for general lighting services - Safety specifications'	
Europe	Lamp	LED	prEN 62838:201X (under drafting)		Safety	'Semi-integrated LED lamps for general lighting services with supply voltages not exceeding 50 V a.c. r.m.s. or 120V ripple free d.c. - Safety specification'	
Europe	Lamp	LED	FprEN 62868:2013 (under approval)		Safety	'Organic light emitting diode (OLED) panels for general lighting - Safety requirements'	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Europe	Lamp	LED	EN 62031:2008/ FprA2:2014 (amendment under approval)		Safety	'LED modules for general lighting - Safety specifications'	
Europe	Lamp	LED	EN 62560:2012/FprA1:2013 (amendment under approval)		Safety	'Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specifications'	
Europe	Lamp	LED	FprEN 62663-1:2012 (under approval)		Safety	'Non-ballasted LED-lamps - Part 1: Safety specifications'	
Europe	Lamp	LED	FprEN 62776:2013 (under approval)		Safety	'Double-capped LED lamps for general lighting services - Safety specifications'	
Europe	Lamp	LED	prEN 62838:201X (under drafting)		Safety	'Semi-integrated LED lamps for general lighting services with supply voltages not exceeding 50 V a.c. r.m.s. or 120V ripple free d.c. - Safety specification'	
Europe	Lamp	LED	FprEN 62868:2013 (under approval)		Safety	'Organic light emitting diode (OLED) panels for general lighting - Safety requirements'	
Europe	Lamp	LED	COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources	EN 50285	Performance/ measurement	The product group "light bulbs" shall comprise: "single-ended light bulbs": all light bulbs which provide general purpose lighting and have single-ended, bayonet, screw or pin fittings. The light bulbs shall be connectable to the public electricity supply. "double-ended light bulbs": all light bulbs which provide general purpose lighting and have fittings at both ends. This includes, principally, all linear fluorescent tubes. The light bulbs shall be connectable to the public electricity supply. The following types of lamps are not included in the product group: compact fluorescent lamps with a magnetic ballast, projector lamps, photographic lighting and solarium tubes.	
Europe	Lamp	LED	Commission Delegated Regulation (EU) No 874/2012 of 12 July 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires		Performance/ measurement	This Regulation establishes requirements for labelling of and providing supplementary product information on electrical lamps such as: (a) filament lamps; (b) fluorescent lamps; (c) high-intensity discharge lamps; (d) LED lamps and LED modules. This Regulation also establishes requirements for labelling luminaires designed to operate such lamps and marketed to end users, including when they are integrated into other products that are not dependent on energy input in fulfilling their primary purpose during use (such as furniture). 2. The following products shall be excluded from the scope of this Regulation: (a) lamps and LED modules with a luminous flux of less than 30 lumens; (b) lamps and LED modules marketed for operation with batteries; (c) lamps and LED modules marketed for applications where their primary purpose is not lighting, such as: (i) emission of light as an agent in chemical or biological processes (such as polimerisation, photodynamic therapy, horticulture, petcare, anti-insect products); (ii) image capture and image projection (such as camera flashlights, photocopiers, video projectors); (iii) heating (such as infrared lamps); (iv) signalling (such as airfield lamps). These lamps and LED modules are not excluded when they are marketed for lighting; (d) lamps and LED modules marketed as part of a luminaire and not intended to be removed by the end-user, except when they are offered for sale, hire or hire purchase or displayed separately to the end user, for example as spare parts; (e) lamps and LED modules marketed as part of a product whose primary purpose is not lighting. However, if they are offered for sale, hire or hire purchase or displayed separately, for example as spare parts, they shall be included within the scope of this Regulation; (f) lamps and LED modules that do not comply with requirements becoming applicable in 2013 and 2014 according to Regulations implementing Directive 2009/125/EC of the European Parliament and of the Council [4]; (g) luminaires that are designed to operate	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						exclusively with the lamps and LED modules listed in points (a) to (c).	
Europe	Lamp	LED	Commission Regulation (EU) No 1194/2012 of 12 December 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment		Performance/ measurement	This Regulation establishes ecodesign requirements for placing on the market the following electrical lighting products: (a) directional lamps; (b) light-emitting diode (LED) lamps; (c) equipment designed for installation between the mains and the lamps, including lamp control gear, control devices and luminaires (other than ballasts and luminaires for fluorescent and high-intensity discharge lamps); including when they are integrated into other products.	
Europe	Lamp	Special purpose	EN 61228:2008		Performance/ measurement	'Fluorescent ultraviolet lamps used for tanning - Measurement and specification method'	
Europe	Lamp	Special purpose	EN 61549:2003/ A3:2012		Performance/ measurement	'Miscellaneous lamps'	
Europe	Lamp	Special purpose	EN 2240-001:2009		Performance/ measurement	'Aerospace series - Lamps, incandescent - Part 001: Technical specification'	
Europe	Lamp cap/holder/ etc	All	EN 60838-2-2		Lamp cap/holder/et c	Connectors	
Europe	Lamp cap/holder/ etc	All	EN 60061-1:1993/ A41:2009 A50:2014		Safety	'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 1: Lamp caps'	
Europe	Lamp cap/holder/ etc	All	EN 60061-2:1993/ A47:2014		Safety	'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 2: Lampholders'	
Europe	Lamp cap/holder/ etc	All	EN 60061-3:1993/ A48:2014		Safety	'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 3: Gauges'	
Europe	Lamp cap/holder/ etc	All	EN 60061-4:1992/A9:2005		Safety	'Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 4: Guidelines and general information'	
Europe	Lamp cap/holder/ etc	All	EN 60238:2004/ A2:2011 ; FprEN 60238:2013 (under approval)		Lamp cap/holder/et c	'Edison screw lampholders'	
Europe	Lamp cap/holder/ etc	All	EN 60360:1998		Lamp cap/holder/et c	'Standard method of measurement of lamp cap temperature rise'	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Europe	Lamp cap/holder/ etc	All	EN 60399:2004/ A1:2008		Lamp cap/holder/etc	'Barrel thread for lampholders with shade holder ring'	
Europe	Lamp cap/holder/ etc	All	EN 60400:2008/ FprA2:2014 (under approval)		Lamp cap/holder/etc	'Lampholders for tubular fluorescent lamps and starterholders'	
Europe	Lamp cap/holder/ etc	All	EN 60838-1:2004/ A2:2011 ; FprEN 60838-1:2013 under approval		Lamp cap/holder/etc	'Miscellaneous lampholders - Part 1: General requirements and tests'	
Europe	Lamp cap/holder/ etc	All	EN 60838-2-1:1996/ A2:2004		Lamp cap/holder/etc	'Miscellaneous lampholders - Part 2-1: Particular requirements - Lampholders S14'	
Europe	Lamp cap/holder/ etc	All	EN 61184:2008/A1:2011		Lamp cap/holder/etc	'Bayonet lampholders'	
Europe	Lamp cap/holder/ etc	LED	EN 60838-2-2:2006/ A1:2012		Lamp cap/holder/etc	'Miscellaneous lampholders - Part 2-2: Particular requirements - Connectors for LED-modules'	
Europe	Lamp cap/holder/ etc	LED	Project EN/IEC 60838-2-3 (under approval)		Lamp cap/holder/etc	'Miscellaneous lampholders - Part 2-3: Particular requirements - Lampholders for double-capped linear LED lamps'	
Europe	Lamp cap/holder/ etc	LED	EN 60838-2-2:2006/A1:2012		Lamp cap/holder/etc	'Miscellaneous lampholders - Part 2-2: Particular requirements - Connectors for LED-modules'	
Europe	Lamp cap/holder/ etc	LED	Project EN/IEC 60838-2-3 (under approval)		Lamp cap/holder/etc	'Miscellaneous lampholders - Part 2-3: Particular requirements - Lampholders for double-capped linear LED lamps'	
Europe	Lamp cap/holder/ etc	LED	FprEN 62722-2-1:2013 (under approval)		Lamp cap/holder/etc	'Luminaire performance - Part 2-1: Particular requirements for LED luminaires'	
Europe	Lamp cap/holder/ etc		EN 61995-1:2008		Lamp cap/holder/etc	'Devices for the connection of luminaires for household and similar purposes - Part 1: General requirements'	
Europe	Lamp cap/holder/ etc		EN 61995-2:2009		Lamp cap/holder/etc	'Devices for the connection of luminaires for household and similar purposes - Part 2: Standard sheets for DCL'	
Europe	Luminaire	Road	EN 60598-2-3:2003/ A1:2011		Performance/ measurement	'Luminaires - Part 2-3: Particular requirements - Luminaires for road and street lighting'	
Europe	Luminaire		EN 60598-1 & -2		Safety	LUMINAIRE safety requirements: tests and markings related to electrical, thermic and mechanical security. Visual performance in luminance. Robustness test is described. Surface temperature limits. Applies to LED luminaires	
Europe	Luminaire		ENEC Luminaire certification		Performance/ measurement	Quality certificate for security of professional products	
Europe	Luminaire		EN 16268:2013		Performance/ measurement	'Performance of reflecting surfaces for luminaires'	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Europe	Luminaire		EN 60598-1:2008/ A11:2009 ; FprEN 60598-1:2014 (under approval)		Performance/ measurement	'Luminaires - Part 1: General requirements and tests'	
Europe	Luminaire		EN 60598-2-1:1989		Performance/ measurement	'Luminaires - Part 2-1: Particular requirements - Fixed general purpose luminaires'	
Europe	Luminaire		EN 60598-2-2:2012		Performance/ measurement	'Luminaires - Part 2-2: Particular requirements - Recessed luminaires'	
Europe	Luminaire		EN 60598-2-4:1997		Performance/ measurement	'Luminaires - Part 2-4: Particular requirements - Portable general purpose luminaires'	
Europe	Luminaire		EN 60598-2-5:1998 ; FprEN 60598-2-5:2014 (under approval)		Performance/ measurement	'Luminaires - Part 2-5: Particular requirements – Floodlights.'	
Europe	Luminaire		EN 60598-2-6:1994/A1:1997		Performance/ measurement	'Luminaires - Part 2-6: Particular requirements - Luminaires with built-in transformers or convertors for filament lamps'	
Europe	Luminaire		EN 60598-2-7:1989/A13:1997		Performance/ measurement	'Luminaires. Particular requirements. Portable luminaires for garden use.	
Europe	Luminaire		EN 60598-2-8:2013		Performance/ measurement	'Luminaires - Part 2-8: Particular requirements – Handlamps'	
Europe	Luminaire		EN 60598-2-9:1989/A1:1994		Performance/ measurement	'Luminaires - Part 2: Particular requirements - Section 9: Photo and film luminaires (non-professional)'	
Europe	Luminaire		EN 60598-2-10:2003/ corrigendum Aug. 2005		Performance/ measurement	'Luminaires - Part 2-10: Particular requirements - Portable luminaires for children'	
Europe	Luminaire		EN 60598-2-11:2013		Performance/ measurement	'Luminaires - Part 2-11: Particular requirements - Aquarium luminaires'	
Europe	Luminaire		EN 60598-2-12:2013		Performance/ measurement	'Luminaires - Part 2-12: Particular requirements - Mains socket-outlet mounted nightlights'	
Europe	Luminaire		EN 60598-2-13:2006/A1:2012		Performance/ measurement	'Luminaires - Part 2-13: Particular requirements - Ground recessed luminaires'	
Europe	Luminaire		EN 60598-2-14:2009		Performance/ measurement	'Luminaires - Part 2-14: Particular requirements - Luminaires for cold cathode tubular discharge lamps (neon tubes) and similar equipment'	
Europe	Luminaire		EN 60598-2-17:1989		Performance/ measurement	'Luminaires - Part 2: Particular requirements - Section 17: Luminaires for stage lighting, television film and photographic studios (outdoor and indoor)'	
Europe	Luminaire		EN 60598-2-18:1994/A1:2012		Performance/ measurement	'Luminaires - Part 2-18: Particular requirements - Luminaires for swimming pools and similar applications'	
Europe	Luminaire		EN 60598-2-19:1989/ corrigendum Dec. 2005		Safety	'Luminaires - Part 2: Particular requirements - Air-handling luminaires (safety requirements)'	
Europe	Luminaire		EN 60598-2-20:2010 /corrigendum Sep. 2010 ; FprEN 60598-2-20:2013 (under approval)		Performance/ measurement	'Luminaires - Part 2-20: Particular requirements - Lighting chains'	
Europe	Luminaire		FprEN 60598-2-21:2013 (under		Performance/ measurement	'Luminaires - Part 2-21: Particular requirements - Sealed lighting chains'	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			approval)				
Europe	Luminaire		EN 60598-2-22:1998/A2:2008 FprEN 60598-2-22:2014 (under approval)		Performance/ measurement	'Luminaires - Part 2-22: Particular requirements - Luminaires for emergency lighting'	
Europe	Luminaire		EN 60598-2-23:1996/A1:2000		Performance/ measurement	'Luminaires. Particular requirements - Extra low voltage lighting systems for filament lamps'	
Europe	Luminaire		EN 60598-2-24:2013		Performance/ measurement	'Luminaires - Part 2-24: Particular requirements - Luminaires with limited surface temperatures'	
Europe	Luminaire		EN 60598-2-25:1994/A1:2004		Performance/ measurement	'Luminaires. Part 2-25: Particular requirements. Luminaires for use in clinical areas of hospitals and health care buildings.'	
Europe	Luminaire		FprEN 62722-1:2013 (under approval)		Performance/ measurement	'Luminaire performance - Part 1: General Requirements'	
Europe	Luminaire		FprEN 62722-2-1:2013 (under approval)		Performance/ measurement	'Luminaire performance - Part 2-1: Particular requirements for LED luminaires'	
Europe	Luminaire		EN 60529:1991/ A2:2013		Safety	'Degrees of protection provided by enclosures (IP Code)'	
Europe	System		EN 62493		Performance/ measurement	human exposure evaluation according to ICNIRP recommendations regarding exposure to EM fields	
Europe	System		EN 12464-1		Performance/ measurement	indoor work place lighting standard : UGR, uniformity, average maintained illumination, minimal CRI	
Europe	System		EN 15913		Performance/ measurement	Energy requirements for lighting (in buildings)	
Europe	System		EN 12665:2011		Performance/ measurement	'Light and lighting - Basic terms and criteria for specifying lighting requirements'	
Europe	System		EN 12464-2:2014		Performance/ measurement	'Light and Lighting-Part 2: Lighting of outdoor work places.'	
Europe	System		CEN/TR 13201-1:2004 ; FprCEN/TR 13201-1 (under approval in 2014)		Performance/ measurement	'Road lighting - Part 1: Selection of lighting classes.'	
Europe	System		EN 13201-2:2003 ; prEN 13201-2 rev (under approval in 2014)		Performance/ measurement	'Road lighting - Part 2: Performance requirements.'	
Europe	System		EN 13201-3:2003/ AC:2007 ; prEN 13201-3 rev (under approval in 2014)		Performance/ measurement	'Road lighting - Part 3: Calculation of performance.'	
Europe	System		EN 13201-4:2003 ; prEN 13201-4 rev (under approval in 2014)		Performance/ measurement	'Road lighting - Part 4: Methods of measuring lighting performance.'	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Europe	System		prEN 13201-5 (under approval in 2014)		Performance/ measurement	'Road lighting-Part 5: Energy performance indicators.'	
Europe	System		CEN/ CR 14380:2003		Performance/ measurement	'Lighting applications - Tunnel lighting'	
Europe	System		EN 16276:2013		Performance/ measurement	'Evacuation Lighting in Road Tunnels'	
Europe	System		EN 12352:2006		Performance/ measurement	'Traffic control equipment - Warning and safety light devices'	
Europe	System		EN 50556:2011		Performance/ measurement	'Road traffic signal systems'	
Europe	System		EN 12464-1:2011		Performance/ measurement	'Light and Lighting-Part 1: Lighting of indoor work places.'	
Europe	System		EN 15193:2007/AC:2010 ; prEN 15193 rev (under drafting)		Performance/ measurement	'Energy performance of buildings – Energy requirements for lighting'	
Europe	System		EN 15251:2007		Performance/ measurement	'Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics'	
Europe	System		CEN/TC 169 (WI=00169067) (under drafting)		Performance/ measurement	'Energy performance of buildings - Energy requirements for lighting - Part 2: Technical Report to EN 15193-1'	
Europe	System		CEN/TS 16163:2014		Performance/ measurement	'Conservation of Cultural Heritage - Guidelines and procedures for choosing appropriate lighting for indoor exhibitions'	
Europe	System		EN 12193:2007		Performance/ measurement	'Light and lighting - Sports lighting.'	
Europe	System		EN 1838:2013		Performance/ measurement	'Lighting applications - Emergency lighting.'	
Europe	System		EN 13032-3:2007		Performance/ measurement	'Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 3: Presentation of data for emergency lighting of work places.'	
Europe	System		EN 50171:2001 ; prEN 50171:2013 (under approval)		Performance/ measurement	'Central power supply systems.'	
Europe	System		EN 50172:2004		Performance/ measurement	'Emergency escape lighting systems.'	
Europe	System		CEN/TC 169, (WI=00169063) (under drafting, expected 2015)		Performance/ measurement	'Eye mediated non visual effects of light on humans - Measures of neurophysiological and melanopic photosensitivity'	
Europe	System		EN 14255-1:2005		Performance/ measurement	'Measurement and assessment of personal exposures to incoherent optical radiation - Ultraviolet radiation emitted by artificial sources in the workplace'	
Europe	System		EN 14255-2:2005		Performance/ measurement	'Measurement and assessment of personal exposures to incoherent optical radiation - Visible and infrared radiation emitted by artificial sources in the workplace'	
Europe	System		EN 14255-4:2006		Performance/ measurement	'Measurement and assessment of personal exposures to incoherent optical radiation - Terminology and quantities used in UV-, visible and IR-exposure measurements'	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Europe	System		HD 60364-7-715:2012		Performance/ measurement	'Low-voltage electrical installations - Part 7-715: Requirements for special installations or locations - Extra-low-voltage lighting installations'	
Europe	System		prHD 60364-7-719:2011 (under approval)		Performance/ measurement	'Low-voltage installations - Part 7-719: Requirements for special installations or locations - Lighting installations for advertising signs with a rated output voltage not exceeding 1 000 V, which are illuminated by hot-cathode-fluorescent-lamps, luminous-discharge tubes (neon-tubes), inductive discharge lamps, light emitting diodes (LED) and/or LED modules'	
Europe	System		EN ISO 24502:2010		Performance/ measurement	'Ergonomics - Accessible design - Specification of age-related luminance contrast for coloured light (ISO 24502:2010)'	
Europe	System		COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources	EN 50285	Performance/ measurement	The product group "light bulbs" shall comprise: "single-ended light bulbs": all light bulbs which provide general purpose lighting and have single-ended, bayonet, screw or pin fittings. The light bulbs shall be connectable to the public electricity supply. "double-ended light bulbs": all light bulbs which provide general purpose lighting and have fittings at both ends. This includes, principally, all linear fluorescent tubes. The light bulbs shall be connectable to the public electricity supply. The following types of lamps are not included in the product group: compact fluorescent lamps with a magnetic ballast, projector lamps, photographic lighting and solarium tubes.	
Europe	System		COMMISSION DIRECTIVE 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps	EN 50285	Performance/ measurement	The Commission Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps shall apply to household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Europe	System		Commission Regulation (EC) No 245/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:092:0011:0014:EN:PDF	Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			Parliament and of the Council with regard to ecodesign requirements for for fluorescent lamps without integrated ballast, for high intensity discharg			The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
France	Ballast	LED	NF EN 62386-207: Control protocols of LED (DALI etc)				
France	Lamp	All	NF EN 50285: Lifetime for various products		Performance/ measurement		
France	Lamp	LED	NF C 15-100		Performance/ measurement	General electrical security,prescription against adverse thermal effects in LED lamps and luminaires	
France	Lamp	LED	NF C 15-100: General Electric Security, prescription against adverse thermal effects in LED lamps and luminaires		Safety		
France	Lamp	LED	NF EN 62031: Electrical safety for LED modules		Safety		
France	Lamp	LED	NF EN 61347-2-13: Alimentation, continuous or alternating of LED modules		Performance/ measurement		
France	Lamp	LED	NF EN 60968: Electrical safety for non-LED lamps		Safety		
France	Luminaire	LED	UTE C 15-559		Performance/ measurement	Installation guide for LED luminaire intallation (mounting surfaces etc)	
France	Luminaire	LED	NF EN 60598-1 & 2: Electrical safety of LED luminaires		Performance/ measurement		
France	Luminaire		UTE C 15-801		Performance/ measurement	Recessed luminaires installation guide	
France	System		NF X 35-103		Performance/ measurement	Visual ergonomy based on luminance distribution	
France	System		HQE label for environmental performances of buildings		Performance/ measurement	A few criteria for electric lighting : electrical installation, CCT, CRI, maintained illumination levels	
Germany	Ballast	Fluorescent	http://www.blauer-engel.de/en/products			The label may be used for the marking of electronic ballasts for fluorescent lamps provided that they comply with the requirements.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			_brands/vergabegrundlage.php?id=25				
Germany	Lamp	CFLi	http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=207 http://www.blauer-engel.de/de/fuer-unternehmen/survey-all-basic-award-criteria , lamps RAL-UZ 151		Performance/ measurement	Applies to lamps meeting the following requirements: They § are directly powered from the mains (230 V, 50 Hz) and therefore need no external ballast, power supply pack or the like[8]; § are suitable for indoor use; § have a luminous flux Φ of 60 ≤ Φ ≤ 6'500 lumens (lm). The following lamps do not fall within the scope: § lamps [9]: - having at least 6 % of total radiation of the range 250 -780 nm in the range of 250 and 400 nm, - having the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); § lamps - for which several operating points may be chosen, i.e. several conditions differing with respect to luminous flux and/or colour temperature and/or light colour [10]: - operated by an external circuit or - operated by an internal circuit using, for example, a built-in daylight sensor.	
Germany	Lamp	Fluorescent double cap	http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=207		Performance/ measurement	Applies to lamps meeting the following requirements: They § are directly powered from the mains (230 V, 50 Hz) and therefore need no external ballast, power supply pack or the like[8]; § are suitable for indoor use; § have a luminous flux Φ of 60 ≤ Φ ≤ 6'500 lumens (lm). The following lamps do not fall within the scope: § lamps [9]: - having at least 6 % of total radiation of the range 250 -780 nm in the range of 250 and 400 nm, - having the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); § lamps - for which several operating points may be chosen, i.e. several conditions differing with respect to luminous flux and/or colour temperature and/or light colour [10]: - operated by an external circuit or - operated by an internal circuit using, for example, a built-in daylight sensor.	
Germany	Lamp	Incandescent / halogen	http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=207		Performance/ measurement	Applies to lamps meeting the following requirements: They § are directly powered from the mains (230 V, 50 Hz) and therefore need no external ballast, power supply pack or the like[8]; § are suitable for indoor use; § have a luminous flux Φ of 60 ≤ Φ ≤ 6'500 lumens (lm). The following lamps do not fall within the scope: § lamps [9]: - having at least 6 % of total radiation of the range 250 -780 nm in the range of 250 and 400 nm, - having the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); § lamps - for which several operating points may be chosen, i.e. several conditions differing with respect to luminous flux and/or colour temperature and/or light colour [10]: - operated by an external circuit or - operated by an internal circuit using, for example, a built-in daylight sensor.	
Germany	Lamp	Incandescent / halogen	http://www.blauer-engel.de/en/products_brands/vergabegrun		Performance/ measurement	Applies to lamps meeting the following requirements: They § are directly powered from the mains (230 V, 50 Hz) and therefore need no external ballast, power supply pack or the like[8];	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			dlage.php?id=207			§ are suitable for indoor use; § have a luminous flux Φ of 60 ≤ Φ ≤ 6'500 lumens (lm). The following lamps do not fall within the scope: § lamps [9]: - having at least 6 % of total radiation of the range 250 -780 nm in the range of 250 and 400 nm, - having the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); § lamps - for which several operating points may be chosen, i.e. several conditions differing with respect to luminous flux and/or colour temperature and/or light colour [10]: - operated by an external circuit or - operated by an internal circuit using, for example, a built-in daylight sensor.	
Germany	Lamp	LED	http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=207		Performance/ measurement	Applies to lamps meeting the following requirements: They § are directly powered from the mains (230 V, 50 Hz) and therefore need no external ballast, power supply pack or the like[8]; § are suitable for indoor use; § have a luminous flux Φ of 60 ≤ Φ ≤ 6'500 lumens (lm). The following lamps do not fall within the scope: § lamps [9]: - having at least 6 % of total radiation of the range 250 -780 nm in the range of 250 and 400 nm, - having the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); § lamps - for which several operating points may be chosen, i.e. several conditions differing with respect to luminous flux and/or colour temperature and/or light colour [10]: - operated by an external circuit or - operated by an internal circuit using, for example, a built-in daylight sensor.	
Germany	System		DIN V 18599 - 4		Performance/ measurement	'Energy efficiency of buildings - Calculation of the net, final and primary energy demand for heating, cooling, ventilation, domestic hot water and lighting - Part 4: Net and final energy demand for lighting.'	
Hong Kong	Ballast	Fluorescent	IEC 60929 EN 50924			The provisions of this scheme shall apply to electronic ballasts that are designed for standard fluorescent lamps (for linear, circular and compact types), HID lamps including high pressure sodium (SON) lamps and metal halide lamps. The electronic ballasts must be capable of being powered from either a 220V 50Hz AC supply or an appropriate DC power source. Electronic ballasts with dimmable facility may also qualify under this scheme as far as they are measured and tested at their full output conditions.	
Hong Kong	Ballast	Fluorescent	The Hong Kong Voluntary Energy Efficiency Labelling Scheme for Electronic Ballasts	IEC 60929 EN 50924		The provisions of this scheme shall apply to electronic ballasts that are designed for standard fluorescent lamps (for linear, circular and compact types), HID lamps including high pressure sodium (SON) lamps and metal halide lamps. The electronic ballasts must be capable of being powered from either a 220V 50Hz AC supply or an appropriate DC power source. Electronic ballasts with dimmable facility may also qualify under this scheme as far as they are measured and tested at their full output conditions.	
Hong Kong	Lamp	CFLi	The Hong Kong Mandatory Energy Efficiency Labelling Scheme (MEELS) for CFLs	CIE 84 IEC 60969	Performance/ measurement	"Compact fluorescent lamp": (a) means a type of fluorescent lamp which has a single lamp cap; and (b) includes integrated type compact fluorescent lamps that— (i) use mains electricity as the primary power source; (ii) have a rated lamp wattage up to 60 watts; and (iii) have a screw or bayonet cap.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						"Compact fluorescent lamp" does not include— (a) non-integrated type compact fluorescent lamps; (b) reflector compact fluorescent lamps; or (c) cold cathode fluorescent lamps.	
Hong Kong	Lamp	CFLi	The Hong Kong Voluntary Energy Efficiency Labelling Scheme for Single Capped Fluorescent Lamps	CIE 84 IEC 60969	Performance/ measurement	The provisions of this scheme shall apply to non-integrated type CFLs which is electrically connected to permanently wired external ballast and is intended for general lighting purposes having the following characteristics: (a) those with a rated voltage of 220 volts; (b) those with a rated input current frequency of 50 Hz.; and (c) those with a rated lamp wattage up to 60 watts. The scheme shall apply to non-integrated type CFLs designed for multi-level and/or dimming operation. Non-integrated type CFLs operated with cold cathode and reflector type lamps are excluded from this scheme.	
Hong Kong	Lamp	CFLi	CIE 84 IEC 60969		Performance/ measurement	The provisions of this scheme shall apply to non-integrated type CFLs which is electrically connected to permanently wired external ballast and is intended for general lighting purposes having the following characteristics: (a) those with a rated voltage of 220 volts; (b) those with a rated input current frequency of 50 Hz.; and (c) those with a rated lamp wattage up to 60 watts. The scheme shall apply to non-integrated type CFLs designed for multi-level and/or dimming operation. Non-integrated type CFLs operated with cold cathode and reflector type lamps are excluded from this scheme.	
Hong Kong	Lamp	LED	The Hong Kong Voluntary Energy Efficiency Labelling Scheme for LED Lamp	IES LM-79, IEC/PAS 62612	Performance/ measurement	The provision of this scheme shall apply to directional and non-directional LED lamps, and is intended for general lighting purposes having the following characteristics: (a) those with a rated voltage up to 240 volts AC or DC; (b) those with a rated frequency of 50 Hz for AC; (c) those with a rated lamp wattage up to 60 Watts; and (d) those with a rated CCT value from 2700K to 6500K. The scheme shall apply to LED lamps designed with dimming or non-dimming operations. 3.7 The scheme does not cover (i) LED tubes, and (ii) LED lamps that intentionally produce tinted or coloured light neither does it cover organic LED (OLED) lamps.	
IEC	Ballast	LED	IEC 61347-2-13			Control gear for LED modules – Safety	
IEC	Ballast	LED	IEC 62384			Control gear for LED modules – Performance	
IEC	Ballast	LED	IEC 62386-207			DALI for LED modules	
IEC	Ballast	LED	IEC 62442-X			Control gear for LED modules - Energy efficiency	
IEC	Ballast		IEC-62442-2 FprEN 62442-2:2014 (under approval)			'Energy performance of lamp controlgear - Part 2: Controlgear for high intensity discharge lamps (excluding fluorescent lamps) - Method of measurement to determine the efficiency of controlgear '	
IEC	Ballast		IEC 62442-3 FprEN 62442-3:2014 (under approval)			'Energy performance of lamp controlgear - Part 3: Controlgear for halogen lamps and LED modules - Method of measurement to determine the efficiency of the controlgear '	
IEC	Lamp	All	IEC/TR 62778: 2012		Safety	'Application of IEC/EN 62471 for the assessment of blue light hazard to light sources and luminaires (Technical report)'	
IEC	Lamp	All	IEC TR 62471-2		Safety	Photobiological safety - adds the indication of the safe distance (No risk), optional marking for Low risk, compulsory for Moderate risk	
IEC	Lamp	Incandescent / halogen	IEC TR 61341		Performance/ measurement	Beam angle for reflector lamps	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
IEC	Lamp	Incandescent / halogen	IEC 61341 TR		Performance/ measurement	Center beam intensity and beam angle of reflector lamps	
IEC	Lamp	Incandescent / halogen	IEC/TR 61341 EN 61341:2011		Performance/ measurement	'Method of measurement of centre beam intensity and beam angle(s) of reflector lamps'	
IEC	Lamp	LED	pr IEC PAS xxxxx		Performance/ measurement	Minimum performance of LED Modules	
IEC	Lamp	LED	IEC PAS 62612		Performance/ measurement	Minimum performance of ballasted LED retrofit lamps (> 50Veffac or > 120 Vdc)	
IEC	Lamp	LED	prIEC 62560 (due end 2010)		Safety	Safety requirements for ballasted LED retrofit lamps (for non LED lamps, see EN 60968)	
IEC	Lamp	LED	prIEC 62663-1 (due 2011)		Safety	Safety requirements for non ballasted LED retrofil lamps	
IEC	Lamp	LED	prIEC 62663-2 (due 2011)		Performance/ measurement	Performance requirements for non ballasted LED retrofit lamps	
IEC	Lamp	LED	IEC 62031		Safety	LED modules – Safety	
IEC	Lamp	LED	IEC 62504 TS		Classification	Terms and definitions	
IEC	Lamp	LED	IEC 62560		Safety	Self-ballasted LED lamps > 50 V – Safety	
IEC	Lamp	LED	IEC 62612		Performance/ measurement	Self-ballasted LED lamps > 50 V – Performance	
IEC	Lamp	LED	IEC 62612 PAS		Performance/ measurement	Self-ballasted LED lamps > 50 V – Performance	
IEC	Lamp	LED	IEC 62663-1		Safety	Non-self-ballasted LED lamps < 50 V - Safety	
IEC	Lamp	LED	IEC 62663-2		Performance/ measurement	Self-ballasted LED lamps < 50 V - Performance	
IEC	Lamp	LED	IEC 62707-1		Performance/ measurement	LED - Binning - Part 1: General requirements and white grid	
IEC	Lamp	LED	IEC 62707-1 PAS		Performance/ measurement	LED - Binning - Part 1: General requirements and white grid	
IEC	Lamp	LED	IEC 62707-2		Performance/ measurement	LED - Binning - Part 2: Luminous flux binning	
IEC	Lamp	LED	IEC 62707-3		Performance/ measurement	LED - Binning - Part 3: Forward voltage binning	
IEC	Lamp	LED	IEC 62717		Performance/ measurement	LED modules – Performance	
IEC	Lamp	LED	IEC 62717 PAS		Performance/ measurement	LED modules – Performance	
IEC	Lamp	LED	None		Safety	Double-capped LED lamps - Safety	
IEC	Lamp	LED	None		Performance/ measurement	LED - Testing and prediction of lumen maintenance and other provisions	
IEC	Lamp	LED	None		Performance/ measurement	OLED - Performance	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
IEC	Lamp	LED	None		Safety	OLED - Safety	
IEC	Lamp	LED	None		Safety	Self-ballasted LED lamps </= 50 V - Safety	
IEC	Lamp	LED	IEC 60810		Performance/ measurement	Automotive-lamps - Performance	
IEC	Lamp	LED	CEI TS 62560: Electrical safety for LED retrofit lamps		Safety		
IEC	Lamp	LED	CEI TS 61231: ILCOS Lamp classification of LED lamps		Classification		
IEC	Lamp	LED	PAS CEI 62612: Minimum Performance of LED retrofit Lamps		Performance/ measurement		
IEC	Lamp	LED	IEC 62717 FprEN 62717:2013 (under approval)		Performance/ measurement	'LED modules for general lighting - Performance requirements'	
IEC	Lamp	LED	IEC TS 61231		Classification	ILCOS lamp classification of LED lamps	
IEC	Lamp cap/holder/ etc	All	IEC 60061-1		Lamp cap/holder/etc	Lamp caps - CH14.65d	
IEC	Lamp cap/holder/ etc	All	IEC 60061-1		Lamp cap/holder/etc	Lamp caps - G7.5	
IEC	Lamp cap/holder/ etc	All	IEC 60061-1		Lamp cap/holder/etc	Lamp caps - GU(X)(Y)(Z)2.5d	
IEC	Lamp cap/holder/ etc	All	IEC 60061-1		Lamp cap/holder/etc	Lamp caps - GUZ5.3	
IEC	Lamp cap/holder/ etc	All	IEC 60061-1		Lamp cap/holder/etc	Lamp caps - GZ(X)(Y)(Z)7d	
IEC	Lamp cap/holder/ etc	All	IEC 60061-1		Lamp cap/holder/etc	Lamp caps - PGJ21t	
IEC	Lamp cap/holder/ etc	All	IEC 60061-2		Lamp cap/holder/etc	Lampholders - CH14.65d	
IEC	Lamp cap/holder/ etc	All	IEC 60061-2		Lamp cap/holder/etc	Lampholders - G7.5	
IEC	Lamp cap/holder/	All	IEC 60061-2		Lamp cap/holder/et	Lampholders - GU(X)(Y)(Z)2.5d	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
	etc				c		
IEC	Lamp cap/holder/ etc	All	IEC 60061-2		Lamp cap/holder/etc	Lampholders - GUZ5.3	
IEC	Lamp cap/holder/ etc	All	IEC 60061-2		Lamp cap/holder/etc	Lampholders - GZ(X)(Y)(Z)7d	
IEC	Lamp cap/holder/ etc	All	IEC 60061-2		Lamp cap/holder/etc	Lampholders - PGJ21t	
IEC	Lamp cap/holder/ etc	All	IEC 60838-2-2		Lamp cap/holder/etc	Connectors for LED modules	
IEC	Lamp cap/holder/ etc	LED	IEC 60061-4, sheet 7007-1		Lamp cap/holder/etc	Lamp caps and holders - Designation system	
IEC	Luminaire	LED	IEC 62772-2-1		Performance/ measurement	LED luminaires - Performance	
IEC	Luminaire	LED	IEC 62772-2-1 PAS		Performance/ measurement	LED luminaires - Performance	
IEC	Luminaire	LED	IEC 60598-1		Safety	Luminaires - Safety	
IEC	Luminaire		pr IEC PAS xxxxx		Performance/ measurement	Minimum performance of LED Luminaires	
IEC	System		HD 60364-5-559:2005/ corrigendum Oct. 2007		Performance/ measurement	'Electrical installations of buildings - Part 5-55: Selection and erection of electrical equipment - Other equipment - Clause 559: Luminaires and lighting installations'	
IEC	System		HD 60364-5-559:2012		Performance/ measurement	'Low-voltage electrical installations - Part 5-559: Selection and erection of electrical equipment - Luminaires and lighting installations'	
IEC	System		IEC TS 62504		Classification	definition of components	
India	Ballast	Fluorescent	Schedule 15 Ballasts	IS 1534 (Part 1), for electromagnetic ballasts, IS 13021 (Part 1 & 2) for electronic ballasts		This schedule specifies the requirements for participating in the energy efficiency labelling scheme for ballasts covering electromagnetic ballasts and electronic ballasts for tubular fluorescent lamps (TFL) and single capped fluorescent lamps .This schedule also includes built in ballasts where the ballast is inbuilt in the luminaire. The ballasts which are integral to the lamps are excluded from the scope of this schedule. The Indian standards referred in this schedule are IS 1534 (Part 1): 1977 for electromagnetic ballasts and IS 13021(Part 1 & 2): 1991 for electronic ballasts.	
India	Ballast	Fluorescent	IS 1534 (Part 1), for electromagnetic ballasts, IS 13021 (Part 1 & 2) for electronic ballasts			This schedule specifies the requirements for participating in the energy efficiency labelling scheme for ballasts covering electromagnetic ballasts and electronic ballasts for tubular fluorescent lamps (TFL) and single capped fluorescent lamps .This schedule also includes built in ballasts where the ballast is inbuilt in the luminaire. The ballasts which are integral to the lamps are excluded from the scope of this schedule. The Indian standards referred in this schedule are IS 1534 (Part 1): 1977 for electromagnetic ballasts and IS 13021(Part 1 & 2): 1991 for electronic ballasts.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
India	Ballast	Fluorescent	IS 13021			Electronic Ballast	IEC 60928
India	Ballast	Fluorescent	IS 1534			Ballast for Fluorescent Lamp	IEC 82
India	Ballast	LED	15885 (Part 2/Sec 13): 2012			Lamp Control Gear Part 2 Particular Requirements Section 13 DC or AC Supplied Electronic Controlgear for LED Modules	
India	Lamp	All	IS 16108: 2012		Safety	Photobiological Safety of Lamps and Lamp Systems	
India	Lamp	CFLi	IS 15111		Performance/ measurement	Self ballasted lamps for general lighting services. Part 2 Performance requirements	Reference Test Standard: IEC 60969
India	Lamp	Fluorescent double cap	TFL Notification/Gazette (Schedule 2 - Tubular Fluorescent Lamps)	IS 2418 (part I) & (part II)	Performance/ measurement	This standard specifies the requirements for participating in the energy labelling scheme for tubular fluorescent lamps for General lighting service. The referred Indian Standard are IS 2418 (part I) and (part II) – 1977 including all the amendments. The scheme covers 4 feet tubular fluorescent lamps for wattages upto 40W. The scheme shall cover 6500K colour temperature for halo-phosphates and 6500K, 4000K & 2700K for tri-phosphate category.	
India	Lamp	Fluorescent double cap	TFL Notification/Gazette (Schedule 2 - Tubular Fluorescent Lamps)	IS 2418 (part I) & (part II)	Performance/ measurement	This standard specifies the requirements for participating in the scheme for Tubular Fluorescent lamps for General lighting service. The referred Indian Standard are IS 2418 (part I) and (part II) – 1977 including all the amendments. The scheme covers 4 feet tubular fluorescent lamps for wattages upto 40W. The scheme shall cover 6500K colour temperature for halo-phosphates and 6500K, 4000K & 2700K for tri-phosphate category. The MEPS level is that of Star 1.	
India	Lamp	Fluorescent double cap	IS 2418 (Part II)		Performance/ measurement	Specification for Tubular Fluorescent Lamps for General Lighting Service - Part II: Standard Lamp Data Sheets	
India	Lamp	Fluorescent double cap	IS 2418 (part I) & (part II)		Performance/ measurement	This standard specifies the requirements for participating in the energy labelling scheme for tubular fluorescent lamps for General lighting service. The referred Indian Standard are IS 2418 (part I) and (part II) – 1977 including all the amendments. The scheme covers 4 feet tubular fluorescent lamps for wattages upto 40W. The scheme shall cover 6500K colour temperature for halo-phosphates and 6500K, 4000K & 2700K for tri-phosphate category.	
India	Lamp	Fluorescent double cap	IS 2418 (part I) & (part II)		Performance/ measurement	This standard specifies the requirements for participating in the scheme for Tubular Fluorescent lamps for General lighting service. The referred Indian Standard are IS 2418 (part I) and (part II) – 1977 including all the amendments. The scheme covers 4 feet tubular fluorescent lamps for wattages upto 40W. The scheme shall cover 6500K colour temperature for halo-phosphates and 6500K, 4000K & 2700K for tri-phosphate category. The MEPS level is that of Star 1.	
India	Lamp	Fluorescent double cap	IS 2418		Performance/ measurement	1200mm linear fluorescent lamps for general lighting service	Local test method and international test method are harmonised
India	Lamp	Fluorescent double cap	IS 2418 (Part I)		Performance/ measurement	Specification for Tubular Fluorescent Lamps for General Lighting Service - Part I: Requirements and Tests	Reference Test Standard: IEC 60081
India	Lamp	HID	IS 9900		Performance/ measurement	HPMV lamp	IEC 188
India	Lamp	HID	IS 9974		Performance/ measurement	HPSV lamp	IEC 662
India	Lamp	Incandescent / halogen	IS 418		Performance/ measurement	Tungsten filament general service electric lamps (up to 100 W)	
India	Lamp	LED	IS 16104: 2012		Performance/ measurement	DC or AC Supplied Electronic Control Gear for LED Modules - Performance Requirements	IEC 62384
India	Lamp	LED	IS 16102 (Part 1): 2012		Safety	Self Ballasted LED-Lamps for General Lighting Services Part 1 Safety Requirements	IEC 62612

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
India	Lamp	LED	IS 16102 (Part 2): 2012		Performance/ measurement	Self Ballasted LED-Lamps for General Lighting Services Part 2 Performance Requirements	IEC 62612
India	Lamp	LED	IS 16103 (Part 2)		Performance/ measurement	LED Modules for General Lighting -Part 2, Performance Requirements	IEC 62717
India	Lamp	LED	IS 16107		Performance/ measurement	LED Luminaries for General Lighting purposes- Performance Requirements	IEC/PAS 62722-2-1
India	Lamp	LED	IS 16106: 2012		Performance/ measurement	Method of Electrical and Photometric Measurements of Solid-State Lighting (LED) Products	Reference Test Standard: IES-LM-79-08
India	Lamp	LED	IS 16105: 2012		Performance/ measurement	Method of Measurement of Lumen Maintenance of Solid -State Light (LED) Sources	Reference Test Standard: IES-LM-80-08
India	Lamp	LED			Safety	Self-ballasted LED lamps with a d.c. supplies up to 250 V or a.c. supplies up to 1000 V at 50 Hz, intended for domestic and similar general lighting purposes, having, (1) a rated wattage up to 60 W; (2) a rated d.c. supplies up to 250 V or a.c. supplies up to 1000 V at 50 Hz; and (3) a lmap cap according to IS 16102 (Part 1): 2012 "Self-ballasted LED lamps for general lighting services: Part 1 Safety requirements". This standard does not cover self-ballasted LED-lamps that intentionally produce tinted or coloured light neither does it cover OLEDS.	
India	Lamp	LED	IS 16101: 2012		Classification	General Lighting - LEDs and LED modules – Terms and Definitions	
India	Lamp	LED	IS 16102 (Part 2): Performance Requirements for Self-Ballasted LED Lamps for General Lighting Services		Safety	Self-ballasted LED lamps with a d.c. supplies up to 250 V or a.c. supplies up to 1000 V at 50 Hz, intended for domestic and similar general lighting purposes, having, (1) a rated wattage up to 60 W; (2) a rated d.c. supplies up to 250 V or a.c. supplies up to 1000 V at 50 Hz; and (3) a lmap cap according to IS 16102 (Part 1): 2012 "Self-ballasted LED lamps for general lighting services: Part 1 Safety requirements". This standard does not cover self-ballasted LED-lamps that intentionally produce tinted or coloured light neither does it cover OLEDS.	
India	Lamp cap/holder/ etc	All	IS 9206		Lamp cap/holder/etc	Lamp cap	IEC 60061
India	Luminaire		IS10322		Performance/ measurement	Luminaire series	
India	Luminaire		IS13383		Performance/ measurement	Methods of Photometry of Luminaires	
India	Luminaire		IS1944		Design	Lighting of public thoroughfare	
India	Luminaire		IS5077		Performance/ measurement	Decorative Lighting	
India	Luminaire		IS7786		Performance/ measurement	Aerodrome Lighting Fittings	
Indonesia	Ballast	Fluorescent	Ballast (magnetic) SNI IEC 60929-2009			Ballasts (Electronic)	
Indonesia	Ballast	Fluorescent	unknown	Ballast (magnetic) SNI IEC 60929-2009		Ballasts (Electronic)	
Indonesia	Ballast	Fluorescent	unknown	Ballast (magnetic) SNI IEC 60929-2009		Ballasts (Electronic)	
Indonesia	Ballast	Fluorescent	SNI 04-3561-1994			Fluorescent Ballast for 50 Hz Alternating Current	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Indonesia	Ballast	Fluorescent	SNI 04-6509.1-2001			Ballast for tubular fluorescent lamps - General and safety requirements. Section 1: General requirements	
Indonesia	Ballast	Fluorescent	SNI IEC 60155:2010			Glow-starter for fluorescent lamps	IEC 60 155
Indonesia	Ballast	Fluorescent	SNI IEC 60921:2010			Ballasts for tubular fluorescent lamps - Performance requirements	IEC 60921
Indonesia	Ballast	Fluorescent	SNI IEC 60929:2009			AC-supplied electronic ballasts for tubular fluorescent lamps - Performance requirements	IEC 60929
Indonesia	Ballast	Fluorescent	SNI IEC 61347-2-8:2009			Lamp controlgear - Part 2-8:	IEC 61199
Indonesia	Ballast	Fluorescent	SNI IEC 61347-1:2011			Lamp controlgear - Part 1: General and safety requirements	IEC 61347.1
Indonesia	Ballast	Fluorescent	SNI IEC 61347-2-3:2011			Lamp controlgear - Part 2-3: Particular requirements for a.c. supplied electronic ballasts for fluorescent lamps	IEC 81347.2.3
Indonesia	Lamp	CFLi	Ministerial Regulation No 6/2011		Performance/ measurement	Energy Efficiency Labelling on CFL	
Indonesia	Lamp	CFLi	SNI IEC 60969:2009		Performance/ measurement	Self-ballasted lamps for general lighting services - Performance requirements	IEC 60969
Indonesia	Lamp	CFLi	SNI 04-6504-2001		Safety	Self ballasted lamps for general lighting services- Safety requirement	IEC IEC 60968:1998 61347.1
Indonesia	Lamp	CFLi	IEC 60969		Performance/ measurement		Local test method and international test method are harmonised
Indonesia	Lamp	CFLi	Ministery Regulation (MEMR) No. 6/2011 on Energy Labelling for CFL	IEC 60969: 2009	Performance/ measurement		
Indonesia	Lamp	Fluorescent double cap	SNI IEC 61195:2009		Safety	Double-capped fluorescent lamps - Safety specifications	IEC 61195
Indonesia	Lamp	Fluorescent single cap	SNI IEC 60901:2009		Performance/ measurement	Single-capped fluorescent lamps - Performance specifications	IEC 60901
Indonesia	Lamp	Fluorescent single cap	SNI IEC 61199:2009		Safety	Single-capped fluorescent lamps - Safety specifications	IEC 61195
Indonesia	Lamp	Incandescent / halogen	SNI IEC 60064:2007		Performance/ measurement	Tungsten filament lamps for domestic and similar public lighting - Performance requirements	IEC 60064
Indonesia	Lamp	Incandescent / halogen	SNI IEC 60432-1:2009		Performance/ measurement	Part 1: Tungsten filament lamps for domestic and similar general lighting purposes	IEC 60432.1
Indonesia	Lamp	LED	SNI 7397 : 2008		Performance/ measurement	LED (Light Emmiting Diode) signal lamps on the trains	IEC 7397
Indonesia	Lamp	Special purpose	SNI 03-7051-2004		Performance/ measurement	The sign and obstacle light installation in airports	ICAO
Indonesia	Lamp	Special purpose	SNI 7399 : 2008		Performance/ measurement	Rear fog lamps of motor vehicles	UNECE
Indonesia	Lamp	Special purpose	SNI 7402 : 2008		Performance/ measurement	Filament lamps for motor vehicles, joined carriages and sticked carriages	UNECE

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Indonesia	Lamp	Special purpose	SNI 7405 : 2008		Performance/ measurement	Master lamps for four wheels or more motor vehicles	UNECE
Indonesia	Luminaire	Road	SNI 04 6973: 2005		Performance/ measurement	Luminaries for road Light	
Indonesia	Luminaire	Road	SNI 7391: 2008		Performance/ measurement	Specification for street lighting in urban areas	
Indonesia	Luminaire		SNI 04-6973.2.5-2005		Performance/ measurement	Luminaires - Part 2-5: Particular requirements - Floodlights	IEC 6973.2.5
Indonesia	System		SNI 03-6197-2000 on Energy Conservation of Lighting System in Building		Performance/ measurement	Lighting systems in buildings	
Indonesia	System				Performance/ measurement	Lighting systems in buildings	
Iran	Ballast	Fluorescent	ISIRI 10759, 1st Edition, Fluorescent lamp ballast - technical specifications and test method for energy consumption and energy labelling instruction	34C/682/INF: 2005, Performance of electrical lighting equipment-Ballasts for fluorescent lamps-part 1: Method measurement to determine energy consumption and performance of ballast-lamp circuits. 3- 34C/693/NP: 2005, Performance of electrical lighting equipment- Ballasts for fluorescent lamps-part 2: Energy labelling and minimum energy performance standard requirements.		Covers electric fluorescent ballast and tube fluorescent lamps (20-40 W), frequency 50hz, and 220-240 volts	
Iran	Ballast	Fluorescent	ISIRI 10759, 1st Edition, Fluorescent lamp ballast - technical specifications and test method for energy consumption and energy labelling instruction	34C/682/INF: 2005, Performance of electrical lighting equipment-Ballasts for fluorescent lamps-part 1: Method measurement to determine energy consumption and performance of ballast-lamp circuits. 3- 34C/693/NP: 2005, Performance of electrical lighting equipment- Ballasts for fluorescent lamps-part 2: Energy labelling and minimum energy performance standard requirements.		Covers electric fluorescent ballast and tube fluorescent lamps (20-40 W), frequency 50hz, and 220-240 volts	
Iran	Lamp	CFLi	ISIRI 5916 Self Ballasted Lamps for Genral Lighting	IEC 60968 and IEC 60969	Performance/ measurement	Covers multi sector self ballasted lamps (60W and 100-250V)	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			Services-performance requirements				
Iran	Lamp	CFLi	ISIRI 5916, ISIRI 5917	IEC 60968 and IEC 60969	Performance/ measurement		
Iran	Lamp	Fluorescent double cap	ISIRI NS 7341, 1st edition, Electric lamps, Technical specifications and test method for energy consumption and energy labelling instruction	NS687 (Double Capped), NS 2702 (High Pressure Mercury Vapor), NS 5191 (HPSI), NS 5211 (Single Capped), 98/11/EC	Performance/ measurement	Tubular, double capped	
Iran	Lamp	Fluorescent double cap	ISIRI NS 7341, 1st edition, Electric lamps, Technical specifications and test method for energy consumption and energy labelling instruction	NS687 (Double Capped), NS 2702 (High Pressure Mercury Vapor), NS 5191 (HPSI), NS 5211 (Single Capped), 98/11/EC	Performance/ measurement	Tubular, double capped	
ISO	System	All	ISO 16813		System	Building environment design -- Indoor environment -- General principles	
Israel	Ballast	Fluorescent	SI 5485 - Ballasts for fluorescent lamps - Energy efficiency requirements and labelling				
Israel	Ballast	Fluorescent	SI 5485 - Ballasts for fluorescent lamps - Energy efficiency requirements and labelling				
Israel	Lamp	CFLi	SI 60968		Safety	Self-ballasted lamps for general lighting services	
Israel	Lamp	Fluorescent double cap	SI 520 TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE		Performance/ measurement	Tubular	
Israel	Lamp	Fluorescent double cap	SI 520 TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE		Performance/ measurement	Tubular	
Israel	Lamp	Incandescent / halogen	The Energy Sources Regulations (Minimal Energetic Efficiency for Indoor Light Bulb), 2011		Performance/ measurement	Electric light bulb - tungsten incandescent bulb	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Israel	Lamp	Incandescent / halogen	The Energy Sources Regulations (Minimal Energetic Efficiency for Indoor Light Bulb), 2011		Performance/ measurement	Electric light bulb - tungsten incandescent bulb	
Japan	Ballast	Fluorescent	C8147.2.13 (2008)			Lamp controlgear. Part 2.13: Particular requirements for DC or AC supplied electronic controlgear for LED modules	IEC 61347.2.13
Japan	Ballast	LED	C8153 (2009)			DC or AC supplied electronic controlgear for LED modules. Performance requirements	IEC 62384
Japan	Lamp	All	JIS C 7801: 2009 (JELMA/JSA) Measuring methods of lamps for general lighting, JIS C 8105-5: 2011 Luminaires – Part 5: Gonio-photometric method, JIS C 7801 Amendment 1: 2012.		Performance/ measurement		
Japan	Lamp	All	C7550 (2011)		Safety	Photobiological safety for lamps and lamp system	IEC 62471 [to IEC 62471.1] (IEC 62471.2 TR)
Japan	Lamp	Fluorescent double cap	Energy-Saving Labelling Program	JIS C 7601	Performance/ measurement	Lighting fixtures which equip fluorescent lamps as the main light source. However, the following types are excluded from this application: explosion-proof types, heat resistant types, dustproof types, corrosion-resistant types, types designed for vehicles and other transport vehicles, fluorescent lighting fixtures using fluorescent lamp with less than type 40 (except fluorescent lighting fixtures specified in JIS C 8115 “Fluorescent lighting fixtures for home” and JIS C 8112 “Fluorescent lamp desk stand (for study and reading)”).	
Japan	Lamp	Fluorescent double cap	Label Display Program for Retailers - Fluorescent Lamps	JIS C 7601	Performance/ measurement	Lighting fixtures which equip fluorescent lamps as the main light source. However, the following types are excluded from this application: explosion-proof types, heat resistant types, dustproof types, corrosion-resistant types, types designed for vehicles and other transport vehicles, fluorescent lighting fixtures using fluorescent lamp with less than type 40 (except fluorescent lighting fixtures specified in JIS C 8115 “Fluorescent lighting fixtures for home” and JIS C 8112 “Fluorescent lamp desk stand (for study and reading)”).	
Japan	Lamp	Fluorescent double cap	Top Runner Program for Fluorescent Lamps		Performance/ measurement	Lighting fixtures which equip fluorescent lamps as the main light source. However, the following types are excluded from this application: explosion-proof types, heat resistant types, dustproof types, corrosion-resistant types, types designed for vehicles and other transport vehicles, fluorescent lighting fixtures using fluorescent lamp with less than type 40 (except fluorescent lighting fixtures specified in JIS C 8115 “Fluorescent lighting fixtures for home” and JIS C 8112 “Fluorescent lamp desk stand (for study and reading)”).	
Japan	Lamp	Fluorescent double cap	JIS C7601		Performance/ measurement	Fluorescent lamps for general lighting service The JIS standard notes that the lamp data sheets in IEC60081 and IEC60901 are not included. It appears that the basic performance requirements are therefore equivalent to IEC standards (if not identical). Efficacy can be determined from measurements within the standard. Energy consumption efficiency (1m/W) is given by the following ratio: [Σ(Lamp luminous flux (1m) ´ Ballast factor ´ Temperature correction factor of lamp)]/Power consumption (W) Ballast factor is given by the following ratio from a single reference lamp:	JIS C7601 is based on a number of IEC standards and the requirements appear to be largely compatible with these requirements. The IEC standards used to develop JIS C7601 include: • IEC60081 - Double-capped

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						Light output of the ballast/Light output of reference ballast Examples of temperature correction factors for various types of lamps and conditions of operation in the luminaire are provided in the section on Japan in the main report. Lamp luminous flux is the rated lamp output in Lumens.	fluorescent lamps - Performance specifications • IEC60901 - Single-capped fluorescent lamps - Performance requirements • IEC61195 - Double-capped fluorescent lamps - Safety specifications • IEC61199 - Single-capped fluorescent lamps - Safety requirements
Japan	Lamp	LED	C8154 (2009)		Safety	LED modules for general lighting. Safety specifications	IEC 62031
Japan	Lamp	LED	C8156 (2010)		Safety	Self-ballasted LED lamps for general lighting services by voltage >50V. Safety specifications	IEC 62560
Japan	Lamp	LED	C8157 (2011)		Performance/ measurement	Self-ballasted LED lamps for general lighting services by voltage >50V. Performance requirements	IEC 62612
Japan	Lamp	LED	C8155 (2010)		Performance/ measurement	LED modules for general lighting service. Performance requirements	IEC PAS 62717
Japan	Lamp	LED	C8152.2		Performance/ measurement	Photometry of white light emitting diode for general lighting. Part 2: LED modules and LED light engines	To be proposed
Japan	Lamp	LED	Cxxxx.x		Safety	Tubular LED lamps with GX15t-5 cap. Safety specifications	To be proposed
Japan	Lamp	LED	Cxxxx.x		Performance/ measurement	Tubular LED lamps with GX15t-5 cap. Performance requirements	To be proposed
Japan	Lamp	LED			Performance/ measurement	ypes and forms in Annex B (Normative) in JIS C 8157 " Self - ballasted LED - lamp s for general lighting services > 50 V -- Performance requirements " and have a bayonet cap of E17 or E26 and emit light according to the light - source col ors defined in the JIS Z 9112 " Classification of fluorescent lamps based on light - source colours and colour rending pr operties." 3 . Terminology	
Japan	Lamp	LED	C8152.1		Performance/ measurement	Photometry of white light emitting diode for general lighting. Part 1: LED packages	
Japan	Lamp	LED	C8152.3		Performance/ measurement	Method of lumen maintenance measurement for LED lamps (including packages)	
Japan	Lamp	LED	C8158 plan		Performance/ measurement	Self-ballasted LED lamps for general lighting services by voltage >50V	
Japan	Lamp	LED	Japan Environment Association (JEA) Eco Mark - LED Bulb Lamp (Type A) Version1.0 Certification Criteria		Performance/ measurement	ypes and forms in Annex B (Normative) in JIS C 8157 " Self - ballasted LED - lamp s for general lighting services > 50 V -- Performance requirements " and have a bayonet cap of E17 or E26 and emit light according to the light - source col ors defined in the JIS Z 9112 " Classification of fluorescent lamps based on light - source colours and colour rending pr operties." 3 . Terminology	
Japan	Luminaire		JIS C 7601		??	Lighting fixtures which equip fluorescent lamps as the main light source. However, the following types are excluded from this application: explosion-proof types, heat resistant types, dustproof types, corrosion-resistant types, types designed for vehicles and other transport vehicles, fluorescent lighting fixtures using fluorescent lamp with less than type 40 (except fluorescent lighting fixtures specified in JIS C 8115 "Fluorescent lighting fixtures for home" and JIS C 8112 "Fluorescent lamp desk stand (for study and reading)").	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Japan	Luminaire		C8121-2-2		Lamp cap/holder/etc	Miscellaneous lampholders. Part 2.2: Particular requirements. Connectors for printed circuit board based LED modules	IEC 60038-2-2
Japan	Luminaire		C8121-2-3 plan		Lamp cap/holder/etc	Miscellaneous lampholders. Part 2.3: Particular requirements. Lampholders for double-capped tubular LED lamps	IEC 60038-2-3 plan
Japan	Luminaire		C8105-1		Safety	Luminaires Part 1: General requirements for safety	IEC 60598-1
Japan	Luminaire		New C8105-3 plan		Performance/ measurement	Luminares. Part 3: General requirements for performance	IEC 62722-1
Japan	Luminaire		New C8105-4-1		Performance/ measurement	Luminaire performance. Part 2.1: Particular requirements for LED luminaires	IEC 62722-2-1
Japan	Luminaire		C8105-3		Performance/ measurement	Luminaires Part 3: General requirements for performance	
Japan	Luminaire		C8105-5		Performance/ measurement	Luminaires Part 5: Gonio-photometric method	
Japan	Luminaire		C8106		??	Fluorescent lamp luminaires for commercial, industrial and public lighting	
Japan	Luminaire		C8112		??	Fluorescent table study lamps	
Japan	Luminaire		C8113		??	Floodlights	
Japan	Luminaire		C8115		??	Fluorescent lamp luminaires for residential lighting	
Japan	Luminaire		C8131		??	Luminaires for road lighting	
Jordan	Ballast	Fluorescent	Techinical Regulation on Eco-design requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps (transposition of 245/2009/EC)			This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Jordan	Ballast	HID	Techinical Regulation on Eco-design requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to			This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			operate such lamps (transposition of 245/2009/EC)				
Jordan	Lamp	CFLi	Techincal Regulation on Eco-design requirements for non-directional household lamps (transposition of 244/2009/EC)	244/2009/EC	Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Jordan	Lamp	CFLi	Technical Regulation on energy labelling of household electric lamps (transposition of No. 98/11/EC)	EN 50285	Performance/ measurement	Household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Jordan	Lamp	Fluorescent double cap	Techinical Regulation on Eco-design requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps (transposition of 245/2009/EC)		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Jordan	Lamp	Fluorescent double cap	Technical Regulation on energy labelling of household electric lamps (transposition of No. 98/11/EC)	EN 50285	Performance/ measurement	Linear. Household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Jordan	Lamp	HID	Techinical Regulation on Eco-design requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps (transposition of 245/2009/EC)		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Jordan	Lamp	HID	Techincal Regulation on Eco-design requirements for non-directional household lamps (transposition of 244/2009/EC)	244/2009/EC	Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Jordan	Lamp	Incandescent / halogen	Techincal Regulation on Eco-design requirements for non-directional household lamps (transposition of 244/2009/EC)	244/2009/EC	Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Jordan	Lamp	Incandescent / halogen	Technical Regulation on energy labelling of household electric lamps (transposition	EN 50285	Performance/ measurement	Household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s)	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			of No. 98/11/EC)			which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Jordan	Lamp	LED	Techincal Regulation on Eco-design requirements for non-directional household lamps (transposition of 244/2009/EC)	244/2009/EC	Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Jordan	Lamp	LED	Technical Regulation on energy labelling of household electric lamps (transposition of No. 98/11/EC)	EN 50285	Performance/ measurement	Household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Jordan	System		Technical Regulation on energy labelling of household electric lamps (transposition of No. 98/11/EC)	EN 50285	Performance/ measurement	Household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However,	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Kenya	Ballast	Fluorescent	unknown				
Kenya	Lamp	Fluorescent double cap	unknown		Performance/ measurement	Double capped	
Kenya	Lamp	Fluorescent double cap	unknown		Performance/ measurement	The EESL programme has extended the scope of MEPS for lighting appliances to include fluorescent tubes. The expected maximum Hg content is fluorescent tubes with MEPS will be 15 mg.	
Korea	Ballast	Fluorescent	High-efficiency Appliances Certification Program for Associated Ballasts	KS C 7621-99			
Korea	Ballast	Fluorescent	MEPS for Fluorescent Lamps Ballast	KS C 8100; KS C 8102		• By KS C 8100 and KS C 8102 Fluorescent lamps ballasts which are the tubular type of rated power consumption of 20W, 28W, 32W, and 40W, the circular type of rated power consumption of 32W, and 40W, and the compact type of rated power consumption of FPX 13W, FDX 26W, FPL 27W, FPL32W, FPL 36W, FPL 36W, FPL 45W, and FPL 55W • Energy Efficiency (lm/W) shall be first measured with reference ballast, and then measured with test sample ballast by the test method in KS C 8102. Two results shall be compared. But, FPL 32W and FPL 45W shall be measured by the test method in “Safety Certification”.	
Korea	Ballast	Fluorescent	KS C 7621-99				
Korea	Ballast	Fluorescent	KS C 8100; KS C 8102			By KS C 8100 and KS C 8102 Fluorescent lamps ballasts which are the tubular type of rated power consumption of 20W, 28W, 32W, and 40W, the circular type of rated power consumption of 32W, and 40W, and the compact type of rated power consumption of FPX 13W, FDX 26W, FPL 27W, FPL32W, FPL 36W, FPL 36W, FPL 45W, and FPL 55W • Energy Efficiency (lm/W) shall be first measured with reference ballast, and then measured with test sample ballast by the test method in KS C 8102. Two results shall be compared. But, FPL 32W and FPL 45W shall be measured by the test method in “Safety Certification”.	
Korea	Ballast	Fluorescent	KS C 7621-99			By KS C 7621 Associated ballasts which all components are in one, and any parts are not allowed to change, and the rated power consumption of 5 W~60W. But globe type is excluded. • Energy Efficiency (lm/W) shall be measured by the test method in KS C 7621, which is obtained from lumen divided by power consumption.	
Korea	Ballast	Fluorescent	MEPS for Associated Ballasts	KS C 7621-99		By KS C 7621 Associated ballasts which all components are in one, and any parts are not allowed to change, and the rated power consumption of 5 W~60W. But globe type is excluded.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						Energy Efficiency (lm/W) shall be measured by the test method in KS C 7621, which is obtained from lumen divided by power consumption.	
Korea	Ballast	Fluorescent	KS C8100-1997			Electronic ballasts for fluorescent lamps	Equivalent to IEC60929
Korea	Ballast	Fluorescent	KS C8102-1995			Magnetic ballasts for fluorescent lamps The scope of the JIS C8108 covers the design and construction of ballasts for fluorescent lamps. It is a combined safety and performance standard is based largely on IEC60920 (safety) and IEC60921 (performance) and appears to be equivalent to these standards in most respects. The scope of the standard covers ballasts used with a starter, rapid and instant start ballasts and electronic ballasts. The standard defines the characteristics of reference ballasts and lamps for use in testing. The standard covers aspects such as construction and marking, secondary voltage, starting voltage, cathode pre-heating, secondary short circuit, lamp current and wattage, lamp current waveform, lamp input current and power, power factor, noise, moisture resistance, temperature rise, insulation resistance, dielectric withstand voltage, abnormal temperature rise and thermal endurance of windings. Interestingly, the standard sets performance requirements for electronic ballasts and rapid start ballasts in terms of the ratio of luminous output in lieu of the measurement of the lamp wattage. As mentioned elsewhere, the determination of lamp power for these ballasts types is difficult under normal circumstances. As with the IEC standards, the standard does not specifically cover efficacy, but data on lumen output and total circuit power measured under the standard can be used to determine this parameter if required.	Equivalent to JIS C8108
Korea	Lamp	CFLi	Energy Efficiency Grade Label for Fluorescent Lamps		Performance/ measurement	• By KS C 7601 Fluorescent lamps which are the tubular type of rated power consumption of 20W, 28W, 32W, and 40W, the circular type of rated power consumption of 32W, and 40W, and the compact type of rated power consumption of FPX 13W, FDX 26W, FPL 27W, FPL32W, FPL 36W, FPL36W, FPL 45W, and FPL 55W .7 • By K 61195, K 61199 Fluorescent lamps which are the tubular type of rated power consumption of 20W and 32W, the compact type of rated power consumption of FPL 36W, and the commercial used type (which is more than 7100K of colour temperature, and can be used in the conventional lamp) • Energy Efficiency (lm/W) shall be measured by the test method in KS C 7601, which is obtained from lumen divided by power consumption. But, FPL 32W and FPL 45W shall be measured by the test method in “Safety Certification”.	
Korea	Lamp	CFLi	High-efficiency Appliances Certification Program		Performance/ measurement	FPL 32W Compact Fluorescent Lamps, 26mm 32W Fluorescent Lamps and 16 mm Fluorescent Lamps	
Korea	Lamp	CFLi	MEPS for Fluorescent Lamps		Performance/ measurement	• By KS C 7601 Fluorescent lamps which are the tubular type of rated power consumption of 20W, 28W, 32W, and 40W, the circular type of rated power consumption of 32W, and 40W, and the compact type of rated power consumption of FPX 13W, FDX 26W, FPL 27W, FPL32W, FPL 36W, FPL36W, FPL 45W, and FPL 55W .7 • By K 61195, K 61199 Fluorescent lamps which are the tubular type of rated power consumption of 20W and 32W, the compact type of rated power consumption of FPL 36W, and the commercial used type (which is more than 7100K of colour temperature, and can be used in the conventional lamp)	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						• Energy Efficiency (lm/W) shall be measured by the test method in KS C 7601, which is obtained from lumen divided by power consumption. But, FPL 32W and FPL 45W shall be measured by the test method in "Safety Certification".	
Korea	Lamp	CFLi			Performance/ measurement	• By KS C 7601 Fluorescent lamps which are the tubular type of rated power consumption of 20W, 28W, 32W, and 40W, the circular type of rated power consumption of 32W, and 40W, and the compact type of rated power consumption of FPX 13W, FDX 26W, FPL 27W, FPL32W, FPL 36W, FPL36W, FPL 45W, and FPL 55W .7 • By K 61195, K 61199 Fluorescent lamps which are the tubular type of rated power consumption of 20W and 32W, the compact type of rated power consumption of FPL 36W, and the commercial used type (which is more than 7100K of colour temperature, and can be used in the conventional lamp) • Energy Efficiency (lm/W) shall be measured by the test method in KS C 7601, which is obtained from lumen divided by power consumption. But, FPL 32W and FPL 45W shall be measured by the test method in "Safety Certification".	
Korea	Lamp	CFLi	KS C7621-1997		Performance/ measurement	Self ballasted lamps (screw base CFLs)	Based on KS C8100 and KS C7601, as well as parts of IEC60969
Korea	Lamp	Fluorescent double cap	High-efficiency Appliances Certification Program for Fluorescent Lamps		Performance/ measurement	meeting KSC 7601 standards, whose light conversion efficiency is higher than the value of light velocity on Annex3 of KSC 7601 divided by rated power consumption	
Korea	Lamp	Fluorescent double cap	High-efficiency Appliances Certification Program for Reflector Fluorescent Lamp		Performance/ measurement	Reflectors for Fluorescent Lamps	
Korea	Lamp	Fluorescent double cap	MEPS for Fluorescent Lamps		Performance/ measurement	• By KS C 7601 Fluorescent lamps which are the tubular type of rated power consumption of 20W, 28W, 32W, and 40W, the circular type of rated power consumption of 32W, and 40W, and the compact type of rated power consumption of FPX 13W, FDX 26W, FPL 27W, FPL32W, FPL 36W, FPL36W, FPL 45W, and FPL 55W .7 • By K 61195, K 61199 Fluorescent lamps which are the tubular type of rated power consumption of 20W and 32W, the compact type of rated power consumption of FPL 36W, and the commercial used type (which is more than 7100K of colour temperature, and can be used in the conventional lamp) • Energy Efficiency (lm/W) shall be measured by the test method in KS C 7601, which is obtained from lumen divided by power consumption. But, FPL 32W and FPL 45W shall be measured by the test method in "Safety Certification".	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Korea	Lamp	Fluorescent double cap			Performance/ measurement	meeting KSC 7601 standards, whose light conversion efficiency is higher than the value of light velocity on Annex3 of KSC 7601 divided by rated power consumption	
Korea	Lamp	Fluorescent double cap			Performance/ measurement	• By KS C 7601 Fluorescent lamps which are the tubular type of rated power consumption of 20W, 28W, 32W, and 40W, the circular type of rated power consumption of 32W, and 40W, and the compact type of rated power consumption of FPX 13W, FDX 26W, FPL 27W, FPL32W, FPL 36W, FPL36W, FPL 45W, and FPL 55W .7 • By K 61195, K 61199 Fluorescent lamps which are the tubular type of rated power consumption of 20W and 32W, the compact type of rated power consumption of FPL 36W, and the commercial used type (which is more than 7100K of colour temperature, and can be used in the conventional lamp) • Energy Efficiency (lm/W) shall be measured by the test method in KS C 7601, which is obtained from lumen divided by power consumption. But, FPL 32W and FPL 45W shall be measured by the test method in "Safety Certification".	
Korea	Lamp	Fluorescent double cap			Performance/ measurement	Reflectors for Fluorescent Lamps	
Korea	Lamp	Fluorescent double cap	KS C7601-1997		Performance/ measurement	Fluorescent lamps for general lighting service	Equivalent to JIS C7601
Korea	Lamp	HID	High-efficiency Appliances Certification Program		Performance/ measurement	Reflectors for HID Lamps	
Korea	Lamp	HID	High-efficiency Appliances Certification Program		Performance/ measurement	Metal-Halide Lamps	
Korea	Lamp	HID			Performance/ measurement	Reflectors for HID Lamps	
Korea	Lamp	HID			Performance/ measurement	Metal-Halide Lamps	
Korea	Lamp	Incandescent / halogen	KS C7501-1994		Performance/ measurement	Incandescent lamps for general lighting service The standard covers the design and construction of A and PS type general lighting service (GLS) lamps. The standard also specifies initial performance characteristics, life, marking and related requirements.The scope of the standard A and PS type general lighting service lamps (GLS) with an Edison screw (ES) base of E25/E26 type. Performance requirements related to energy and energy service include: • Initial luminous flux must be greater than 90% rated for coated and 93% for clear lamps • Average life >96% specified value • Dimensions are specified A number of other requirements are also specified (eg temperature rise, strength, marking etc.), mostly related to construction and safety. Ambient temperature is 20oC ±15oC for the test, with a humidity of 65% ±20%. The lamp is seasoned for 40 minutes with voltage of 120% and 20 minutes at a voltage of 130% before measurement. The lamp is held base up or base down for the luminance ratio test – the luminance is determined in a plane which is perpendicular to the lamp axis. The product has to	Equivalent to JIS C7501; general requirements broadly in accordance with IEC 60064

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						be marked with the type and power.	
Korea	Lamp	Incandescent / halogen	Energy Efficiency Grade Label for Incandescent Lamps	KS C 7501	Performance/ measurement	• By KS C 7501 the white tungsten bulb at 220V of rated power consumption of 25~150W, which includes the colourless transparent bulb, the inner frosting bulb, the bulb coated with white, and the bulb coated with thin film. • Energy Efficiency (lm/W) shall be measured by the test method in KS C 7501, which is obtained from lumen divided by power consumption.	
Korea	Lamp	Incandescent / halogen	MEPS for Incandescent Lamps	KS C 7501	Performance/ measurement	• By KS C 7501 the white tungsten bulb at 220V of rated power consumption of 25~150W, which includes the colourless transparent bulb, the inner frosting bulb, the bulb coated with white, and the bulb coated with thin film. • Energy Efficiency (lm/W) shall be measured by the test method in KS C 7501, which is obtained from lumen divided by power consumption.	
Korea	Lamp	Incandescent / halogen	KS C 7501		Performance/ measurement	• By KS C 7501 the white tungsten bulb at 220V of rated power consumption of 25~150W, which includes the colourless transparent bulb, the inner frosting bulb, the bulb coated with white, and the bulb coated with thin film. • Energy Efficiency (lm/W) shall be measured by the test method in KS C 7501, which is obtained from lumen divided by power consumption.	
Korea	Lamp	LED			??	LED Luminaire	
Korea	Lamp	LED	K10021		??	Tubular LED lamps using external converter	
Korea	Lamp	LED	K10023		Safety	Self Ballasted LED Lamps for general lighting service--safety and performance	
Korea	Lamp	LED	K10025		??	LED lamp for fluorescent lamp retrofit-internal converter type	
Korea	Lamp	LED	K20001		??	Tubular LED lamps	
Korea	Lamp	LED	K60968		Performance/ measurement	LED lamps using internal converter (Self Ballasted Lamps)	
Korea	Lamp	LED	K61347-2-13		??	Part 2-13 particular requirements for DC or AC supplied Controlgear for LED modules	
Korea	Lamp	LED	K62031		??	LED modules for general lighting	
Korea	Lamp	LED	K62384		??	DC or AC Supplied Electronic Controlgear for LED modules-Perfomance requirements	
Korea	Lamp	LED	KS C 7528		??	LED lamps for Traffic signal	
Korea	Lamp	LED	KS C 7651		??	LED lamps using internal converter (Self Ballasted LED Lamps	
Korea	Lamp	LED	KS C 7652		??	LED lamps using external converter (Non-ballasted LED lamps)	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Korea	Lamp	LED	KS C 7653		??	Recessed LED Luminaires and Fixed LED luminaires	
Korea	Lamp	LED	KS C 7654		??	LED emergency luminaires	
Korea	Lamp	LED	KS C 7655		??	Electronic control gear for LED modules	
Korea	Lamp	LED	KS C 7656		??	LED lamps using portable luminaires	
Korea	Lamp	LED	KS C 7657		??	LED sensor luminaires	
Korea	Lamp	LED	KS C 7658		??	LED luminaires for road and street lighting	
Korea	Lamp	LED	KS C 7659		??	LED module for channel letter signs	
Korea	Lamp	LED	KS C 7711		??	LED ground recessed luminaires	
Korea	Lamp	LED	KS C 7712		??	LED flood-lighting luminaires	
Korea	Lamp	LED	KS C 7713		??	LED landscape lighting	
Korea	Lamp	LED	KS C 7714		??	LED aviation obstruction system	
Korea	Lamp	LED	KS C 7716		??	LED Tunnel luminaires	
Korea	Lamp	LED	KS C 7717		??	LED lamp for Crosswalk	
Korea	Lamp	LED	KS C 7718		??	LED insert light for airport	
Korea	Lamp	LED	KS C IEC PAS 62717		??	LED modules for general lighting-performance	
Korea	Lamp	LED	KS C IEC61347		??	Part 2-13 particular requirements for DC or AC supplied Controlgear for LED modules	
Korea	Lamp	LED	KS C IEC62031		??	LED modules for general lighting	
Korea	Lamp	LED	KS C IEC62384		??	DC or AC Supplied Electronic Controlgear for LED modules-Performance requirements	
Korea	Lamp	LED	KS C IEC62386-207		??	Digital addressable lighting interface-particular requirements for control gear-led module	
Korea	Lamp	LED			??	using external converter	
Korea	Lamp	LED			Safety	using external converter-safety and performance	
Korea	Lamp	LED	High-efficiency Appliances Certification Program		Performance/ measurement	LED Luminaire	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Korea	Lamp cap/holder/ etc	LED	K 60838-2-2		Lamp cap/holder/etc	Miscellaneous Lampholdes-part2-2, Connectors for LED-Modules	
Korea	Lamp cap/holder/ etc	LED	K20002		Lamp cap/holder/etc	Lampholder for Tubular LED lamps	
Korea	Lamp cap/holder/ etc	LED	KS C IEC60838-2-2		Lamp cap/holder/etc	Miscellaneous Lampholdes-part2-2, Connectors for LED-Modules	
Korea	Luminaire	Exit Sign	High-efficiency Appliances Certification Program		Performance/ measurement	LED Exit Signs	
Korea	Luminaire	Exit Sign			Performance/ measurement	LED Exit Signs	
Korea	Luminaire	LED	KS C 7719		??	LED hand lamp	
Korea	Luminaire	Road	K60598		??		
Korea	Luminaire	Road	K60598-2-3		??		
Korea	Luminaire	Road	KSC 7658		??		
Korea	Luminaire	Traffic Light	High-efficiency Appliances Certification Program		Performance/ measurement	LED Traffic Lights	
Korea	Luminaire	Traffic Light			??	LED Traffic Lights	
Korea	Luminaire		High-efficiency Appliances Certification Program for Sensor Lighting Equipment		Performance/ measurement	Sensor Lighting Equipment	
Malaysia	Ballast	Fluorescent	Performance indicator and testing standard for ballasts	MS 141: Part 2 :1993 Testing Standard for Conventional Ballasts, MS IEC 929 :1995 Testing Standard for Electronic Ballasts			
Malaysia	Ballast	Fluorescent	MS 141: Part 2 :1993 Testing Standard for Conventional Ballasts, MS IEC 929 :1995 Testing Standard for Electronic Ballasts				
Malaysia	Ballast	Fluorescent	(MS 141: Part 2: 1993)			Specification for ballasts for tubular fluorescent lamps: Part 2 : Performance requirements Reference is made to IEC60929 for the performance of electronic ballasts. The only difference is the addition of a brief Appendix to determine the ballast loss test (Appendix E) which is required for local Malaysian regulations. This requires the measurement and reporting of the	Identical to IEC60921-1988, and only covers ferromagnetic ballasts.

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						lamp power, lamp voltage, current and total power using both the test ballast and the reference ballast on the reference lamp. The ballast loss is calculated from the total circuit power less the lamp power. The reference ballast power is used to check that the lamp is within specification, rather than to adjust to the results on the test ballast. This can only be used for ballasts that use an external starter.	
Malaysia	Ballast	Fluorescent	MS 141: Part 1: 1993			Specification for ballasts for tubular fluorescent lamps : Part 1 : General and safety requirements (First revision)	IEC 60920
Malaysia	Ballast	Fluorescent	MS IEC 60928: 1995			Specification for a.c supplied electronic ballasts for tubular fluorescent lamps-general and safety requirements	IEC 60928
Malaysia	Ballast	Fluorescent	MS IEC 60929: 1995			Specification for a.c supplied electronic ballasts for tubular fluorescent lamps-performance requirements	IEC 60929
Malaysia	Lamp	CFLi	P.U. (A) 151, Electricity (Amendment) Regulations 2013		Performance/ measurement	MEPS for *CFL (Non integrated lamps)* *Specifies lm/W limit for <10W, 11-26W, ≥ 26W lamps*	
Malaysia	Lamp	CFLi	P.U. (A) 151, Electricity (Amendment) Regulations 2013[2]		Performance/ measurement	MEPS for CFLi (Self ballasted). Specifies lm/W limit for <9W, 9-15W, 16-24W and ≥ 25W lamps	
Malaysia	Lamp	CFLi	MS IEC 60969		Performance/ measurement	Self-Ballasted lamps for general lighting services - Performance requirements for fluorescent lamp	
Malaysia	Lamp	CFLi	Performance indicator and testing standard for electric lamps	MS IEC 60969:2006 (Self-ballasted lamps for general lighting services – Performance requirements) for fluorescent lamps.	Performance/ measurement		
Malaysia	Lamp	CFLi	MS IEC 60969:2006 (Self-ballasted lamps for general lighting services – Performance requirements) for fluorescent lamps.		Performance/ measurement		
Malaysia	Lamp	Fluorescent double cap	P.U. (A) 151, Electricity (Amendment) Regulations 2013		Performance/ measurement	MEPS for fluorescent lamps. Specifies lm/W limit for T8 (18-30 W and ≥ 31W) and T5 (14W and ≥ 15W) lamps	
Malaysia	Lamp	Incandescent / halogen	P.U. (A) 151, Electricity (Amendment) Regulations 2013		Performance/ measurement	MEPS for incandescent lamps. Specifies lm/W limit for incandescent lamps and lists exemptions	
Malaysia	Lamp	LED	IES LM 79-08 Electrical and photometric measurement of solid state lighting products,MS IEC 62612 (P) (Self-		Performance/ measurement		

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			ballasted LED-lamps for general lighting services – performance requirement)				
Malaysia	Lamp	LED	LM 79-08		Performance/ measurement	IES Approved Method for the Electrical and Photometric Measurements of. Solid-State Lighting Product	
Malaysia	Lamp	LED	MS IEC 62612 (P)		Performance/ measurement	Self - ballasted LED - lamps for general lighting services - performance requirement	
Malaysia	Lamp	LED	P.U. (A) 151, Electricity (Amendment) Regulations 2013		Performance/ measurement	MEPS for LEDs. Specifies lm/W limit for LEDs	
Malaysia	Lamp	LED	Performance indicator and testing standard for electric lamps	IES LM 79-08 Electrical and photometric measurement of solid state lighting products,MS IEC 62612 (P) (Self-ballasted LED-lamps for general lighting services – performance requirement)	Performance/ measurement		
Mexico	Ballast	Fluorescent	Sello FIDE No. 4104	NMX-J-198-ANCE; NMX-J-513-ANCE		This endorsement label establishes specifications for T8 fluorescent lamps ballasts, electronic or electromagnetic, quick or instant start, with or without dimming options.With nominal voltages at the ballast of 120, 127, 220, 240, 254, 277 or 440V, at an operating frequency of 60 Hertz, feeding 1,2,3 or 4 linear fluorescent lamps or U shape, with T8 tube (2.54cm), and operating at one or several of the following lamp power ratings: 17, 25, 31, 32 or 59 W.	
Mexico	Ballast	Fluorescent	Sello FIDE No. 4130	NMX-J-198-ANCE; NMX-J-513-ANCE		This endorsement label establishes specifications for ballasts with preheat, rapid, programmed rapid or instant start for CFLs with T4 and T5 tube or circular fluorescent lamps T5 and T9.With nominal voltages at the ballast of 120, 127, 220 or 277 Volts, at an operating frequency of 60 Hertz.	
Mexico	Ballast	Fluorescent	Sello FIDE No. 4131	NMX-J-198-ANCE; NMX-J-513-ANCE		This endorsement label establishes specifications for T5 linear fluorescent lamps ballasts of programmed quick start.With nominal voltages at the ballast of 120, 127, 220, 240, 254, 277 or 440V, at an operating frequency of 60 Hertz, feeding 1,2,3 or 4 linear fluorescent T5 tube (16mm) lamps, and operating at one or several of the following lamp power ratings: 14W, 21W, 28W, 35W or 24WHO, 39WHO, 54WHO or 80WHO.	
Mexico	Ballast	Fluorescent	NMX-J-198-ANCE; NMX-J-513-ANCE			This endorsement label establishes specifications for T5 linear fluorescent lamps ballasts of programmed quick start.With nominal voltages at the ballast of 120, 127, 220, 240, 254, 277 or 440V, at an operating frequency of 60 Hertz, feeding 1,2,3 or 4 linear fluorescent T5 tube (16mm) lamps, and operating at one or several of the following lamp power ratings: 14W, 21W, 28W, 35W or 24WHO, 39WHO, 54WHO or 80WHO.	
Mexico	Ballast	Fluorescent	NMX-J-198-ANCE; NMX-J-513-ANCE			This endorsement label establishes specifications for ballasts with preheat, rapid, programmed rapid or instant start for CFLs with T4 and T5 tube or circular fluorescent lamps T5 and T9.With nominal voltages at the ballast of 120, 127, 220 or 277 Volts, at an operating frequency of 60 Hertz.	
Mexico	Ballast	Fluorescent	NMX-J-198-ANCE; NMX-J-513-ANCE			This endorsement label establishes specifications for T8 fluorescent lamps ballasts, electronic or electromagnetic, quick or instant start, with or without dimming options.With nominal voltages at the ballast of 120, 127, 220, 240, 254, 277 or 440V, at an operating frequency of 60 Hertz, feeding 1,2,3 or 4 linear fluorescent lamps or U shape, with T8 tube (2.54cm), and operating at	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						one or several of the following lamp power ratings: 17, 25, 31, 32 or 59 W.	
Mexico	Ballast	HID	Sello FIDE No. 4105	NMX-J-503-ANCE; NMX-J-230-ANCE		This endorsement label establishes specifications for HID lamps ballasts of the self-regulated electromagnetic type or electronic type for high pressure sodium lamps, pulse start metal additives or metal halide lamps from 39W to 400W. With rated supply voltage of 120V and 480V or at any range of the aforementioned voltages at a 60Hz frequency.	
Mexico	Ballast	HID	Sello FIDE No. 4136	NMX-J-503-ANCE; NMX-J-230-ANCE		This endorsement label establishes specifications for HID lamps dimming ballasts of the self-regulated electromagnetic type or electronic type for high pressure sodium lamps, pulse start metal additives or metal halide lamps. Operating at a low frequency (60Hz to 400Hz) with a sine or square waveform, or operating at a high frequency (70Hz to 350Hz) with a sine waveform. With a supply voltage of 120V, 127V, 220V, 240V, 254V or 277V or at any range of the aforementioned voltages at a 60Hz frequency.	
Mexico	Ballast	HID	NMX-J-503-ANCE; NMX-J-230-ANCE			This endorsement label establishes specifications for HID lamps ballasts of the self-regulated electromagnetic type or electronic type for high pressure sodium lamps, pulse start metal additives or metal halide lamps from 39W to 400W. With rated supply voltage of 120V and 480V or at any range of the aforementioned voltages at a 60Hz frequency.	Local test method and IEC test method are harmonised
Mexico	Lamp	CFLi	NOM-017-ENER/SCFI-2012	NOM-17-ENER/SCFI-2012	Performance/ measurement	This standard establishes the minimum energy efficiency levels for self-ballasted compact fluorescent lamps, the user safety requirements for such lamps and the test methods for verifying compliance with these requirements. Furthermore, the Standard specifies the information to be displayed on the products covered by this draft Standard and marketed in Mexico and responds to the need for such products to be conducive to energy efficiency and saving.	
Mexico	Lamp	CFLi	Sello FIDE No. 4102	NMX-J-545-ANCE	Performance/ measurement	This endorsement label establishes specifications for self-ballasted compact fluorescent lamps, single, double, triple, quadruple or spiral, with or without reflector, with or without housing, with globe, bullet, pear or other shape, with an integral electronic adapter, with minimum luminous flux of 120 lumens, with minimum average life of 6000 hours, with screw base E-12, E-26, E-27 or Mogul; with nominal voltages at the ballast of 120, 127, 220 or 277 Volts, with power range from 3 Watts and an operating frequency of 60 Hertz.	
Mexico	Lamp	CFLi	Sello FIDE No. 4124	NMX-J-295-ANCE	Performance/ measurement	This endorsement label establishes specifications for outdoor lighting fixtures for compact fluorescent lamps T4 or T5 with electronic or electromagnetic ballast operating voltages of 120, 127, 220 or 277 volts at a frequency of 60 Hertz.	
Mexico	Lamp	CFLi	Sello FIDE No. 4125	NMX-J-295-ANCE	Performance/ measurement	This endorsement label establishes specifications for indoor luminaires, built-in or other, for T4 and T5 compact fluorescent lamps or T5 and T9 circular fluorescent lamps, with electronic or electromagnetic ballast operating voltages of 120, 127, 220 or 277 volts and at frequency of 60 Hertz.	
Mexico	Lamp	CFLi	Sello FIDE No. 4132	NMX-J-295-ANCE	Performance/ measurement	This endorsement label establishes specifications for compact fluorescent lamps without ballast, single tube-shaped, double, triple and long twin tube T4 or T5.	
Mexico	Lamp	CFLi	NOM-17-ENER/SCFI-2012		Performance/ measurement	This standard establishes the minimum energy efficiency levels for self-ballasted compact fluorescent lamps, the user safety requirements for such lamps and the test methods for verifying compliance with these requirements. Furthermore, the Standard specifies the information to be displayed on the products covered by this draft Standard and marketed in Mexico and responds to the need for such products to be conducive to energy efficiency and saving.	
Mexico	Lamp	CFLi	NMX-J-295-ANCE		Performance/ measurement	This endorsement label establishes specifications for indoor luminaires, built-in or other, for T4 and T5 compact fluorescent lamps or T5 and T9 circular fluorescent lamps, with electronic or electromagnetic ballast operating voltages of 120, 127, 220 or 277 volts and at frequency of 60 Hertz.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Mexico	Lamp	CFLi	NMX-J-545-ANCE		Performance/ measurement	This endorsement label establishes specifications for self-ballasted compact fluorescent lamps, single, double, triple, quadruple or spiral, with or without reflector, with or without housing, with globe, bullet, pear or other shape, with an integral electronic adapter, with minimum luminous flux of 120 lumens, with minimum average life of 6000 hours, with screw base E-12, E-26, E-27 or Mogul; with nominal voltages at the ballast of 120, 127, 220 or 277 Volts, with power range from 3 Watts and an operating frequency of 60 Hertz.	
Mexico	Lamp	CFLi	NOM-017-ENER-1997		Performance/ measurement	NOM-017-ENER-1997	Equivalent to IEC60901 contains energy efficiency requirements as well
Mexico	Lamp	CFLi	NOM-017-ENER/SCFI-2008		Performance/ measurement		Local test method and international test method are harmonised
Mexico	Lamp	CFLi	NMX-J-295-ANCE		Performance/ measurement	This endorsement label establishes specifications for indoor luminaires, built-in or other, for T4 and T5 compact fluorescent lamps or T5 and T9 circular fluorescent lamps, with electronic or electromagnetic ballast operating voltages of 120, 127, 220 or 277 volts and at frequency of 60 Hertz.	Local test method and international test method are harmonised
Mexico	Lamp	Fluorescent double cap	Sello FIDE No. 4106	NMX-J-295-ANCE	Performance/ measurement	This endorsement label establishes specifications for self-ballasted circular fluorescent lamps with T5 or T9 bulb, with electronic or electromagnetic adapter, E-26 or E-27 base, and rated supply voltage of 120V and 127V +-10% at an operating frequency of 60 Hertz.	
Mexico	Lamp	Fluorescent double cap	Sello FIDE No. 4108	NMX-J-295-ANCE	Performance/ measurement	This endorsement label establishes specifications for T8 fluorescent lamps, quick start, of power ratings: 15W (457.2mm), 17W (604 mm), 25W (914.4 mm), 25W (1200 mm), 28W (1200 mm), 30W (1200 mm) y 32W (1200 mm), "U" shape of 31W (41.27 mm between electrodes); as well as instant start lamps of 55W (2438.4 mm), 59W (2438.4 mm) and high light output (HO) in 86W (2438.4 mm).	
Mexico	Lamp	Fluorescent double cap	Sello FIDE No. 4110	IES LM-41	Performance/ measurement	This endorsement label establishes specifications for interior fixtures, built-in or overlaid, using linear fluorescent lamps or U-shaped, with T8 or T5 bulbs and their respective ballast, reflector mirror or cabinet using highly reflective paint, with or without diffuser.	
Mexico	Lamp	Fluorescent double cap	Sello FIDE No. 4119	NMX-J-295-ANCE	Performance/ measurement	This endorsement label establishes specifications for T5 linear fluorescent lamps , quick start, operating at the following power ratings: 14W, 21W, 28W, 35W and with high light output or without amalgam in the following power ratings: 24W, 39W, 49W, 54W and 80W.	
Mexico	Lamp	Fluorescent double cap	NMX-J-295-ANCE		Performance/ measurement	This endorsement label establishes specifications for T8 fluorescent lamps, quick start, of power ratings: 15W (457.2mm), 17W (604 mm), 25W (914.4 mm), 25W (1200 mm), 28W (1200 mm), 30W (1200 mm) y 32W (1200 mm), "U" shape of 31W (41.27 mm between electrodes); as well as instant start lamps of 55W (2438.4 mm), 59W (2438.4 mm) and high light output (HO) in 86W (2438.4 mm).	
Mexico	Lamp	Fluorescent double cap	NMX-J-295-ANCE		Performance/ measurement	T8, T5, circular	Local test method and international test method are harmonised
Mexico	Lamp	HID	NOM-028-ENER-2010	NOM-028-ENER-2010	Performance/ measurement	Standard NOM-028-ENER-2010 applies to all lamps for general use in the residential, comercial, services, industrial sectors and public lighting (all high intensity discharge lamps; self-ballasted fluorescent lamps; linear fluorescent lamps; incandescent lamps; incandescent halogen lamps, and mixed light), with exceptions as defined in NOM-028-ENER-2010.	
Mexico	Lamp	HID	Sello FIDE No. 4107	NMX-J-530-ANCE	Performance/ measurement	This endorsement label establishes specifications for high intensity discharge lamps: high pressure sodium vapor lamps and pulse start metal halides, powers from 70W to 600W, with clear finish bulb and E26, E27, E39 and E40 screws.	
Mexico	Lamp	HID	Sello FIDE No. 4112	IES LM-31	Performance/ measurement	This endorsement label establishes specifications for street lighting fixtures for HID lamps (high pressure sodium vapor, pulse start metal halide lamps or induction lamps), with electronic or	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						electromagnetic ballast, with operating voltages of 120, 127, 220, 240, 254, 277, 440 or 480V with ±10% variation operating at a frequency of 60 Hz.	
Mexico	Lamp	HID	Sello FIDE No. 4123	IES LM-46; IES LM-41	Performance/ measurement	This endorsement label establishes specifications for high bay and low bay fixtures for HID lamps (high pressure sodium vapor, pulse start metal halide lamps or induction lamps), linear fluorescent lamps T5, T5HO and T8, with electronic or electromagnetic ballast, with operating voltages of 120, 127, 220, 240, 254, 277, 440 or 480V with ±10% variation operating at a frequency of 60 Hz.	
Mexico	Lamp	HID	Sello FIDE No. 4161	IES LM-31	Performance/ measurement	This endorsement label establishes specifications for outdoors lighting fixtures for HID lamps (high pressure sodium vapor, pulse start metal halide lamps or induction lamps), with electronic or electromagnetic ballast, with operating voltages of 120, 127, 220, 240, 254, 277, 440 or 480V with ±10% variation operating at a frequency of 60 Hz.	
Mexico	Lamp	HID	IES LM-46; IES LM-41		Performance/ measurement	This endorsement label establishes specifications for high bay and low bay fixtures for HID lamps (high pressure sodium vapor, pulse start metal halide lamps or induction lamps), linear fluorescent lamps T5, T5HO and T8, with electronic or electromagnetic ballast, with operating voltages of 120, 127, 220, 240, 254, 277, 440 or 480V with ±10% variation operating at a frequency of 60 Hz.	
Mexico	Lamp	HID	IES LM-31		Performance/ measurement	This endorsement label establishes specifications for outdoors lighting fixtures for HID lamps (high pressure sodium vapor, pulse start metal halide lamps or induction lamps), with electronic or electromagnetic ballast, with operating voltages of 120, 127, 220, 240, 254, 277, 440 or 480V with ±10% variation operating at a frequency of 60 Hz.	
Mexico	Lamp	HID	IES LM-31		Performance/ measurement	This endorsement label establishes specifications for street lighting fixtures for HID lamps (high pressure sodium vapor, pulse start metal halide lamps or induction lamps), with electronic or electromagnetic ballast, with operating voltages of 120, 127, 220, 240, 254, 277, 440 or 480V with ±10% variation operating at a frequency of 60 Hz.	
Mexico	Lamp	HID	NMX-J-530-ANCE		Performance/ measurement	This endorsement label establishes specifications for high intensity discharge lamps: high pressure sodium vapor lamps and pulse start metal halides, powers from 70W to 600W, with clear finish bulb and E26, E27, E39 and E40 screws.	
Mexico	Lamp	HID	NOM-028-ENER-2010		Performance/ measurement	Standard NOM-028-ENER-2010 applies to all lamps for general use in the	Local test method and international test method are harmonised
Mexico	Lamp	HID	NMX-J-530-ANCE		Performance/ measurement	HID lamps: high pressure sodium vapor lamps and pulse start metal halides, powers from 70W to 600W, with clear finish bulb and E26, E27, E39 and E40 screws.	Local test method and international test method are harmonised
Mexico	Lamp	HID	NOM-028-ENER-2010		Performance/ measurement	Standard NOM-028-ENER-2010 applies to all lamps for general use in the	Local test method and international test method are harmonised
Mexico	Lamp	Incandescent / halogen	NOM-028-ENER-2010	NOM-028-ENER-2010	Performance/ measurement	Standard NOM-028-ENER-2010 applies to all lamps for general use in the residential, comercial, services, industrial sectors and public lighting (all high intensity discharge lamps; self-ballasted fluorescent lamps; linear fluorescent lamps; incandescent lamps; incandescent halogen lamps, and mixed light), with exceptions as defined in NOM-028-ENER-2010.	
Mexico	Lamp	Incandescent / halogen	NOM-028-ENER-2010		Performance/ measurement	Standard NOM-028-ENER-2010 applies to all lamps for general use in the residential, comercial, services, industrial sectors and public lighting (all high intensity discharge lamps; self-ballasted fluorescent lamps; linear fluorescent lamps; incandescent lamps; incandescent halogen lamps, and mixed light), with exceptions as defined in NOM-028-ENER-2010.	
Mexico	Lamp	LED	IES LM-79		Performance/ measurement	This endorsement label establishes specifications for interior fixtures and lamps with integrated LEDs, with control device, with nominal operating voltage of 120, 127, 220, 240, 254 or 277 volts, or multi-voltage with a ±10% variation, at a frequency of 60 Hertz.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Mexico	Lamp	LED	NOM-30-ENER-12		Performance/ measurement	Integrated LED lamps	
Mexico	Lamp	LED	NMX-J-198-ANCE		Performance/ measurement	This endorsement label establishes specifications for outdoor LED reflectors with a nominal operating voltage of 120, 127, 220, 240, 254, 277 or 440 volts at a frequency of 60 Hertz.	
Mexico	Lamp	LED	IES LM-79		Performance/ measurement	This endorsement label establishes specifications for LED fixtures for street lighting used in principal roads, highways, primary or secondary streets and pedestrian zones. With LED integrated modules or LED adapted to street lighting fixtures. The LED supply source may have a nominal operating voltage of 120, 127, 220, 240, 254, 277 or 440 volts at a frequency of 60 Hertz.	
Mexico	Lamp	LED	Sello FIDE No. 4139	IES LM-79	Performance/ measurement	This endorsement label establishes specifications for LED fixtures for street lighting used in principal roads, highways, primary or secondary streets and pedestrian zones. With LED integrated modules or LED adapted to street lighting fixtures. The LED supply source may have a nominal operating voltage of 120, 127, 220, 240, 254, 277 or 440 volts at a frequency of 60 Hertz.	
Mexico	Lamp	LED	Sello FIDE No. 4139	NMX-J-198-ANCE	Performance/ measurement	This endorsement label establishes specifications for outdoor LED reflectors with a nominal operating voltage of 120, 127, 220, 240, 254, 277 or 440 volts at a frequency of 60 Hertz.	
Mexico	Lamp	LED	NOM-30-ENER-2012	NOM-30-ENER-12	Performance/ measurement	Integrated LED lamps	
Mexico	Lamp	LED	Sello FIDE No. 4171	IES LM-79	Performance/ measurement	This endorsement label establishes specifications for interior fixtures and lamps with integrated LEDs, with control device, with nominal operating voltage of 120, 127, 220, 240, 254 or 277 volts, or multi-voltage with a ±10% variation, at a frequency of 60 Hertz.	
Mexico	Luminaire	Road	NOM-31-ENER-2012		Performance/ measurement	Street lighting - LED luminaires	
Mexico	Luminaire	Road	NOM-31-ENER-2012	NOM-31-ENER-2012	Performance/ measurement	Street lighting - LED luminaires	
Mexico	Luminaire		IES LM-41		Performance/ measurement	This endorsement label establishes specifications for interior fixtures, built-in or overlaid, using linear fluorescent lamps or U-shaped, with T8 or T5 bulbs and their respective ballast, reflector mirror or cabinet using highly reflective paint, with or without diffuser.	
Mexico	System		NOM-007-ENER-2004	NOM-007-ENER-2004	??	Standard NOM-007-ENER-2004 applies to indoor and outdoor lighting systems for new non-residential buildings with a total load for lighting of >= 3 kW, as well as to extensions and modifications of indoor and outdoor lighting systems of existing buildings with a load for lighting of >= 3 kW, in particular: Offices, Schools and other educational centers, Commercial establishments, Hotels, Restaurants, Shops, Recreation and Culture, Service workshops, Passenger terminals.	
Mexico	System		NOM-013-ENER-2004	NOM-013-ENER-2004	??	Standard NOM-013-ENER-2004 applies to new lighting systems for: Roadways, Open and closed public car parks, Open air public areas. Exceptions are defined in NOM-013-ENER-2004 and include, among others, security sensitive areas	
Mexico	System		NOM-028-ENER-2010	NOM-028-ENER-2010	??	Standard NOM-028-ENER-2010 applies to all lamps for general use in the residential, comercial, services, industrial sectors and public lighting (all high intensity discharge lamps; self-ballasted fluorescent lamps; linear fluorescent lamps; incandescent lamps; incandescent halogen lamps, and mixed light), with exceptions as defined in NOM-028-ENER-2010.	
Mexico	System		Sello FIDE No. 4172	IES LM-31	??	This endorsement label establishes specifications for fixtures with induction lamps, integrated with an electronic controller with rated voltage of 120, 127, 220, 240, 254, 277, 440 o 480 Volts with +-10% variation, operated at 60Hz, and induction lamp rated powers of 40 - 400W.	
Mexico	System		NOM-007-ENER-2004		??	Standard NOM-007-ENER-2004 applies to indoor and outdoor lighting systems for new non-residential buildings with a total load for lighting of >= 3 kW, as well as to extensions and modifications of indoor and outdoor lighting systems of existing buildings with a load for	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						lighting of >= 3 kW, in particular: Offices, Schools and other educational centers, Commercial establishments, Hotels, Restaurants, Shops, Recreation and Culture, Service workshops, Passenger terminals.	
Mexico	System		NOM-028-ENER-2010		??	Standard NOM-028-ENER-2010 applies to all lamps for general use in the residential, comercial, services, industrial sectors and public lighting (all high intensity discharge lamps; self-ballasted fluorescent lamps; linear fluorescent lamps; incandescent lamps; incandescent halogen lamps, and mixed light), with exceptions as defined in NOM-028-ENER-2010.	
Mexico	System		IES LM-31		Performance/ measurement	This endorsement label establishes specifications for fixtures with induction lamps, integrated with an electronic controller with rated voltage of 120, 127, 220, 240, 254, 277, 440 o 480 Volts with +-10% variation, operated at 60Hz, and induction lamp rated powers of 40 - 400W.	
Mexico	System		NOM-013-ENER-2004		Performance/ measurement	Standard NOM-013-ENER-2004 applies to new lighting systems for: Roadways, Open and closed public car parks, Open air public areas. Exceptions are defined in NOM-013-ENER-2004 and include, among others, security sensitive areas	
New Zealand	Ballast	Fluorescent	AS/NZS 4783.2:2002 Performance of electrical lighting equipment - Ballasts for fluorescent lamps - Energy labelling and minimum energy performance standard requirements	AS/NZS 4783.1:2001		The ballasts covered by this Standard are the ferromagnetic or electronic type, that are used with fluorescent lamps with a rated lamp power from 10 W to 70 W, for use on 50 Hz supplies of 230/240/250 V or a range which includes one or more of these voltages. This Standard covers ballasts that are supplied as separate components or as part of a luminaire. This Standard does not cover the following ballast-lamp combinations: (a) Primarily for use on d.c. supply or batteries. (b) Primarily for the production of light outside the visible spectrum, ie. 400 nm to 800 nm. (c) For exit signs within the scope of AS/NZS 2293. (d) Hazardous area lighting equipment, within the scope of AS/NZS 2380, AS/NZS 60079 and AS/NZS 61241 Series of Standards.	
New Zealand	Ballast	Fluorescent	AS/NZS 4783.2:2002 Performance of electrical lighting equipment - Ballasts for fluorescent lamps - Energy labelling and minimum energy performance standard requirements	AS/NZS 4783.1:2001		MEPS DOES apply to the following types of ballasts: • ferromagnetic and electronic ballasts used with linear fluorescent lamps from 15W to 70W; • rated for 50 Hz and 230/240/250V supply (or a range that includes these); • ballasts supplied as separate components or as part of a luminaire. MEPS DOES NOT apply to the following types of ballasts: • primarily for use on DC supplies or batteries; • primarily for the production of light (radiation) outside the visible spectrum; • to exit signs within the scope of AS/NZS 2293; • to hazardous area lighting equipment within the scope of AS/NZS 2380, AS/NZS 60079 and AS/NZS 61241.	
New Zealand	Lamp	CFLi	AS/NZS 4847.2:2010 Self ballasted lamps for general lighting services - Minimum Energy Performance Standards (MEPS) requirements	AS/NZS 4847.1 Self-ballasted lamps for general lighting services – Test methods – Energy performance	Performance/ measurement	CFLs with integrated ballasts in homes and businesses	
New Zealand	Lamp	CFLi	ENERGY STAR® Compact Fluorescent	AS/NZS 4847.1:2010	Performance/ measurement	Self-ballasted compact fluorescent lamps (CFLs) and other gas-discharge lamps with integrated means for controlling, starting and stable operation that are intended for domestic and similar	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			Lamps (CFLs) specification			general lighting purposes; applies to self-ballasted lamps of all voltages and wattages irrespective of the type of lamp cap.	
New Zealand	System		AS/NZS 4782.2:2004 Double-capped fluorescent lamps - Performance specifications - Minimum Energy Performance Standard (MEPS) (10-2004); NZHB4782.2	AS/NZS 4782.1:2004	Performance/ measurement	This Standard specifies Minimum Energy Performance standard (MEPS) requirements for double-capped (FD and FDH) tubular fluorescent lamps with a nominal length of 550 mm to 1500 mm and having nominal lamp wattage of 16 watts or more, that are within the scope of AS/NZS 4782.1. This Standard covers lamps for general illumination purposes, for use in luminaires and with lamp ballasts connected to a 230 V 50 Hz single phase or similar mains supply. Lamps that are intended for use only with high frequency (electronic) ballasts are also covered.	
Nigeria	Lamp	LED	unknown		Performance/ measurement	LED and solid state lighting. As part of the UNDP/GEP funded project, MEPS will be implemented for lighting.	
Nigeria	Lamp	LED	unknown		Performance/ measurement	LED and solid state lighting. As part of the UNDP/GEP funded project, MEPS will be implemented for lighting.	
Pakistan	Ballast	Fluorescent	MEPS and Labelling for ballast	PS 429-2-1997		The standard shall apply to magnetic ballast commonly used in domestic sector of Pakistan, with input power between 20 and 40 watts	
Pakistan	Ballast	Fluorescent	MEPS and Labelling for ballast	PS 429-2-1997		The standard shall apply to magnetic ballast commonly used in domestic sector of Pakistan, with input power between 20 and 40 watts	
Pakistan	Ballast	Fluorescent	PS 429-2-1997			The standard shall apply to magnetic ballast commonly used in domestic sector of Pakistan, with input power between 20 and 40 watts	
Pakistan	Ballast	Fluorescent	IEC 60929			AC Supplied Electronic Ballasts for Tubular fluorescent lamps Performance Requirements	
Pakistan	Ballast	Fluorescent	IEC 61347-2-8			Lamp Control Gear-Part 2-3 : Particular requirements for A.C Supplied Electronic Ballasts for Fluorescent lamp	
Pakistan	Lamp	CFLi	PS- IEC : 60968		Safety	Self-Ballasted Lamps for General Lighting Services – Safety Requirements	
Pakistan	Lamp	CFLi	PS- IEC: 60969		Performance/ measurement	Self-Ballasted Lamps for General Lighting Services – Performance Requirements	
Pakistan	Lamp	CFLi	MEPS and labelling for CFL	PS-IEC 60969 Self ballasted lamps for general lighting services - Performance Requirements	Performance/ measurement	The standard shall apply to all common sizes and types (u-shaped & spiral) of CFL used in domestic and commercial sectors in Pakistan with ranges between 5-25 watts and up to 60 watts	
Pakistan	Lamp	CFLi	MEPS and labelling for CFL	PS-IEC 60969 Self ballasted lamps for general lighting services - Performance Requirements	Performance/ measurement	The standard shall apply to all common sizes and types (u-shaped & spiral) of CFL used in domestic and commercial sectors in Pakistan with ranges between 5-25 watts and up to 60 watts	
Pakistan	Lamp	Fluorescent double cap	IEC 60081		Performance/ measurement	Double Capped Fluorescent Lamps-Performance Specifications	
Pakistan	Lamp	Fluorescent double cap	IEC 60921		Performance/ measurement	Ballasts for Fluorescent lamps-Performance Requirements	
Pakistan	Lamp	Fluorescent single cap	IEC 60901		Performance/ measurement	Single Capped Fluorescent Lamps-Performance Specifications	
Peru	Ballast	Fluorescent	http://www.mem.gob.pe/publicacion.php?idSector=12&idPublicacion=352	http://www.indecopi.gob.pe/0/modulos/TIE/TIE_DetallarProducto.aspx?PRO=1677			

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Peru	Ballast	Fluorescent	GUÍA DE LA ETIQUETA DE EFICIENCIA ENERGÉTICA	NTP 370.102:2008 Dispositivos de control de lámpara. Balastos para lámparas fluorescentes – Sistema de Codificación Energética			
Peru	Ballast	HID	http://www.indecopi.gob.pe/0/modulos/TIE/TIE_DetallarProducto.aspx?PRO=6422	NTP 370.103:2010 EFICIENCIA ENERGÉTICA. Pérdidas máximas en balastos, para lámparas de vapor de sodio de alta presión		High Pressure Sodium Ballast	
Peru	Lamp	CFLi	Efficient Lighting Initiative (ELI)	ELI Voluntary Technical Specification for CFLs Second Edition (2011)	Performance/ measurement		
Peru	Lamp	CFLi	GUÍA DE ESTÁNDARES MÍNIMOS DE EFICIENCIA ENERGÉTICA	NTP 370.100:2008 USO RACIONAL DE ENERGIA. Lámparas fluorescentes compactas (LFCs). Definiciones, requisitos y rotulados. 2a. ed.	Performance/ measurement		
Peru	Lamp	CFLi	GUÍA DE LA ETIQUETA DE EFICIENCIA ENERGÉTICA	NTP 370.101-2:2008 Etiquetado de eficiencia energética para lámparas fluorescentes compactas, circulares, lineales y similares de uso doméstico.	Performance/ measurement		
Peru	Lamp	Incandescent / halogen	GUÍA DE LA ETIQUETA DE EFICIENCIA ENERGÉTICA	NTP 370.101-1 2008: Etiquetado de Eficiencia Energética para Lámparas Incandescentes y similares de uso doméstico.	Performance/ measurement	Household incandescent and similar lamps	
Philippines	Ballast	Fluorescent	PNS 2050-4: 2007 - Lamps and related equipment Energy labelling requirements, Part 4: Ballast	PNS IEC 60929:2006; PNS IEC 61347-1:2002; PNS IEC 61347-2-3:2002, Amd. 01:2006		The standard covers AC supplied electronic ballast for tubular fluorescent lamps specifically with ratings from 10 watts to 40 watts for T12, T10, T9, T8 and T5 halophosphate and triphosphate fluorescent lamps with G13 and G5 caps. Ballast for modular CFLs are excluded.	
Philippines	Ballast	Fluorescent	PNS 2050-4: 2007 - Lamps and related equipment Energy labelling requirements, Part 4: Ballast (Magnetic)	PNS IEC 60921:2006; PNS IEC 61347-2-8:2002; PNS IEC 61347-1:2002		Magnetic ballasts The program covers ballast for tubular fluorescent lamps specifically with ratings from 18 watts to 40 watts for T12, T10, T9 and T8 halophosphate fluorescent lamps with G13 cap, 50/60 Hz. Ballast for modular CFLs are excluded.	
Philippines	Ballast	Fluorescent	PNS IEC 60929:2006; PNS IEC 61347-1:2002; PNS IEC 61347-2-3:2002, Amd.			The standard covers AC supplied electronic ballast for tubular fluorescent lamps specifically with ratings from 10 watts to 40 watts for T12, T10, T9, T8 and T5 halophosphate and triphosphate fluorescent lamps with G13 and G5 caps. Ballast for modular CFLs are excluded.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			01:2006				
Philippines	Ballast	Fluorescent	PNS 12-1: 1996			Ballast for Tubular Fluorescent Lamps: General & Safety Requirements	IEC 60920
Philippines	Ballast	Fluorescent	PNS 135-1: 1997			AC Supplied Electronic Ballast for Tubular Fluorescent Lamps – General & Safety Requirements	IEC 60928
Philippines	Ballast	Fluorescent	PNS IEC 60929:2006			AC-supplied electronic ballasts for tubular fluorescent lamps – Performance requirements	IEC published 2003
Philippines	Ballast	Fluorescent	PNS IEC 60921:2006			Ballast for tubular fluorescent lamps – Performance requirements (Electromagnetic)	IEC published 2004
Philippines	Ballast	Fluorescent	PNS IEC 60921:2006			Ballast for tubular fluorescent lamps - Performance requirements	Reference Test Standard: IEC 60921
Philippines	Ballast	Fluorescent	PNS 2050-4: 2007			Lamps and related equipment- Energy labelling requirements- Part 4: Ballast	Reference Test Standard: IEC 60921 (Electromagnetic Ballast)
Philippines	Ballast	Fluorescent	PNS IEC 60929:2006			AC supplied electronic ballast for tubular fluorescent lamps - Performance requirements	Reference Test Standard: IEC 60929
Philippines	Ballast	Fluorescent	PNS 2050-4: 2007			Lamps and related equipment- Energy labelling requirements- Part 4: Ballast	Reference Test Standard: IEC 60929 (Electronic Ballast)
Philippines	Ballast	Fluorescent	PNS IEC 61347-1:2002, Amd. 01:2006			Lamp Control Gear - Part 1: General and Safety requirements	Reference Test Standard: IEC 61347-1:2002
Philippines	Ballast	Fluorescent	PNS IEC 61347-2-3:2002, Amd. 01:2006			A.C. Supplied Electronic ballasts for Fluorescent lamps - Part 2: Particular requirements for AC supplied electronic ballast for fluorescent lamps	Reference Test Standard: IEC 61347-2-3
Philippines	Ballast	Fluorescent	PNS IEC 61347-2-8:2002			Lamp Control Gear-Part 2: Particular requirements for ballast for tubular fluorescent lamps	Reference Test Standard: IEC 61347-2-8
Philippines	Ballast	LED	PNS IEC 61347-2-13:2006			Lamp Control Gear – Part 2-13 - particular requirement for DC and AC supplied electronic control gear for LED modules	IEC 61347-2-13:2006 reviewed and adopted as PNS
Philippines	Lamp	CFLi	PNS IEC 969:2006		Performance/ measurement	Self Ballasted Lamps for General Lighting Service - Performance Requirements	
Philippines	Lamp	CFLi	PNS 2050-2: 2006 - Lamps and related equipment - Energy Efficiency and Labelling requirements - Part 2: Self ballasted lamps for general lighting services	PNS IEC 969:2006; PNS IEC 968:2006	Performance/ measurement	The program covers 2 watts to 60 watts operating up to 250volts AC, 50/60 hertz with Edison screw base E14 and E27. LED and par lamps are excluded.	
Philippines	Lamp	CFLi	PNS IEC 969:2006 - Self Ballasted Lamps for General Lighting Service - Performance Requirements	PNS IEC 969:2006; PNS IEC 968:2006	Performance/ measurement		
Philippines	Lamp	CFLi	PNS IEC 969:2006; PNS IEC 968:2006		Performance/ measurement	The program covers 2 watts to 60 watts operating up to 250volts AC, 50/60 hertz with Edison screw base E14 and E27. LED and par lamps are excluded.	
Philippines	Lamp	CFLi	PNS 603-2:1993		Performance/ measurement	Compact fluorescent lamps	Based on IEC60969

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Philippines	Lamp	CFLi	PNS IEC 968:2006		Safety	Self ballasted lamps for general lighting services - Safety requirements	Reference Test Standard: IEC 968
Philippines	Lamp	CFLi	PNS 2050-2: 2007		Performance/ measurement	Lamps and related equipment- Energy labelling requirements- Part 2: Self-ballasted lamps for general lighting services	Reference Test Standard: IEC 969
Philippines	Lamp	CFLi	PNS IEC 969:2006		Performance/ measurement	Self Ballasted Lamps for General Lighting Service - Performance Requirements	Reference Test Standard: IEC 969
Philippines	Lamp	CFLi	Efficient Lighting Initiative (ELI) Program	PNS IEC 969:2006; PNS IEC 968:2006	Performance/ measurement		
Philippines	Lamp	Fluorescent double cap	PNS 02:1994		Performance/ measurement	Tubular fluorescent lamps for general lighting services	Equivalent to IEC60081
Philippines	Lamp	Fluorescent double cap	PNS 2050-1-1: 2007		Performance/ measurement	Lamps and related equipment- Energy labelling requirements- Part 1-1: Double-capped fluorescent lamps	Reference Test Standard: IEC 60081
Philippines	Lamp	Fluorescent double cap	PNS IEC 60081:2006, Amd. 03:2006		Performance/ measurement	Double capped fluorescent lamps - Performance specifications	Reference Test Standard: IEC 60081
Philippines	Lamp	Fluorescent double cap	PNS IEC 60081:2006, Amd. 03:2006		Performance/ measurement	Double capped fluorescent lamps - Performance specifications	Reference Test Standard: IEC 60081
Philippines	Lamp	Fluorescent single cap	PNS IEC 901: 2001		Performance/ measurement	Single-capped fluorescent lamps - Performance requirement	
Philippines	Lamp	Fluorescent single cap	PNS IEC 60901:2001 Amd. 01, 02, &03:2006		Performance/ measurement	Single capped fluorescent lamps - Performance specifications	Reference Test Standard: IEC 60901
Philippines	Lamp	Fluorescent single cap	PNS 2050-1-2: 2007		Performance/ measurement	Lamps and related equipment- Energy labelling requirements- Part 1-2: Single-capped fluorescent lamps	Reference Test Standard: IEC 901
Philippines	Lamp	HID	PNS 2050-3:2007 - Lamps and related equipment-Energy labelling requirements-Part 3: High intensity discharge (HID) lamps	PNS IEC 60662:2006	Performance/ measurement		
Philippines	Lamp	HID	PNS IEC 60662:2006		Performance/ measurement		
Philippines	Lamp	HID	PNS 2050-3:2007 - Lamps and related equipment-Energy labelling requirements-Part 3: High intensity discharge (HID) lamps	PNS IEC 60662:2006	Performance/ measurement		
Philippines	Lamp	HID	PNS IEC 60662:2006		Performance/ measurement		
Philippines	Lamp	Incandescent / halogen	PNS 2050-6:2010		Performance/ measurement	Lamps and related equipment –energy performance requirements – Part 6: Incandescent lamps for domestic and similar general lighting purposes	
Philippines	Lamp	Incandescent / halogen	PNS 38-2:1995		Performance/ measurement	Tungsten filament lamps for domestic and similar general lighting purposes - Performance requirement	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Philippines	Lamp	LED	PNS IEC 62031		Safety	LED Modules for General Lighting. Safety Specifications (2011)	IEC 62031 reviewed and adopted as PNS
Philippines	Lamp	LED	CDPNS 2094		??	LED Lighting chains	
Philippines	Lamp cap/holder/ etc	All	PNS IEC 60838-2-2:2006		Lamp cap/holder/etc	Miscellaneous lamp holder. Particular requirement - connectors for LED modules	IEC 60838-2-2:2006 reviewed and adopted as PNS
Philippines	System		PNS 2050-1-1:2007 - Lamps and related equipment-Energy efficiency and labelling requirements-Part 1-1: Double-capped fluorescent lamps	PNS IEC 60081:2006	Performance/ measurement	Double-capped fluorescent lamps This standard covers Linear fluorescent lamps for general lighting service T12, T8 and T5 halophosphate and triphosphate fluorescent lamps with G13 and G5 caps with power input 10 watts to 65 watts at 220 to 230 volts AC, 50/60 hertz.	
Philippines	System		PNS 2050-1-1:2007 - Lamps and related equipment-Energy efficiency and labelling requirements-Part 1-1: Double-capped fluorescent lamps	PNS IEC 60081:2006	Performance/ measurement	Double-capped fluorescent lamps This standard covers Linear fluorescent lamps for general lighting service T12, T8 and T5 halophosphate and triphosphate fluorescent lamps with G13 and G5 caps with power input 10 watts to 65 watts at 220 to 230 volts AC, 50/60 hertz.	
Philippines	System		PNS 2050-1-2:2006 - Lamps and related equipment-Energy labelling requirements-Part 1-2: Single-capped fluorescent lamps	PNS IEC 60901:2001 Amd. 01, 02, & 03:2006	Performance/ measurement	Single-capped fluorescent lamps. This standard covers Circular fluorescent lamps for general lighting service.	
Philippines	System		PNS 2050-1-2:2006 - Lamps and related equipment-Energy labelling requirements-Part 1-2: Single-capped fluorescent lamps	PNS IEC 60901:2001 Amd. 01, 02, & 03:2006	Performance/ measurement	Single-capped fluorescent lamps This standard covers Circular fluorescent lamps for general lighting service.	
Philippines	System		PNS IEC 60081:2006		Performance/ measurement	Double-capped fluorescent lamps This standard covers Linear fluorescent lamps for general lighting service T12, T8 and T5 halophosphate and triphosphate fluorescent lamps with G13 and G5 caps with power input 10 watts to 65 watts at 220 to 230 volts AC, 50/60 hertz.	
Philippines	System		PNS IEC 60901:2001 Amd. 01, 02, & 03:2006		Performance/ measurement	Single-capped fluorescent lamps This standard covers Circular fluorescent lamps for general lighting service.	
Poland	Lamp	CFLi	ELI Voluntary Technical	IEC 60969	Performance/ measurement	This specification applies exclusively to self-ballasted compact fluorescent lamps (CFLs)—with or without a cover, and without any reflector element. These lamps have an integrated means	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			Specification for Self-Ballasted Compact Fluorescent Lamps (CFLs)			for controlling starting and stable operation and are intended for general lighting purposes. They have screw or bayonet caps, a rated power up to 60W and a rated voltage of 100V to 250V.	
Russia	Lamp	HID	Federal Law No. 261-FZ		Performance/ measurement	Low-pressure lamps	
Russia	Lamp	Incandescent / halogen	Federal Law No. 261-FZ		Performance/ measurement	Incandescent lamps under 100 watts	
Russia	Lamp	Incandescent / halogen	Federal Law No. 261-FZ		Performance/ measurement	The government has ruled to introduce a ban on the distribution, sale, and general use of inefficient lighting, such as 100-watt or higher incandescent lamps, starting on 1 January 2011, particularly in the budgetary and government sector. This ban will be followed by the prohibition of sale and distribution of 75-watt lights from 1 January 2013, and completely prohibiting the sales and distribution of all incandescent lighting (25-watts or higher) starting on 1 January 2014.	
Singapore	Ballast	Fluorescent	SS 490: Part 2.8: 2001			Ballast for Tubular Fluorescent Lamps: General and Safety Requirements	IEC 60920
Singapore	Ballast	Fluorescent	SS 491: 2001				IEC 60921
Singapore	Ballast	Fluorescent	SS 490: Part 2.3: 2002			AC Supplied Electronic Ballast for Tubular Fluorescent Lamps – General and Safety Requirements	IEC 60928
Singapore	Ballast	Fluorescent	SS 380: Part 2: 1996				IEC 60929
Singapore	Lamp	CFLi	Environmental Protection and Management (Energy Conservation) Regulations		Performance/ measurement		
Singapore	Lamp	Incandescent / halogen	Environmental Protection and Management (Energy Conservation) Regulations		Performance/ measurement		
Singapore	Lamp	Incandescent / halogen	Environmental Protection and Management (Energy Conservation) Regulations		Performance/ measurement		
South Africa	Ballast	Fluorescent					
South Africa	Ballast	Fluorescent					
South Africa	System		VC 9091		Performance/ measurement	Single-capped tubular fluorescent lamps and other discharge lamps with integrated means for controlling starting and stable operation (self-ballasted lamps), intended for general lighting purposes that have a rated wattage up to 60 W, a rated voltage of 100 to 250 V a.c. and 2G7, 2GX7, GR8, 2G10, G10q, GX10q, GY10g, 2G11, G23, GX23, G24, GX24 and GX32 Edison screw or bayonet lamps.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Sri Lanka	Ballast	Fluorescent	SLS 1150: 2011			Ballasts for Tubular Fluorescent Lamps	
Sri Lanka	Ballast	Fluorescent	SLS 1200:2012			Energy Efficiency Rating for Fluorescent Lamp Ballasts	
Sri Lanka	Lamp	CFLi	SLS 1231:2002		Performance/ measurement	Specification for Self ballasted lamps for General Lighting Services (Integral type compact fluorescent lamps)	
Sri Lanka	Lamp	CFLi	SLS1225:2002		Performance/ measurement	Energy efficiency rating for Self ballasted lamps (Integral type compact fluorescent lamps)	
Sri Lanka	Lamp	Fluorescent double cap	*No number given at time of writing*		Performance/ measurement	Energy Efficiency Rating for Double capped Tubular Fluorescent Lamps	
Sri Lanka	Lamp	Fluorescent double cap	SLS 566:1996		Performance/ measurement	Tubular Fluorescent Lamps	
Sri Lanka	Lamp	LED	IEC62560		Safety	Self Ballasted LED Lamps for General Lighting greater than 50 V – Safety Requirements	
Switzerland	Ballast	Fluorescent	EC 245/2009			This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Switzerland	Ballast	HID	EC 245/2009			This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Switzerland	Lamp	CFLi	98/11/EC		Performance/ measurement	The Commission Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps shall apply to household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Switzerland	Lamp	CFLi	COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria	EN 50285	Performance/ measurement	The product group 'light sources' shall comprise all light sources of a luminous flux = 60 and = 12 000 lumens for general lighting applications with direct or indirect connection to the public electricity supply equipped with a lamp cap listed in EN 60061 and made in order to produce a visible radiation. The following types of light sources are not included in the product group:	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			for the award of the EU Ecolabel for light sources			directional lamps, high-intensity discharge lamps, coloured lamps, projector lamps, photographic lighting, solarium tubes, battery driven systems and other light sources that are not intended for general lighting applications. The following types of light sources are not included in the product group if they are not supplied directly from the mains: integral compact fluorescent lamps, filament lamps, LED lamps.	
Switzerland	Lamp	CFLi	EC 244/2009		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Switzerland	Lamp	HID	EC 245/2009		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Switzerland	Lamp	HID	EC 244/2009		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Switzerland	Lamp	Incandescent / halogen	98/11/EC		Performance/ measurement	The Commission Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps shall apply to household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Switzerland	Lamp	Incandescent / halogen	COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources	EN 50285	Performance/ measurement	The product group 'light sources' shall comprise all light sources of a luminous flux = 60 and = 12 000 lumens for general lighting applications with direct or indirect connection to the public electricity supply equipped with a lamp cap listed in EN 60061 and made in order to produce a visible radiation. The following types of light sources are not included in the product group: directional lamps, high-intensity discharge lamps, coloured lamps, projector lamps, photographic lighting, solarium tubes, battery driven systems and other light sources that are not intended for general lighting applications. The following types of light sources are not included in the product group if they are not supplied directly from the mains: integral compact fluorescent lamps, filament lamps, LED lamps.	
Switzerland	Lamp	Incandescent / halogen	EC 244/2009		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Switzerland	Lamp	LED	98/11/EC		Performance/ measurement	The Commission Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps shall apply to household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Switzerland	Lamp	LED	COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources	EN 50285	Performance/ measurement	The product group 'light sources' shall comprise all light sources of a luminous flux = 60 and = 12 000 lumens for general lighting applications with direct or indirect connection to the public electricity supply equipped with a lamp cap listed in EN 60061 and made in order to produce a visible radiation. The following types of light sources are not included in the product group: directional lamps, high-intensity discharge lamps, coloured lamps, projector lamps, photographic lighting, solarium tubes, battery driven systems and other light sources that are not intended for general lighting applications. The following types of light sources are not	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						included in the product group if they are not supplied directly from the mains: integral compact fluorescent lamps, filament lamps, LED lamps.	
Switzerland	Lamp	LED	EC 244/2009		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Switzerland	System		98/11/EC		Performance/ measurement	The Commission Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps shall apply to household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Switzerland	System		COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources	EN 50285	Performance/ measurement	The product group 'light sources' shall comprise all light sources of a luminous flux = 60 and = 12 000 lumens for general lighting applications with direct or indirect connection to the public electricity supply equipped with a lamp cap listed in EN 60061 and made in order to produce a visible radiation. The following types of light sources are not included in the product group: directional lamps, high-intensity discharge lamps, coloured lamps, projector lamps, photographic lighting, solarium tubes, battery driven systems and other light sources that are not intended for general lighting applications. The following types of light sources are not included in the product group if they are not supplied directly from the mains: integral compact fluorescent lamps, filament lamps, LED lamps.	
Switzerland	System		EC 245/2009		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Thailand	Ballast	Fluorescent	Green Label Scheme - TGL-23-R1-03	TIS 1506-2542; TIS 1449; TIS 623; CIE No. 25		Electronic ballasts for fluorescent lamps	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			Electronic Ballasts				
Thailand	Ballast	Fluorescent	The Energy Efficiency Label No.5	TIS 1506-2541 (1998); TIS 885-2551 (2008)		Low loss magnetic ballast, 6 watt loss, for 18W T8 and 36W T8 lamps and the electronic ballast for 14W T5 and 28W T5 lamps.	
Thailand	Ballast	Fluorescent	The Energy Efficiency Label No.5	TIS 23-2521		Magnetic ballasts for fluorescent lamps	
Thailand	Ballast	Fluorescent	TIS 1506-2541 (1998); TIS 885-2551 (2008)			Low loss magnetic ballast, 6 watt loss, for 18W T8 and 36W T8 lamps and the electronic ballast for 14W T5 and 28W T5 lamps.	
Thailand	Ballast	Fluorescent	TIS 1506-2542; TIS 1449; TIS 623; CIE No. 25			Electronic ballasts for fluorescent lamps	
Thailand	Ballast	Fluorescent	TIS 23-2521			Magnetic ballasts for fluorescent lamps	
Thailand	Ballast	Fluorescent				Electronic Ballasts for Fluorescent Lamps - Thailand - Minimum Energy Performance Standard	
Thailand	Ballast	Fluorescent				Energy Efficient Ballast Program - Magnetic Ballasts for Fluorescent Lamps	
Thailand	Ballast	Fluorescent				Magnetic Ballasts for Fluorescent Lamps - Thailand - Minimum Energy Performance Standard	
Thailand	Ballast	Fluorescent				Green Label Scheme – Electronic Ballasts for Fluorescent Lamps	
Thailand	Ballast	Fluorescent				Energy Efficient Ballast Program -Electronic Ballasts	
Thailand	Ballast	Fluorescent	TIS 885-2532			AC Supplied Electronic Ballast for Tubular Fluorescent Lamps – Safety Requirements	IEC 60928
Thailand	Ballast	Fluorescent	TIS 885-2551 (2008)			AC Supplied Electronic Ballasts for Tubular Fluorescent Lamps: Safety Requirements	Reference standard: IEC 60081
Thailand	Ballast	Fluorescent	TIS 23-2521			Ballast for fluorescent lamps – Magnetic	Reference standard: IEC 60921
Thailand	Ballast	Fluorescent	TIS 1506-2541			A.C. supplied electronic ballasts for tubular fluorescent lamps – Performance requirements. (For verification of efficacy, the Thai system uses the nominal ballast watt loss and the rated lamp power to determine an allowable system Lumens per watt)	Reference standard: IEC 60969
Thailand	EMC		TIS 1995-2551 (2008)		Performance/ measurement	Lighting and similar equipment: Radio disturbance limits	
Thailand	Lamp	CFLi	*Reference number not known*		Performance/ measurement	Green Label Scheme – CFLs	
Thailand	Lamp	CFLi	*Reference number not known*		Performance/ measurement	Energy Efficient Compact Fluorescent Lamps Program	
Thailand	Lamp	CFLi	TIS 2233-2548		Performance/ measurement	Self-ballasted lamps for general lighting services	
Thailand	Lamp	CFLi	TIS 2234-2548 (2005)		Safety	Self-ballast lamps for general lighting services: Safety Requirements	
Thailand	Lamp	CFLi	Green Label Scheme - TGL-2-R3-11 Fluorescent Lamps	TIS 236-2533; TIS 2310-2549 (2006)	Performance/ measurement	Roof embedded light. -Compact fluorescent light E27 with Down Inner Loop Radiant between 12-30 lumens Centimeter and remain above 760 lumens. -Down Lamps Compact fluorescent light for Roof embed G23 twin with Radiant Inner Loop between 12-30 Centimeter and remain above 760 lumens.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Thailand	Lamp	CFLi	The Energy Efficiency No. 5 Label	TISI 956-2533 and TISI 1955-2542	Performance/ measurement	Louver luminaires, down Roof embedded light. -Compact fluorescent light E27 with Down Inner Loop Radiant between 12-30 lumens Centimeter and remain above 760 lumens. -Down Lamps Compact fluorescent light for Roof embed G23 twin with Radiant Inner Loop between 12-30 Centimeter and remain above 760 lumens. lumens.	
Thailand	Lamp	CFLi	TIS 2310-2549 (2006)	TIS 2233-2548 (2005), TIS 2234-2548 (2005)	Performance/ measurement	Self-Ballasted Lamps for General Lighting Services: Energy Efficiency Requirements (Minimum Energy Performance Standard)	
Thailand	Lamp	CFLi	TIS 2233-2548 (2005), TIS 2234-2548 (2005)		Performance/ measurement	Self-ballasted lamps	
Thailand	Lamp	CFLi	TIS 236-2533; TIS 2310-2549 (2006)		Performance/ measurement	Roof embedded light. -Compact fluorescent light E27 with Down Inner Loop Radiant between 12-30 lumens Centimeter and remain above 760 lumens. -Down Lamps Compact fluorescent light for Roof embed G23 twin with Radiant Inner Loop between 12-30 Centimeter and remain above 760 lumens.	
Thailand	Lamp	CFLi	TISI 956-2533 and TISI 1955-2542		Performance/ measurement	Louver luminaires, down Roof embedded light. -Compact fluorescent light E27 with Down Inner Loop Radiant between 12-30 lumens Centimeter and remain above 760 lumens. -Down Lamps Compact fluorescent light for Roof embed G23 twin with Radiant Inner Loop between 12-30 Centimeter and remain above 760 lumens. lumens.	
Thailand	Lamp	CFLi	TIS 2310-2549 (2006)		Performance/ measurement	Self-Ballasted Lamps for General Lighting Services: Energy Efficiency Requirements	Reference standard: National Appliance and Equipment Energy Efficiency Committee (Australia) Report no.: 2005/12 Minimum Energy Performance Standards – Compact Fluorescent lamps
Thailand	Lamp	CFLi	TIS 2310-2549 (2006)		Performance/ measurement		
Thailand	Lamp	Fluorescent double cap	Double Capped Flourscen Lamps: Energy Efficiency	TIS 236-2548, IEC 60969, TIS 956-2548	Performance/ measurement	Double and single capped	
Thailand	Lamp	Fluorescent double cap	Green Label Scheme - TGL-2-R3-11 Fluorescent Lamps	TIS 236-2533; TIS 2310-2549 (2006)	Performance/ measurement	Double-capped fluorescent lamps	
Thailand	Lamp	Fluorescent double cap	The Energy Efficiency Label No.5		Performance/ measurement	Louver luminaires	
Thailand	Lamp	Fluorescent double cap	*Reference number not known*		Performance/ measurement	Green Label Scheme –Fluorescent Lamps	
Thailand	Lamp	Fluorescent double cap	*Reference number not known*		Performance/ measurement	Energy Efficient Double-capped Fluorescent Lamps Program (T5 lamps)	
Thailand	Lamp	Fluorescent double cap	TIS 2309-2549 (2006)		Performance/ measurement	Double-Capped Fluorescent Lamps: Energy Efficiency Requirements (Minimum Energy Performance Standard)	
Thailand	Lamp	Fluorescent double cap	TIS 956-2548 (2005)		Safety	Double-capped fluorescent: Safety Specifications	
Thailand	Lamp	Fluorescent double cap	TIS 236-2548, IEC 60969, TIS 956-2548		Performance/ measurement	Double and single capped	
Thailand	Lamp	Fluorescent double cap	TIS 236-2533; TIS 2310-2549 (2006)		Performance/ measurement	Double-capped fluorescent lamps	
Thailand	Lamp	Fluorescent double cap	TIS 236-2548		Performance/ measurement	Double-capped fluorescent	Reference standard: IEC 60969

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Thailand	Lamp	Fluorescent single cap	TIS 2334-2550 (2007)		Performance/ measurement	Single-capped fluorescent lamps: Energy efficiency requirements	
Thailand	Lamp	Incandescent / halogen	TIS 4 Part 1-2529 (1986)		Performance/ measurement	Thai Industrial Standard for Incandescent lamps	
Thailand	Luminaire				??	Louver luminaires	
Thailand	Luminaire		*Reference number not known*		Performance/ measurement	Energy Efficient Lighting Luminaires Program. Published: 2004 (for T8 lamps), 2010 (for T5 lamps). Effective: 2004 (for T8 lamps), 2010 (for T5 lamps)	
Tunisia	Lamp	CFLi	unknown		Performance/ measurement	Lamp The exact product type and sub-type are yet to be determined.	
Tunisia	Lamp	Incandescent / halogen	unknown		Performance/ measurement	A policy to phase-out of ILs has already been adopted in Tunisia since 2007. This policy is based on three main actions: 1. Gradual introduction of a consumption tax on the sales of ILs to reach 50 % in 2011. 2. Prohibiting the local production of ILs with the two local manufacturers already having ceased production of ILs in 2010 3. Gradual phase-out of ILs from the local market as follows: - In 2011: ILs with power = 100 W; - In 2012: ILs with power of 75 W and 60 W; - In 2013: ILs with power of 40 W and 25 W.	
Turkey	Ballast	Fluorescent	Turkish Official Gazette No. 28038 (transposition of EC 245/2009)			This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Turkey	Ballast	HID	Turkish Official Gazette No. 28038 (transposition of EC 245/2009)			This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Turkey	Lamp	CFLi	COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources (2011/331/EU) - to be transposed	EN 50285	Performance/ measurement	The product group 'light sources' shall comprise all light sources of a luminous flux = 60 and = 12 000 lumens for general lighting applications with direct or indirect connection to the public electricity supply equipped with a lamp cap listed in EN 60061 and made in order to produce a visible radiation. The following types of light sources are not included in the product group: directional lamps, high-intensity discharge lamps, coloured lamps, projector lamps, photographic lighting, solarium tubes, battery driven systems and other light sources that are not intended for general lighting applications. The following types of light sources are not included in the product group if they are not supplied directly from the mains: integral compact fluorescent lamps, filament lamps, LED lamps.	
Turkey	Lamp	CFLi	Turkish Official Gazette No. 24852 (transposition of 98/11/EC)	EN 50285	Performance/ measurement	The Commission Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps shall apply to household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Turkey	Lamp	CFLi	Turkish Official Gazette No. 28038 (transposition of EC 244/2009)	EC 244/2009	Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Turkey	Lamp	HID	Turkish Official Gazette No. 28038 (transposition of EC 245/2009)		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Turkey	Lamp	HID	Turkish Official Gazette No. 28038 (transposition of EC 244/2009)	EC 244/2009	Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Turkey	Lamp	Incandescent / halogen	COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources (2011/331/EU) - to be transposed	EN 50285	Performance/ measurement	The product group 'light sources' shall comprise all light sources of a luminous flux = 60 and = 12 000 lumens for general lighting applications with direct or indirect connection to the public electricity supply equipped with a lamp cap listed in EN 60061 and made in order to produce a visible radiation. The following types of light sources are not included in the product group: directional lamps, high-intensity discharge lamps, coloured lamps, projector lamps, photographic lighting, solarium tubes, battery driven systems and other light sources that are not intended for general lighting applications. The following types of light sources are not included in the product group if they are not supplied directly from the mains: integral compact fluorescent lamps, filament lamps, LED lamps.	
Turkey	Lamp	Incandescent / halogen	Turkish Official Gazette No. 24852	EN 50285	Performance/ measurement	The Commission Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps shall apply to household electric	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			(transposition of 98/11/EC)			lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Turkey	Lamp	Incandescent / halogen	Turkish Official Gazette No. 28038 (transposition of EC 244/2009)	EC 244/2009	Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Turkey	Lamp	LED	COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources (2011/331/EU) - to be transposed	EN 50285	Performance/ measurement	The product group 'light sources' shall comprise all light sources of a luminous flux = 60 and = 12 000 lumens for general lighting applications with direct or indirect connection to the public electricity supply equipped with a lamp cap listed in EN 60061 and made in order to produce a visible radiation. The following types of light sources are not included in the product group: directional lamps, high-intensity discharge lamps, coloured lamps, projector lamps, photographic lighting, solarium tubes, battery driven systems and other light sources that are not intended for general lighting applications. The following types of light sources are not included in the product group if they are not supplied directly from the mains: integral compact fluorescent lamps, filament lamps, LED lamps.	
Turkey	Lamp	LED	Turkish Official Gazette No. 24852 (transposition of 98/11/EC)	EN 50285	Performance/ measurement	The Commission Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps shall apply to household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the Regulation.	
Turkey	Lamp	LED	Turkish Official Gazette No. 28038 (transposition of EC 244/2009)	EC 244/2009	Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products. It also establishes product information requirements for special purpose lamps. Exclusions: (a) lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; (b) directional lamps; (c) lamps having a luminous flux below 60 lumens or above 12 000 lumens; (d) lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); (e) fluorescent lamps without integrated ballast; (f) high-intensity discharge lamps; (g) incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3 of the Regulation.	
Turkey	Lamp		Turkish Official Gazette No. 28038 (transposition of EC 245/2009)		Performance/ measurement	This Regulation establishes ecodesign requirements for the placing on the market of fluorescent lamps without integrated ballast, of high intensity discharge lamps, and of ballasts and luminaires able to operate such lamps as defined in Article 2, even when they are integrated into other energy-using products. This Regulation also provides indicative benchmarks for products intended for use in office lighting and public street lighting. The products listed in Annex I shall be exempt from the requirements set out in this Regulation.	
Turkey	System		COMMISSION DECISION of 6 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for light sources (2011/331/EU) - to be transposed	EN 50285	Performance/ measurement	The product group 'light sources' shall comprise all light sources of a luminous flux = 60 and = 12 000 lumens for general lighting applications with direct or indirect connection to the public electricity supply equipped with a lamp cap listed in EN 60061 and made in order to produce a visible radiation. The following types of light sources are not included in the product group: directional lamps, high-intensity discharge lamps, coloured lamps, projector lamps, photographic lighting, solarium tubes, battery driven systems and other light sources that are not intended for general lighting applications. The following types of light sources are not included in the product group if they are not supplied directly from the mains: integral compact fluorescent lamps, filament lamps, LED lamps.	
Turkey	System		Turkish Official Gazette No. 24852 (transposition of 98/11/EC)	EN 50285	Performance/ measurement	The Commission Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps shall apply to household electric lamps supplied directly from the mains (filament and integral compact fluorescent lamps), and to household fluorescent lamps (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use. Where an appliance can be taken apart by end users, for the purposes of this Directive the 'lamp' shall be the part(s) which emit(s) the light. The following lamps shall be excluded from the scope of this Directive: (a) those with a luminous flux of more than 6 500 lumens; (b) those with an input power of less than 4 watts; (c) reflector lamps; (d) those marketed or commercialised primarily for use with other energy sources, such as batteries; (e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm); (f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included. For lamps referred to in paragraph 2, labels and fiches may be provided in accordance with this Directive, provided that harmonised measurement standards applicable to such lamps have been adopted and published in accordance with Article 1 paragraph 4 of the	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						Regulation.	
UK	Lamp	CFLi	Energy Saving Trust Recommended scheme		Performance/ measurement	Stick CFLs	
UK	Lamp	CFLi	Energy Saving Trust Recommended scheme		Performance/ measurement	Candle effect CFLs	
UK	Lamp	CFLi	Energy Saving Trust Recommended scheme		Performance/ measurement	Look alike CFLs	
UK	Lamp	Incandescent / halogen	Energy Saving Trust Recommended scheme	EN 60357; EN 60432-2	Performance/ measurement	Halogen bulbs	
UK	Lamp	LED	Energy Saving Trust Recommended scheme		Performance/ measurement	LED replacement luminaires	
UK	Lamp	LED	Energy Saving Trust Recommended scheme		Performance/ measurement	LED lamps and Modules	
UK	Lamp	LED	Energy Saving Trust Recommended scheme		Performance/ measurement	LED lamps and Modules	
United Arab Emirates	Lamp	CFLi	Technical Regulation: Requirements for Approval and Registration of Lighting Products (draft)		Performance/ measurement		
United Arab Emirates	Lamp	Fluorescent double cap	Technical Regulation: Requirements for Approval and Registration of Lighting Products (draft)		Performance/ measurement	Linear fluorescent lamps	
United Arab Emirates	Lamp	Incandescent / halogen	Technical Regulation: Requirements for Approval and Registration of Lighting Products (draft)		Performance/ measurement		
United Arab Emirates	Lamp	Incandescent / halogen	Technical Regulation: Requirements for Approval and Registration of Lighting Products (draft)		Performance/ measurement	Incandescent lamps = 16W (watts)	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
United Arab Emirates	Lamp	LED	Technical Regulation: Requirements for Approval and Registration of Lighting Products (draft)		Performance/ measurement	Non-directional LED lamps	
Uruguay	Lamp	CFLi	Res. Ministerial 955/011	UNIT 1160	Performance/ measurement		
USA	Ballast	Fluorescent	10 CFR Part 430	10 CFR Part 430 Appendix Q to Subpart B		Fluorescent lamp ballast means a device which is used to start and operate fluorescent lamps by providing a starting voltage and current and limiting the current during normal operation. F4OT12 lamp means a nominal 40 watt tubular fluorescent lamp which is 48 inches in length and one and a half inches in diameter, and conforms to ANSI C78.81–2003 (Data Sheet 7881–ANSI–1010–1). F96T12 lamp means a nominal 75 watt tubular fluorescent lamp which is 96 inches in length and one and one-half inches in diameter, and conforms to ANSI C78.81–2003 (Data Sheet 7881–ANSI–3007–1). F96T12HO lamp means a nominal 110 watt tubular fluorescent lamp that is 96 inches in length and 11/2inches in diameter, and conforms to ANSI C78.81–2003 (Data Sheet 7881–ANSI–1019–1). F34T12 lamp (also known as a "F40T12/ES lamp") means a nominal 34 watt tubular fluorescent lamp that is 48 inches in length and 11/2inches in diameter, and conforms to ANSI C78.81–2003 (Data Sheet 7881–ANSI–1006–1). F96T12/ES lamp means a nominal 60 watt tubular fluorescent lamp that is 96 inches in length and 11/2inches in diameter, and conforms to ANSI C78.81–2003 (Data Sheet 7881–ANSI–3006–1). F96T12HO/ES lamp means a nominal 95 watt tubular fluorescent lamp that is 96 inches in length and 11/2inches in diameter, and conforms to ANSI C78.81–2003 (Data Sheet 7881–ANSI–1017–1).	
USA	Ballast	Fluorescent	16 CFR Part 305	10 CFR 430, Subpart B, Appendix Q		The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Ballast	Fluorescent	ANSI C82.2			Ballasts for linear fluorescent lamps	Very difficult to compare US "ballast luminous efficiency" to the IEC-based test methods and

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
							parameters used in most other countries. It's a complex function using reference lamps and reference ballasts. Also the voltage difference between US and EU makes comparison very difficult. To develop some kind of conversion approach would require in-depth study of ballast test results.
USA	Ballast	HID				Mercury vapor lamp ballasts	
USA	Ballast	HID	10 CFR Part 431.324			Metal Halide Lamp Fixture: Metal halide lamp means a high intensity discharge lamp in which the major portion of the light is produced by radiation of metal halides and their products of dissociation, possibly in combination with metallic vapors. Metal halide lamp fixture means a light fixture for general lighting application designed to be operated with a metal halide lamp and a ballast for a metal halide lamp.	
USA	Ballast	HID	10 CFR Part 431	10 CFR Part 431.324		Metal Halide Lamp Fixture: Metal halide lamp means a high intensity discharge lamp in which the major portion of the light is produced by radiation of metal halides and their products of dissociation, possibly in combination with metallic vapors. Metal halide lamp fixture means a light fixture for general lighting application designed to be operated with a metal halide lamp and a ballast for a metal halide lamp.	
USA	Ballast	HID	10 CFR Part 431			Mercury vapor lamp ballasts	
USA	Lamp	All			Performance/ measurement	Set up and lamp lumen output shall be determined in accordance with IES LM9 at the reference condition, except that the voltage and current conditions are as set out in ANSI C78.1, ANSI C78.2, ANSI C78.3 and ANSI C78.375. The reference ballast is specified in ANSI C82.3. Lamp electrical power input in watts shall be measured and recorded. Lamp efficacy shall be determined by computing the ratio of the measured lamp lumen output and lamp electrical power input at equilibrium for the reference condition. There is also a requirement to measure the colour rendering index (CRI) in accordance with CIE 13.3, IES LM16 and IES LM58. A minimum allowable CRI is specified (depending on the lamp type and size). The manufacturer is required to declare the Lumen output, the lamp power and the lamp life on the lamp package.	
USA	Lamp	All	IES TM-25-13		Performance/ measurement	'Ray File Format for the Description of the Emission Property of Light Sources.'	
USA	Lamp	All	ANSI IESNA RP16-05 & additions		Performance/ measurement	Definitions for illuminating engineering, test procedures, applications	
USA	Lamp	CFLi	10 CFR Part 430	10 CFR Part 430 Appendix W to Subpart B	Performance/ measurement	Medium base compact fluorescent lamp means an integrally ballasted fluorescent lamp with a medium screw base, a rated input voltage range of 115 to 130 volts and which is designed as a direct replacement for a general service incandescent lamp; however, the term does not include—	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						(1) Any lamp that is— (i) Specifically designed to be used for special purpose applications; and (ii) Unlikely to be used in general purpose applications, such as the applications described in the definition of "General Service Incandescent Lamp" in this section; or (2) Any lamp not described in the definition of "General Service Incandescent Lamp" in this section that is excluded by the Secretary, by rule, because the lamp is— (i) Designed for special applications; and (ii) Unlikely to be used in general purpose applications.	
USA	Lamp	CFLi	16 CFR Part 305	10 CFR Part 430 Appendix W to Subpart B	Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	CFLi	Green Seal™ Standard for Compact Fluorescent Lamps - Third Edition	ENERGY STAR Program Requirements for CFLs	Performance/ measurement	Compact fluorescent lamps and lamp systems. This includes those lamps used for general illumination purposes, and can include those for some special purposes such as germicidal and bug lamps. The product group includes those with both screw based and pin based lamps and those with integral (e.g. self-ballasted) and non-integral ballasts (e.g. ballast adapters). This excludes linear fluorescent lamps.	
USA	Lamp	CFLi	Compact Fluorescent Light Bulbs Program Requirements Version 4.3		Performance/ measurement	This ENERGY STAR criteria for CFLs covers the requirements for self-ballasted CFLs and lamp systems, including: A. Medium (Edison) or candelabra screw base compact fluorescent lamps with integral electronic ballasts. B. Circline lamps with a maximum diameter of nine inches and square lamps, with a maximum side length of eight inches with medium screw with electronic ballasts that are tested and packaged with the lamp. C. Medium (Edison) or candelabra screw base fluorescent lamps with integral electronic ballasts, which have a translucent cover over the bare fluorescent tube. The cover may be globe, bullet, pear, torpedo, candle, or any other shape. D. Medium (Edison) screw base compact fluorescent lamps with integral electronic ballasts, which have a reflector that may be open or enclosed. The lamp shall be primarily intended to replace wide beam incandescent reflector lamps.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
USA	Lamp	CFLi	10 CFR Part 430 Appendix W to Subpart B		Performance/ measurement	Medium base compact fluorescent lamp means an integrally ballasted fluorescent lamp with a medium screw base, a rated input voltage range of 115 to 130 volts and which is designed as a direct replacement for a general service incandescent lamp; however, the term does not include— (1) Any lamp that is— (i) Specifically designed to be used for special purpose applications; and (ii) Unlikely to be used in general purpose applications, such as the applications described in the definition of "General Service Incandescent Lamp" in this section; or (2) Any lamp not described in the definition of "General Service Incandescent Lamp" in this section that is excluded by the Secretary, by rule, because the lamp is— (i) Designed for special applications; and (ii) Unlikely to be used in general purpose applications.	
USA	Lamp	CFLi	ENERGY STAR Program Requirements for CFLs		Performance/ measurement	Compact fluorescent lamps and lamp systems. This includes those lamps used for general illumination purposes, and can include those for some special purposes such as germicidal and bug lamps. The product group includes those with both screw based and pin based lamps and those with integral (e.g. self-ballasted) and non-integral ballasts (e.g. ballast adapters). This excludes linear fluorescent lamps.	
USA	Lamp	CFLi	10 CFR Part 430 Appendix W to Subpart B		Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	CFLi	Compact Fluorescent Light Bulbs Program Requirements Version 4.3	Compact Fluorescent Light Bulbs Program Requirements Version 4.3	Performance/ measurement	This ENERGY STAR criteria for CFLs covers the requirements for self-ballasted CFLs and lamp systems, including: A. Medium (Edison) or candelabra screw base compact fluorescent lamps with integral electronic ballasts. B. Circline lamps with a maximum diameter of nine inches and square lamps, with a maximum side length of eight inches with medium screw with electronic ballasts that are tested and packaged with the lamp. C. Medium (Edison) or candelabra screw base fluorescent lamps with integral electronic ballasts, which have a translucent cover over the bare fluorescent tube. The cover may be globe, bullet, pear, torpedo, candle, or any other shape. D. Medium (Edison) screw base compact fluorescent lamps with integral electronic ballasts,	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						which have a reflector that may be open or enclosed. The lamp shall be primarily intended to replace wide beam incandescent reflector lamps.	
USA	Lamp	CFLi	10CFR430 Sub Part B,Appendix R		Performance/ measurement	US Code of Federal Regulations: Energy Conservation Program for Consumer Products Energy labelling applies to compact fluorescent lamps. All set up and test conditions are specified in the standard prepared by the Illumination Engineering Society of North America IES LM66. Lamp electrical power input in watts and light output shall be measured and recorded. Lamp efficacy shall be determined by computing the ratio of the measured lamp lumen output and lamp electrical power input at equilibrium for the reference condition	All of the test conditions are externally referenced to an IES standard. The test procedures are broadly in line with the requirements for Canada, which reference the same IES standard, which involves determining the total input power and light output for the CFL. Note that no minimum light output is required.
USA	Lamp	CFLi	10 CFR 430.23(y)		Performance/ measurement	Medium base CFLs	US test method is effectively harmonised with IEC test method
USA	Lamp	Fluorescent double cap	10 CFR Part 430	10 CFR Part 430 Appendix R to Subpart B	Performance/ measurement	General Service Fluorescent Lamp. Fluorescent lamp means a low pressure mercury electric-discharge source in which a fluorescing coating transforms some of the ultraviolet energy generated by the mercury discharge into light, including only the following: (1) Any straight-shaped lamp (commonly referred to as 4-foot medium bipin lamps) with medium bipin bases of nominal overall length of 48 inches and rated wattage of 25 or more; (2) Any U-shaped lamp (commonly referred to as 2-foot U-shaped lamps) with medium bipin bases of nominal overall length between 22 and 25 inches and rated wattage of 25 or more; (3) Any rapid start lamp (commonly referred to as 8-foot high output lamps) with recessed double contact bases of nominal overall length of 96 inches; (4) Any instant start lamp (commonly referred to as 8-foot slimline lamps) with single pin bases of nominal overall length of 96 inches and rated wattage of 52 or more; (5) Any straight-shaped lamp (commonly referred to as 4-foot miniature bipin standard output lamps) with miniature bipin bases of nominal overall length between 45 and 48 inches and rated wattage of 26 or more; and (6) Any straight-shaped lamp (commonly referred to 4-foot miniature bipin high output lamps) with miniature bipin bases of nominal overall length between 45 and 48 inches and rated wattage of 49 or more.	
USA	Lamp	Fluorescent double cap	16 CFR Part 305	10 CFR 430, Subpart B, Appendix R	Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	Fluorescent double cap	10 CFR 430, Subpart B, Appendix R		Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps,	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	Fluorescent double cap	10 CFR Part 430 Appendix R to Subpart B		Performance/ measurement	General Service Fluorescent Lamp. Fluorescent lamp means a low pressure mercury electric-discharge source in which a fluorescing coating transforms some of the ultraviolet energy generated by the mercury discharge into light, including only the following: (1) Any straight-shaped lamp (commonly referred to as 4-foot medium bipin lamps) with medium bipin bases of nominal overall length of 48 inches and rated wattage of 25 or more; (2) Any U-shaped lamp (commonly referred to as 2-foot U-shaped lamps) with medium bipin bases of nominal overall length between 22 and 25 inches and rated wattage of 25 or more; (3) Any rapid start lamp (commonly referred to as 8-foot high output lamps) with recessed double contact bases of nominal overall length of 96 inches; (4) Any instant start lamp (commonly referred to as 8-foot slimline lamps) with single pin bases of nominal overall length of 96 inches and rated wattage of 52 or more; (5) Any straight-shaped lamp (commonly referred to as 4-foot miniature bipin standard output lamps) with miniature bipin bases of nominal overall length between 45 and 48 inches and rated wattage of 26 or more; and (6) Any straight-shaped lamp (commonly referred to 4-foot miniature bipin high output lamps) with miniature bipin bases of nominal overall length between 45 and 48 inches and rated wattage of 49 or more.	
USA	Lamp	Fluorescent double cap	10CFR430 Sub Part B, Appendix R.		Performance/ measurement	US Code of Federal Regulations: Energy Conservation Program for Consumer Products. Energy labelling and MEPS applies to 1200mm and 2400mm general service (linear) fluorescent lamps. All set up and test conditions are specified in standards prepared by the Illumination Engineering Society of North America (IESNA) and in ANSI standards.	All of the test conditions are externally referenced to IES and ANSI standards. The test procedures are broadly in line with the requirements for Canada
USA	Lamp	Fluorescent double cap	IESNA LM-9		Performance/ measurement	Linear fluorescent lamps 2, 4, 8 foot	US test method is effectively harmonised with IEC test method
USA	Lamp	HID	16 CFR Part 305	10 CFR Part 430 Appendix R to Subpart B	Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	HID			Performance/ measurement	General High Intensity Discharge (HID) Lamps: Will include metal halide, high pressure sodium, and mercury vapor lamps.	
USA	Lamp	HID			Performance/ measurement	General High Intensity Discharge (HID) Lamps: Will include metal halide, high pressure sodium, and mercury vapor lamps.	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
USA	Lamp	HID	10 CFR Part 430 Appendix R to Subpart B		Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	Incandescent / halogen	10CFR430 Sub Part B, Appendix R		Performance/ measurement	US Code of Federal Regulations: Energy Conservation Program for Consumer Products. Energy labelling applies to both GLS lamps and reflector lamps, while MEPS is only applicable to reflector lamps in the range 40W to 205W. All set up and test conditions are specified in standards prepared by the Illumination Engineering Society of North America (IESNA). GLS lamps – Set up and lamp lumen output shall be determined in accordance with IES LM45 at the reference condition. Lamp electrical power input in watts shall be measured and recorded. Lamp efficacy shall be determined by computing the ratio of the measured lamp lumen output and lamp electrical power input at equilibrium for the reference condition. The manufacturer is required to declare the Lumen output, the lamp power and the lamp life on the lamp package. Reflector lamps – Set up and lamp lumen output shall be determined as total forward lumens, and may be measured in an integrating sphere at the reference condition in accordance IES LM20 or from an average intensity distribution curve measured at the reference condition specified in IES LM20. Lamp electrical power input in watts shall be measured and re-corded. Lamp efficacy shall be determined by computing the ratio of the measured lamp lumen output and lamp electrical power input at equilibrium for the reference condition. The manufacturer is required to declare the Lumen output, the lamp power and the lamp life on the lamp package.	All of the test conditions are externally referenced to IES standards. The test procedures are broadly in line with the requirements for Canada.
USA	Lamp	Incandescent / halogen	10 CFR 430, Subpart B, Appendix R		Performance/ measurement	Incandescent Reflector Lamps (IRLs): Commonly referred to as a reflector lamp; any lamp in which light is produced by a filament heated to incandescence by an electric current, which: is not coloured or designed for rough or vibration service applications that contains an inner reflective coating on the outer bulb to direct the light; has an R, PAR, ER, BR, BPAR, or similar bulb shapes with an E26 medium screw base; has a rated voltage or voltage range that lies at least partially in the range of 115 and 130 volts; has a diameter that exceeds 2.25 inches; and has a rated wattage that is 40 watts or higher.	US test method is effectively harmonised with IEC test method
USA	Lamp	Incandescent / halogen	10 CFR Part 430 Appendix R to Subpart B		Performance/ measurement	Incandescent lamp: (1) Means a lamp in which light is produced by a filament heated to incandescence by an electric current, including only the following: (i) Any lamp (commonly referred to as lower wattage nonreflector general service lamps, including any tungsten-halogen lamp) that has a rated wattage between 30 and 199 watts, has an E26 medium screw base, has a rated voltage or voltage range that lies at least partially within 115 and 130 volts, and is not a reflector lamp; (ii) Any lamp (commonly referred to as a reflector lamp) which is not coloured or designed for rough or vibration service applications, that contains an inner reflective coating on the outer bulb to direct the light, an R, PAR, ER, BR, BPAR, or similar bulb shapes with E26 medium screwbases,	US test method is effectively harmonised with IEC test method

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						a rated voltage or voltage range that lies at least partially within 115 and 130 volts, a diameter which exceeds 2.75 inches, and has a rated wattage that is 40 watts or higher; (iii) Any general service incandescent lamp (commonly referred to as a high- or higher-wattage lamp) that has a rated wattage above 199 watts (above 205 watts for a high wattage reflector lamp); but (2) Incandescent lamp does not mean any lamp excluded by the Secretary of Energy, by rule, as a result of a determination that standards for such lamp would not result in significant energy savings because such lamp is designed for special applications or has special characteristics not available in reasonably substitutable lamp types; (3) General service incandescent lamp means (i) In general, a standard incandescent, halogen, or reflector type lamp that— (A) Is intended for general service applications; (B) Has a medium screw base; (C) Has a lumen range of not less than 310 lumens and not more than 2,600 lumens; and (D) Is capable of being operated at a voltage range at least partially within 110 and 130 volts. (ii) Exclusions. The term “general service incandescent lamp” does not include the following incandescent lamps: (A) An appliance lamp as defined at 42 U.S.C. 6291(30); (B) A black light lamp; (C) A bug lamp; (D) A coloured lamp as defined at 42 U.S.C. 6291(30); (E) An infrared lamp; (F) A left-hand thread lamp; (G) A marine lamp; (H) A marine signal service lamp; (I) A mine service lamp; (J) A plant light lamp; (K) A rough service lamp as defined at 42 U.S.C. 6291(30); (L) A shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp); (M) A sign service lamp; (N) A silver bowl lamp; (O) A showcase lamp; (P) A traffic signal lamp; (Q) A vibration service lamp as defined at 42 U.S.C. 6291(30); (R) A G shape lamp (as defined in ANSI C78.20–2003 and C79.1–2002) with a diameter of 5 inches or more; (S) A T shape lamp (as defined in ANSI C78.20–2003 and C79.1–2002) and that uses not more than 40 watts or has a length of more than 10 inches; or (T) A B, BA, CA, F, G16–1/2, G–25, G30, S, or M–14 lamp (as defined in ANSI C79.1–2002 and ANSI C78.20–2003) of 40 watts or less. (4) Incandescent reflector lamp means a lamp described in paragraph (n)(1)(ii) of this section; and (5) Tungsten-halogen lamp means a gas-filled tungsten filament incandescent lamp containing a	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						certain proportion of halogens in an inert gas.	
USA	Lamp	Incandescent / halogen	10 CFR 430, Subpart B, Appendix R		Performance/ measurement	General service incandescent lamp means a standard incandescent or halogen type lamp that is intended for general service applications; has a medium screw base; has a lumen range of not less than 310 lumens and not more than 2,600 lumens; and is capable of being operated at a voltage range at least partially within 110 and 130 volts; however this definition does not apply to the following incandescent lamps—	US test method is effectively harmonised with IEC test method
USA	Lamp	Incandescent / halogen	10 CFR 430, Subpart B, Appendix R		Performance/ measurement	General service incandescent lamp means a standard incandescent or halogen type lamp that is intended for general service applications; has a medium screw base; has a lumen range of not less than 310 lumens and not more than 2,600 lumens; and is capable of being operated at a voltage range at least partially within 110 and 130 volts; however this definition does not apply to the following incandescent lamps—	US test method is effectively harmonised with IEC test method
USA	Lamp	Incandescent / halogen	10 CFR Part 430 Appendix R to Subpart B		Performance/ measurement	Incandescent lamp: (1) Means a lamp in which light is produced by a filament heated to incandescence by an electric current, including only the following: (i) Any lamp (commonly referred to as lower wattage nonreflector general service lamps, including any tungsten-halogen lamp) that has a rated wattage between 30 and 199 watts, has an E26 medium screw base, has a rated voltage or voltage range that lies at least partially within 115 and 130 volts, and is not a reflector lamp; (ii) Any lamp (commonly referred to as a reflector lamp) which is not coloured or designed for rough or vibration service applications, that contains an inner reflective coating on the outer bulb to direct the light, an R, PAR, ER, BR, BPAR, or similar bulb shapes with E26 medium screwbases, a rated voltage or voltage range that lies at least partially within 115 and 130 volts, a diameter which exceeds 2.75 inches, and has a rated wattage that is 40 watts or higher; (iii) Any general service incandescent lamp (commonly referred to as a high- or higher-wattage lamp) that has a rated wattage above 199 watts (above 205 watts for a high wattage reflector lamp); but (2) Incandescent lamp does not mean any lamp excluded by the Secretary of Energy, by rule, as a result of a determination that standards for such lamp would not result in significant energy savings because such lamp is designed for special applications or has special characteristics not available in reasonably substitutable lamp types; (3) General service incandescent lamp means (i) In general, a standard incandescent, halogen, or reflector type lamp that— (A) Is intended for general service applications; (B) Has a medium screw base; (C) Has a lumen range of not less than 310 lumens and not more than 2,600 lumens; and (D) Is capable of being operated at a voltage range at least partially within 110 and 130 volts. (ii) Exclusions. The term “general service incandescent lamp” does not include the following incandescent lamps: (A) An appliance lamp as defined at 42 U.S.C. 6291(30); (B) A black light lamp; (C) A bug lamp; (D) A coloured lamp as defined at 42 U.S.C. 6291(30);	US test method is effectively harmonised with IEC test method

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						(E) An infrared lamp; (F) A left-hand thread lamp; (G) A marine lamp; (H) A marine signal service lamp; (I) A mine service lamp; (J) A plant light lamp; (K) A rough service lamp as defined at 42 U.S.C. 6291(30); (L) A shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp); (M) A sign service lamp; (N) A silver bowl lamp; (O) A showcase lamp; (P) A traffic signal lamp; (Q) A vibration service lamp as defined at 42 U.S.C. 6291(30); (R) A G shape lamp (as defined in ANSI C78.20–2003 and C79.1–2002) with a diameter of 5 inches or more; (S) A T shape lamp (as defined in ANSI C78.20–2003 and C79.1–2002) and that uses not more than 40 watts or has a length of more than 10 inches; or (T) A B, BA, CA, F, G16–1/2, G–25, G30, S, or M–14 lamp (as defined in ANSI C79.1–2002 and ANSI C78.20–2003) of 40 watts or less. (4) Incandescent reflector lamp means a lamp described in paragraph (n)(1)(ii) of this section; and (5) Tungsten-halogen lamp means a gas-filled tungsten filament incandescent lamp containing a certain proportion of halogens in an inert gas.	
USA	Lamp	Incandescent / halogen	16 CFR Part 305	10 CFR Part 430 Appendix R to Subpart B	Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	Incandescent / halogen	10 CFR Part 430	10 CFR Part 430 Appendix R to Subpart B	Performance/ measurement	Incandescent Reflector Lamps (IRLs): Commonly referred to as a reflector lamp; any lamp in which light is produced by a filament heated to incandescence by an electric current, which: is not coloured or designed for rough or vibration service applications that contains an inner reflective coating on the outer bulb to direct the light; has an R, PAR, ER, BR, BPAR, or similar bulb shapes with an E26 medium screw base; has a rated voltage or voltage range that lies at least partially in the range of 115 and 130 volts; has a diameter that exceeds 2.25 inches; and has a rated wattage that is 40 watts or higher.	
USA	Lamp	Incandescent / halogen	10 CFR Part 430	10 CFR Part 430 Appendix R to Subpart B	Performance/ measurement	General service incandescent lamp means a standard incandescent or halogen type lamp that is intended for general service applications; has a medium screw base; has a lumen range of not less than 310 lumens and not more than 2,600 lumens; and is capable of being operated at a	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						voltage range at least partially within 110 and 130 volts; however this definition does not apply to the following incandescent lamps— (1) An appliance lamp; (2) A black light lamp; (3) A bug lamp; (4) A coloured lamp; (5) An infrared lamp; (6) A left-hand thread lamp; (7) A marine lamp; (8) A marine signal service lamp; (9) A mine service lamp; (10) A plant light lamp; (11) A reflector lamp; (12) A rough service lamp; (13) A shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp); (14) A sign service lamp; (15) A silver bowl lamp; (16) A showcase lamp; (17) A 3-way incandescent lamp; (18) A traffic signal lamp; (19) A vibration service lamp; (20) A G shape lamp (as defined in ANSI C78.20) (incorporated by reference; see §430.3) and ANSI C79.1–2002 (incorporated by reference; see §430.3) with a diameter of 5 inches or more; (21) A T shape lamp (as defined in ANSI C78.20) (incorporated by reference; see §430.3) and ANSI C79.1–2002 (incorporated by reference; see §430.3) and that uses not more than 40 watts or has a length of more than 10 inches; and (22) A B, BA, CA, F, G16–1/2, G–25, G30, S, or M–14 lamp (as defined in ANSI C79.1–2002) (incorporated by reference; see §430.3) and ANSI C78.20 (incorporated by reference; see §430.3) of 40 watts or less.	
USA	Lamp	Incandescent / halogen	16 CFR Part 305	10 CFR Part 430 Appendix R to Subpart B	Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	Incandescent / halogen	10CFR430 Sub part C		Performance/ measurement	US Code of Federal Regulations: Energy Conservation Program for Consumer Products	
USA	Lamp	Incandescent / halogen	10 CFR Part 430 Appendix R to Subpart B		Performance/ measurement		
USA	Lamp	Incandescent / halogen	10 CFR Part 430 Appendix R to Subpart		Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
			B			label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	LED	IESNA-LM79-08		Performance/ measurement	Measurement of single lamp performance	
USA	Lamp	LED	IESNA-LM80-08		Performance/ measurement	Measurement of lumen maintenance	
USA	Lamp	LED	IESNA-TM21		Performance/ measurement	Extrapolation of lumen maintenance data to evaluate lifetime	
USA	Lamp	LED	ANSI NEMA ANSLG C78.377		Performance/ measurement	Chromaticity of SSL products	
USA	Lamp	LED	10 CFR Part 430 Appendix R to Subpart B		Performance/ measurement	General service light-emitting diode (LED or OLED) lamp means any light emitting diode (LED or OLED) lamp that: (1) Is a consumer product; (2) Is intended for general service applications; (3) Has a medium screw base; (4) Has a lumen range of not less than 310 lumens and not more than 2,600 lumens; and (5) Is capable of being operated at a voltage range at least partially within 110 and 130 volts.	
USA	Lamp	LED	Integral LED Lamps Program Requirements Version 1.4		Performance/ measurement	These criteria apply to integral LED lamps, defined as a lamp with LEDs, an integrated LED driver, and an ANSI standardized base designed to connect to the branch circuit via an ANSI standardized lampholder/socket. These criteria include integral LED lamps of non-standard form, and those intended to replace standard general service incandescent lamps, decorative (candelabra style) lamps, and reflector lamps. Other types of replacement lamps may be added in the future as improvements to LED technology make LED use in other replacement lamp types viable.	
USA	Lamp	LED	Integral LED Lamps Program Requirements Version 1.4		Performance/ measurement	These criteria apply to integral LED lamps, defined as a lamp with LEDs, an integrated LED driver, and an ANSI standardized base designed to connect to the branch circuit via an ANSI standardized lampholder/socket. These criteria include integral LED lamps of non-standard form, and those intended to replace standard general service incandescent lamps, decorative (candelabra style) lamps, and reflector lamps. Other types of replacement lamps may be added in the future as improvements to LED technology make LED use in other replacement lamp types viable.	
USA	Lamp	LED	10 CFR Part 430 Appendix R to Subpart B		Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	LED			Performance/ measurement	Voluntary label with light quality and energy information for labelling LED products.	
USA	Lamp	LED	Luminaires Program Requirements Version 1.2	Luminaires Program Requirements Version 1.2	Performance/ measurement	LED luminaires	
USA	Lamp	LED	16 CFR Part 305	10 CFR Part 430 Appendix R to Subpart B	Performance/ measurement	The Federal Trade Commission requires energy and other performance labelling of appliance and energy consuming products, across many product categories. For lighting products, the label includes fluorescent lamps and ballasts, CFLs, incandescent, halogen, metal halide, and LED lamps. It excludes many types of specialty lamps, such as infrared lamps, coloured lamps, plant lights, marine lamps and traffic signals, among others. A full description of the scope of the FTC label is available at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=b8524c14b9fba95a12dcfdbc215eac9e&rgn=div8&view=text&node=16:1.0.1.3.29.0.13.3&idno=16 The revised FTC label, introduced in 2011, focuses on lumen output rather than wattage. More information about the change is available at http://www.ftc.gov/opa/2010/06/lightbulbs.shtm	
USA	Lamp	LED	DOE LED Lighting Facts Label		Performance/ measurement	Voluntary label with light quality and energy information for labelling LED products.	
USA	Lamp	LED	Integral LED Lamps Program Requirements Version 1.4	Integral LED Lamps Program Requirements Version 1.4	Performance/ measurement	These criteria apply to integral LED lamps, defined as a lamp with LEDs, an integrated LED driver, and an ANSI standardized base designed to connect to the branch circuit via an ANSI standardized lampholder/socket. These criteria include integral LED lamps of non-standard form, and those intended to replace standard general service incandescent lamps, decorative (candelabra style) lamps, and reflector lamps. Other types of replacement lamps may be added in the future as improvements to LED technology make LED use in other replacement lamp types viable.	
USA	Lamp	LED	IESNA-LM79-08		Performance/ measurement	Measurement of single lamp performance	
USA	Lamp	LED	IESNA-LM80-08		Performance/ measurement	Measurement of lumen maintenance	
USA	Lamp	LED	IESNA-TM21		Performance/ measurement	Extrapolation of lumen maintenance data to evaluate lifetime	
USA	Lamp	LED	ANSI NEMA ANSLG C78.377		Performance/ measurement	Chromaticity of SSL products	
USA	Lamp	LED	IESNA LM-79-08 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.		Performance/ measurement		

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
USA	Luminaire	Exit Sign	10 CFR Part 431	10 CFR Part 431.204	Performance/ measurement	Illuminated exit sign means a sign that— (1) Is designed to be permanently fixed in place to identify an exit; and (2) Consists of an electrically powered integral light source that— (i) Illuminates the legend "EXIT" and any directional indicators; and (ii) Provides contrast between the legend, any directional indicators, and the background.	
USA	Luminaire	Exit Sign	10 CFR Part 431.204		Performance/ measurement	Illuminated exit sign means a sign that— (1) Is designed to be permanently fixed in place to identify an exit; and (2) Consists of an electrically powered integral light source that— (i) Illuminates the legend "EXIT" and any directional indicators; and (ii) Provides contrast between the legend, any directional indicators, and the background.	
USA	Luminaire	Traffic Light	10 CFR Part 431	10 CFR Part 431.224	Performance/ measurement	Traffic signal module means a standard 8-inch (200 mm) or 12-inch (300 mm) traffic signal indication that— (1) Consists of a light source, a lens, and all other parts necessary for operation; and (2) Communicates movement messages to drivers through red, amber, and green colours.	
USA	Luminaire	Traffic Light	10 CFR Part 431.224		Performance/ measurement	Traffic signal module means a standard 8-inch (200 mm) or 12-inch (300 mm) traffic signal indication that—	
USA	Luminaire	Traffic Light	10 CFR Part 431.224		Performance/ measurement	Traffic signal module means a standard 8-inch (200 mm) or 12-inch (300 mm) traffic signal indication that— (1) Consists of a light source, a lens, and all other parts necessary for operation; and (2) Communicates movement messages to drivers through red, amber, and green colours.	
USA	Luminaire		10 CFR Part 430	10 CFR Part 430 Appendix V to Subpart B	Performance/ measurement	Ceiling fan light kit means equipment designed to provide light from a ceiling fan that can be— (1) Integral, such that the equipment is attached to the ceiling fan prior to the time of retail sale; or (2) Attachable, such that at the time of retail sale the equipment is not physically attached to the ceiling fan, but may be included inside the ceiling fan at the time of sale or sold separately for subsequent attachment to the fan.	
USA	Luminaire		Ceiling Fans Program Requirements Version 3.0	Ceiling Fans Program Requirements Version 3.0	Performance/ measurement	Ceiling fan lighting kit which includes a complete lighting unit consisting of lamp(s) and ballasting (when applicable) or LED Light Engine(s), together with the parts designed to distribute the light, position and protect the light sources, and connect the sources to the mains.	
USA	Luminaire		Luminaires Program Requirements Version 1.2	Luminaires Program Requirements Version 1.2	Performance/ measurement	Directional luminaires (residential): accent lights, cove mounts, downlights (recessed, pendant, surface mount), outdoor post, pendant, porch or wall mounted luminaires, under cabinet luminaires, portable desk task lights, all inseparable solid state lighting luminaires including non-directional inseparable solid state luminaires. Directional luminaires (commercial): accent lights, downlights, under cabinet shelf-mounted task lighting, portable desk task lights, includes separable or inseparable solid state lighting luminaires. Non-directional luminaires (residential): indoor (bath vanity, ceiling and close-to-ceiling mount, chandeliers, decorative pendants, linear	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
						strips, wall sconces, wrapped lens, ventilation fan lights), portable luminaires (i.e. desk task lights, floor task lights, table lamps and floor lamps, torchieres), outdoor (ceiling and close-to-ceiling mount, porch, pendant, security)."	
USA	Luminaire				Performance/ measurement	Luminaires	
USA	Luminaire		Decorative Light Strings Specification Version 1.5	Decorative Light Strings Specification Version 1.5	Performance/ measurement	Decorative Light String (DLS) – A string of lamps that operate on AC power in North America (120 V RMS AC, 60 Hz) or via a power adapter or controller that connects directly to AC power, and is used for decorative residential lighting purposes. The lamps may be replaceable or sealed into the lamp holder/wiring harness, and may be assembled in a net or icicle configuration.	
USA	Luminaire		10 CFR Part 430	10 CFR Part 430 Appendix R to Subpart B	Performance/ measurement	Torchiere means a portable electric lamp with a reflector bowl that directs light upward to give indirect illumination.	
Vietnam	Ballast	Fluorescent	Decision No. 51/2011/QD-TTg			Electronic ballasts for fluorescent lamps	
Vietnam	Ballast	Fluorescent	Decision No. 51/2011/QD-TTg			Electronic ballasts for fluorescent lamps	
Vietnam	Ballast	Fluorescent	Decision No. 51/2011/QD-TTg			Electromagnetic ballasts for fluorescent lamps	
Vietnam	Ballast	Fluorescent	Decision No. 51/2011/QD-TTg			Electromagnetic ballasts for fluorescent lamps	
Vietnam	Ballast	Fluorescent	Viet Energy Star (confirmative energy label)			Electronic ballasts	
Vietnam	Ballast	Fluorescent	Viet Energy Star (confirmative energy label)			Electromagnetic ballasts for fluorescent lamps	
Vietnam	Ballast	Fluorescent				Electronic ballasts for fluorescent lamps	
Vietnam	Ballast	Fluorescent				Electromagnetic ballasts for fluorescent lamps	
Vietnam	Ballast	Fluorescent	TCVN 7879:2008			Electronic ballasts for fluorescent lamps – Energy Efficiency	
Vietnam	Ballast	Fluorescent	TCVN 8248: 2009			Electromagnetic Ballasts – Energy Efficiency	
Vietnam	Ballast	Fluorescent	TCVN 6478:1999			Ballasts for tubular fluorescent lamps General and Safety requirements 49Tr(A4)	IEC 60920
Vietnam	Ballast	Fluorescent	TCVN 6479:2010			Ballast uses for fluorescent tube lamps - performance requirement	Reference standard: IEC 60921:2006
Vietnam	Ballast	Fluorescent	TCVN 7674:2007			AC-supplied electronic ballasts for tubular fluorescent lamps – Performance requirements	Reference standard: IEC 60929
Vietnam	Ballast	Fluorescent	TCVN 7590–2–3: 2007			Lamp controlgear – Part 2–3: Particular requirements for a.c. supplied electronic ballasts for fluorescent lamps	Reference standard: IEC 61347–2–3
Vietnam	Ballast	Fluorescent	TCVN 7590–2–8: 2006			Lamp controlgear – Part 2–3: Particular requirements for a.c. supplied electronic ballasts for fluorescent lamps	Reference standard: IEC 61347–2–8
Vietnam	Lamp	CFLi	TCVN 7541-2: 2005		Performance/ measurement	High energy lighting products – Part 2: Methods for determination of energy Performance	

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Vietnam	Lamp	CFLi	TCVN 7896:2008		Performance/ measurement	Compact fluorescent lamps – Energy efficiency	
Vietnam	Lamp	CFLi	TCVN 7672:2007		Safety	Self-ballasted for general lighting services – Safety requirements	Reference standard: IEC 60968
Vietnam	Lamp	CFLi	TCVN 7673:2007		Performance/ measurement	Self-ballasted lamps for general lighting services – Performance requirements	Reference standard: IEC 60969
Vietnam	Lamp	CFLi	Decision No. 51/2011/QD-TTg		Performance/ measurement		
Vietnam	Lamp	CFLi	Decision No. 51/2011/QD-TTg		Performance/ measurement		
Vietnam	Lamp	CFLi	Viet Energy Star (confirmative energy label)		Performance/ measurement		
Vietnam	Lamp	CFLi			Performance/ measurement		
Vietnam	Lamp	Fluorescent double cap	Decision No. 51/2011/QD-TTg	TCVN 7451-2:2005	Performance/ measurement	Tubular fluorescent lamps	
Vietnam	Lamp	Fluorescent double cap	Decision No. 51/2011/QD-TTg	TCVN 7451-2:2005	Performance/ measurement	Tubular fluorescent lamps	
Vietnam	Lamp	Fluorescent double cap	Viet Energy Star (confirmative energy label)	TCVN 7451-2:2005	Performance/ measurement	Tubular fluorescent lamp	
Vietnam	Lamp	Fluorescent double cap	TCVN 8249:2009		Performance/ measurement	Tubular Fluorescent Lamps – Energy Efficiency	
Vietnam	Lamp	Fluorescent double cap	TCVN 7451-2:2005		Performance/ measurement	Tubular fluorescent lamps	
Vietnam	Lamp	Fluorescent double cap	TCVN 7451-2:2005		Performance/ measurement	Tubular fluorescent lamp	
Vietnam	Lamp	Fluorescent double cap	TCVN 7451-2:2005		Performance/ measurement	Tubular fluorescent lamps	
Vietnam	Lamp	Fluorescent double cap	TCVN 7670: 2007		Performance/ measurement	Double-capped fluorescent lamps – Performance specifications	Reference standard: IEC 60081
Vietnam	Lamp	Fluorescent double cap	TCVN 5175: 2006		Safety	Double-fluorescent lamps – Safety specifications	Reference standard: IEC 61195
Vietnam	Lamp	Fluorescent single cap	TCVN 7863: 2008		Performance/ measurement	Single-capped fluorescent lamps – Performance specifications	Reference standard: IEC 60901
Vietnam	Lamp	Fluorescent single cap	TCVN 7591: 2006		Safety	Single-capped fluorescent lamp – Safety specifications	Reference standard: IEC 61199
Vietnam	Lamp	HID	TCVN 8250:2009		Performance/ measurement	HID sodium	
Vietnam	Lamp	HID			Performance/ measurement	HID sodium	
Vietnam	Lamp	Incandescent / halogen	TCVN 7592:2006		Performance/ measurement	Tungsten filament lamp for domestic and similar general lighting purpose – Performance requirements	Reference standard: IEC 60064:2005
Vietnam	Lamp	Incandescent / halogen	TCVN 7592:2006		Performance/ measurement	Tungsten filament lamp for domestic and similar general lighting purpose – Test requirements	Reference standard: IEC 60064:2005

Country/ Organisation	Product Type	Product Sub-Type	Standard or Policy	Standard or Test Method	Standard or Policy Type	Scope	Related Standard
Vietnam	Lamp	Incandescent / halogen	TCVN 7671−1: 2007		Safety	Incandescent lamps – Safety specifications – Part 1: Tungsten lamps for domestic and similar general lighting purposes	Reference standard: IEC 60432−1
Vietnam	Lamp	Incandescent / halogen	Decision No. 51/2011/QD-TTg		Performance/ measurement	Import, manufacture and circulation of incandescent lamps with a power output higher than 60W will be banned from January 1, 2013	
Vietnam	Lamp	Incandescent / halogen			Performance/ measurement	Import, manufacture and circulation of incandescent lamps with a power output higher than 60W will be banned from January 1, 2013	
Vietnam	Luminaire		13/2008/QD-BCT		Performance/ measurement	street light reflector	

Annex J. ADDITIONAL INFORMATION FOR NON-EU LEGISLATION

The purpose of this annex is to provide *additional* information for non-European legislation, although there is inevitable duplication of information between this annex and the main body of this report. Note also that this annex is not a comprehensive summary of all legislation requirements.

J.1 Non-Directional incandescent and halogen lamps

The countries applying MEPS legislation to incandescent and halogen lamps have been studied significantly in recent years. The en.lighten Global Policy Map[52] provides an overview of energy efficient lighting policies in over 150 countries around the world, highlighting national lighting policies aimed at the phase-out of inefficient (primarily tungsten incandescent) lighting - see figure below.

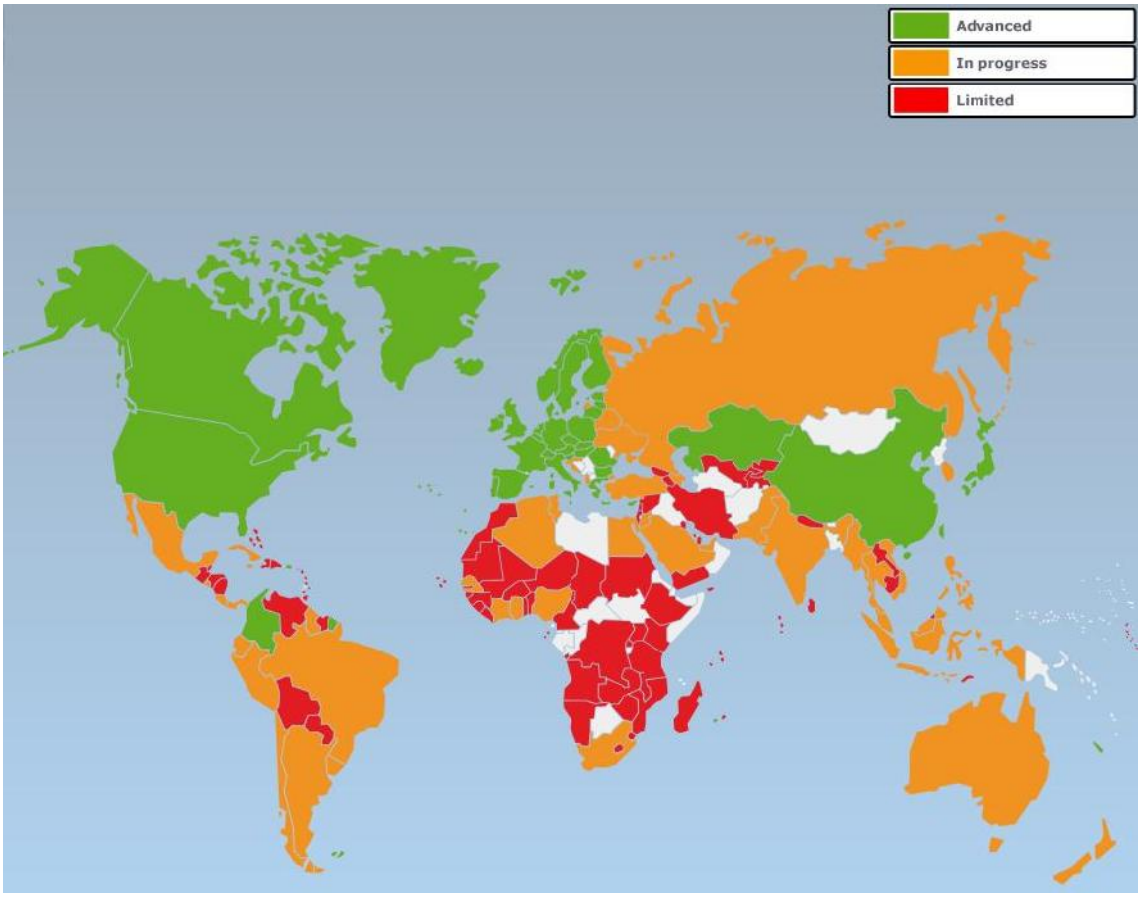


Figure 82 en.lighten Global Policy Map

The majority of the green-shaded countries on the above map have set MEPS limits for efficacy for incandescent and halogen lamps - primarily for non-directional lamps. Developed economies such as the EU, USA and Australia have also set some limits for directional lamps. These non-directional and directional MEPS limits typically do not phase out halogen lamps, but set up requirements that eliminate tungsten-incandescent lamps in favour of halogen lamps with acceptable efficacy.

[52] http://www.enlighten-initiative.org/ResourcesTools/GlobalPolicyMap.aspx

As discussed in the Omnibus study, there are signs in several countries that show a willingness to set more stringent requirements (to phase out halogen lamps) although this has not yet been translated into firm legislation. The Omnibus study states:

- Japan, the largest LED producer in Asia[53], has explicitly announced that it aims for sales of only LED lamps (or lamps with similar efficacy) from 2020 onwards.
- China (including Taiwan) is the worldwide leading manufacturing economy in CFLs and the runner-up in LED production. At the moment China seems not yet ready to announce a 'LED-only' strategy for the future; in 2012 only the 1st stage of the phasing out of incandescent bulbs, comparable in stringency to the EU's stage 1 in 2009, took effect.[54]
- South-Korea, while following the same path as the EU in phasing out incandescent bulbs, does not foresee an overall 'LED only' before 2020. Until that time, there is a policy to promote LEDs through measures in suitable niche markets such as traffic lights.[55]
- The US is committed to strong R&D support through its Solid State Lighting (SSL) program, but there is no sign of imminent legislation that would set more ambitious minimum requirements on efficacy than the ones already in place[56].
- As far as timing is concerned, there seems to be a consensus between Japan, Korea and the US that 'LED only', at an efficacy of around 200 lm/W and without negative functional impacts, is expected to be possible in 2020.
- Overall, most countries appear to be in a transitional phase as regards considering more stringent minimum efficacy requirements for light sources. LED-technology is considered not yet mature enough to be the only alternative in the residential sector. On the other hand, most policy makers seem convinced that the time for LED-only will come and thus - in the interim - are prudent in implementing intermediate solutions.

The table below contains a summary of the scope and exclusions employed by various countries' MEPS programs.

Country	Scope	Exclusions
Australia	Non-directional lamps. Caps E14, E26, E27, B15, B22d, GU10, bi-pin. Voltage 5-14V or ≥220V. Power <150 W.	traffic signal lamp air or sea navigation lamp oven lamp Infra-red lamp Reinforced construction (rough use or vibration) lamp
China	≤ 100W (~1300 lm) 220-250 V	Special lighting applications including scientific research, medical treatment, trains, shipping, aircraft, traffic vehicles, household appliances, etc
Canada	Screw base. Lumen range 310-2600 lm. 110 - 130 volts.	appliance lamp coloured lamp explosion resistant lamp infrared lamp G-shape lamp with a diameter of 12.7 cm or more T-shape with maximum nominal power of 40 W or a length

[53] Digitimes, *Japan is still LED leader in Asia*, 4 Sept. 2013. Note that Digitimes considers a) Taiwan and mainland China as separate entities and b) looks at market value (not necessarily shipments) when stating Japan's leading position.

[54] LEDinside：China's LED Lighting Market Demand Value May Reach $US 10 Billion in 2015; LED Lighting Sales from Online and Physical Channels to Gradually Increase, April.24, 2013. Note that the 1st stage of the Chinese regulation addresses incandescent bulbs with a power of 100 W or higher.

[55] Ministry of Knowledge Economy and KEMCO, Performance Improvements during the First 19 years and a Vision for the Future, KOREA'S ENERGY STANDARDS & LABELING, 2011.

[56] US Dept. of Energy. Federal Register 10 *CFR Part 430. Energy Conservation Program for Consumer Products etc.*

Country	Scope	Exclusions
		exceeding 25.4 cm Left-hand thread lamp plant lamp sign service lamp a silver bowl lamp traffic signal module pedestrian module street light submersible lamp lamp with screw base size of E5, E10, E11, E12, E17, E26/50×39, E26/53×39, E29/28, E29/53×39, E39, E39d, EP39 or EX39 as specified in ANSI C81.61 lamp of shape B, BA, CA, F, G16-½, G25, G30, S or M-14 or similar shape with maximum wattage of 40 W modified spectrum lamp rough service lamp vibration service lamp shatter resistant lamp lamp with E26d screw bases (for 3-way lamp)
USA	Incandescent or halogen lamps intended for general service applications. Medium screw base. Lumen range 310-2600 lm. 110 - 130 volts.	(I) An appliance lamp. (II) A black light lamp. (III) A bug lamp. (IV) A coloured lamp. (V) An infrared lamp. (VI) A left-hand thread lamp. (VII) A marine lamp. (VIII) A marine signal service lamp. (IX) A mine service lamp. (X) A plant light lamp. (XI) A reflector lamp. (XII) A rough service lamp. (XIII) A shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp). (XIV) A sign service lamp. (XV) A silver bowl lamp. (XVI) A showcase lamp. (XVII) A 3-way incandescent lamp. (XVIII) A traffic signal lamp. (XIX) A vibration service lamp. (XX) A G shape lamp (as defined in ANSI C78.20–2003 and C79.1–2002 3 with a diameter of 5 inches or more. (XXI) A T shape lamp (as defined in ANSI C78.20–2003 and C79.1–2002) and 4 that uses not more than 40 watts or has a length of more than 10 inches. (XXII) A B, BA, CA, F, G16–1/2, G–25, G30, S, or M–14 lamp (as defined in ANSI C79.1–2002 and ANSI C78.20–2003) of 40 watts or less.

Table 19 Scope and exclusions of the various countries' MEPS programs, non-directional incandescent and halogen lamps

The MEPS efficacy requirements, for a range of countries, for non-directional incandescent and halogen lamps can be seen in the figure below[57]. Note that an efficacy conversion has been used in order to "normalise" the North American (120V) lamp efficacy requirements in this figure (normalisation method was devised in the same study as the figure is sourced from).

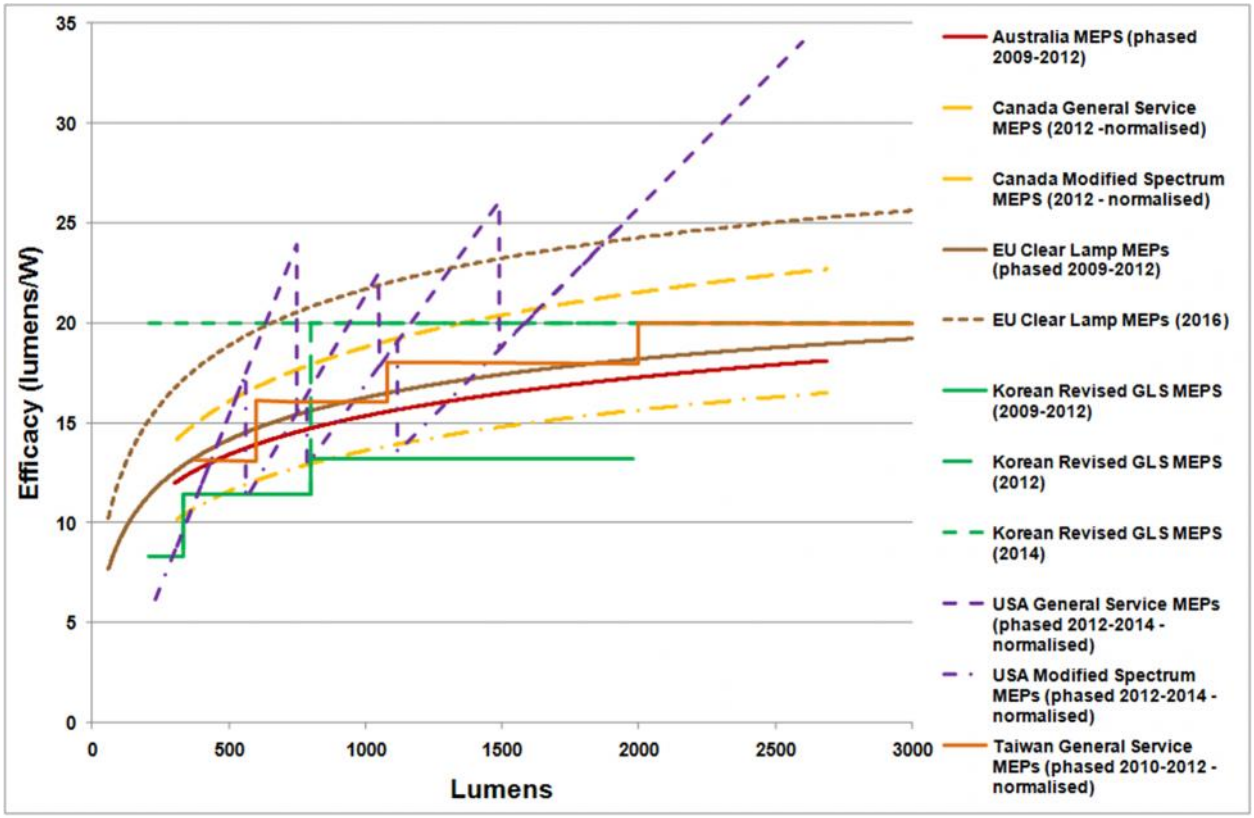


Figure 83 Comparison of MEPS requirements for different countries, non-directional incandescent and halogen lamps

The key MEPS functionality requirements, for a range of countries, for non-directional incandescent and tungsten halogen lamps are shown in the table below.

Country	Minimum Lifetime	Minimum Lumen Maintenance	Minimum CRI
EU	2000 hrs	85% at 75% of life	-
USA	1000 hrs	-	80
Canada	1000 hrs	-	80
Australia	2000 hrs	80% at 75% of life	-
China	-	-	--

Table 20 MEPS functionality requirements for non-directional incandescent and tungsten halogen lamps

[57] http://mappingandbenchmarking.iea-4e.org/shared_files/231/download

J.1.1 Korea

Korea has had energy efficiency regulatory standards for lighting for an extended period. MEPS and grade standards were first applied to incandescent lamps and fluorescent lamps in 1992, and CFLs in 1999. Certification of LEDs has recently been introduced.

After the enforcement of the first standards, there were strengthening and expansion of the scope many times as outlined below.

However, In spite of government efforts to promote compact fluorescent lamps and LED lamps (a voluntary program with financial incentives), incandescent lamps still exceed compact fluorescent lamps in sales. The existing government policies are not able to overcome the barriers to market transformation because of the relatively cheap price of incandescent lamps compare to compact fluorescent lamps. This shows that there is limit on market transformation with the implementation of a voluntary policy.

On December 15th 2008, the National Energy Saving Implementation Committee (Chair: Prime Minister) decided to phase out low efficiency incandescent lamps from the market.

MEPs are employed as a policy tool to phase out incandescent lamps. In other words, incandescent lamps are phased out by raising the standards of MEPS to a level (20 lm/W) so that the incandescent lamps (average efficiency: 10~15 lm/W) are no longer able to manufactured or sold in the market. Phasing out standards were notified on June 16, 2010 and the plan consists of two kinds of policy tool stages.

Phase out plan for incandescent lamp

Rated Wattage	MEPS	
	Phase out	
	1st stage (From Jan 1, 2012)	2st stage (From Jan 1, 2014)
25W ≤ P < 40W	8.3	**20.0** (Phase out)
40W ≤ P < 70W	11.4	**20.0** (Phase out)
70W ≤ P ≤150W	**20.0** (Phase out)	20.0

MEPS

Wattage Range	MEPS(lm/W)		Target (Lm/w) *(see efficiency grades)*
	Jan 2012~	Jan 2014~	
25W ≤ P < 40W	8.3	20.0	10.9
40W ≤ P < 70W	11.4	20.0	15.0
70W ≤ P ≤ 150W	20.0	20.0	17.4

Efficiency Grade[58]

R	Grade
R ≤ 1.00	1
1.00 < R ≤ 1.08	2
1.08 < R ≤ 1.16	3
1.16 < R ≤ 1.24	4
1.24 < R ≤ 1.32	5

R= Target (lm/W) / tested efficiency (lm/W)

Table 21 Korean MEPS program

J.2 Directional incandescent and halogen lamps

The table below contains a summary of the scope and exclusions employed by various countries' MEPS programs.

Country	Scope	Exclusions
USA	Inner reflective coating on the outer bulb to direct the light. Shapes R, PAR, ER, BR, BPAR, or similar bulb shape. E26 medium screw base. 115 - 130 volts. Diameter > 2.25 inches. Rated wattage 40 watts or higher.	Coloured. Rough or vibration service applications. IRLs rated at 50 watts or less that are ER30, BR30, BR40, or ER40 lamps. IRLs rated at 65 watts that are BR30, BR40, or ER40 lamps, R20. IRLs rated 45 watts or less.
Canada	Bulb shape as described in ANSI C79.1 or similar. Medium screw base 100-130 V. Diameter > 57 mm (2.25 inches) 40 - 205 W.	BR30 or BR40 lamp with power up to 50W or 65W. R20 lamp with a power of not more than 45W. Silver bowl lamp. Lamp for heat-sensitive applications.
Australia	ELV halogen reflector Shapes MR11-16 Voltage 5-14 V	Traffic signal lamp. Air or sea navigation lamp. Oven lamp. Infra-red lamp. Reinforced construction (rough use or vibration) lamp.

Table 22 Scope and Exclusions of various countries' MEPS programs, directional lamps

[58] Used for labelling and for signalling likely future performance requirements

The US Efficacy requirements are given in the table below[59] (note that p = rated lamp power).

Rated lamp power	Spectrum Modification	Lamp diameter (inches)	Rated voltage	Minimum average lamp efficacy (lm/W)
40-205	Standard Spectrum	>2.5	≥125V	$6.8*P^{0.27}$
			<125V	$5.9*P^{0.27}$
		≤2.5	≥125V	$5.7*P^{0.27}$
			<125V	$5.0*P^{0.27}$
40-205	Modified Spectrum	>2.5	≥125V	$5.8*P^{0.27}$
			<125V	$5.0*P^{0.27}$
		≤2.5	≥125V	$4.9*P^{0.27}$
			<125V	$4.2*P^{0.27}$

Table 23 US efficacy requirements, directional lamps

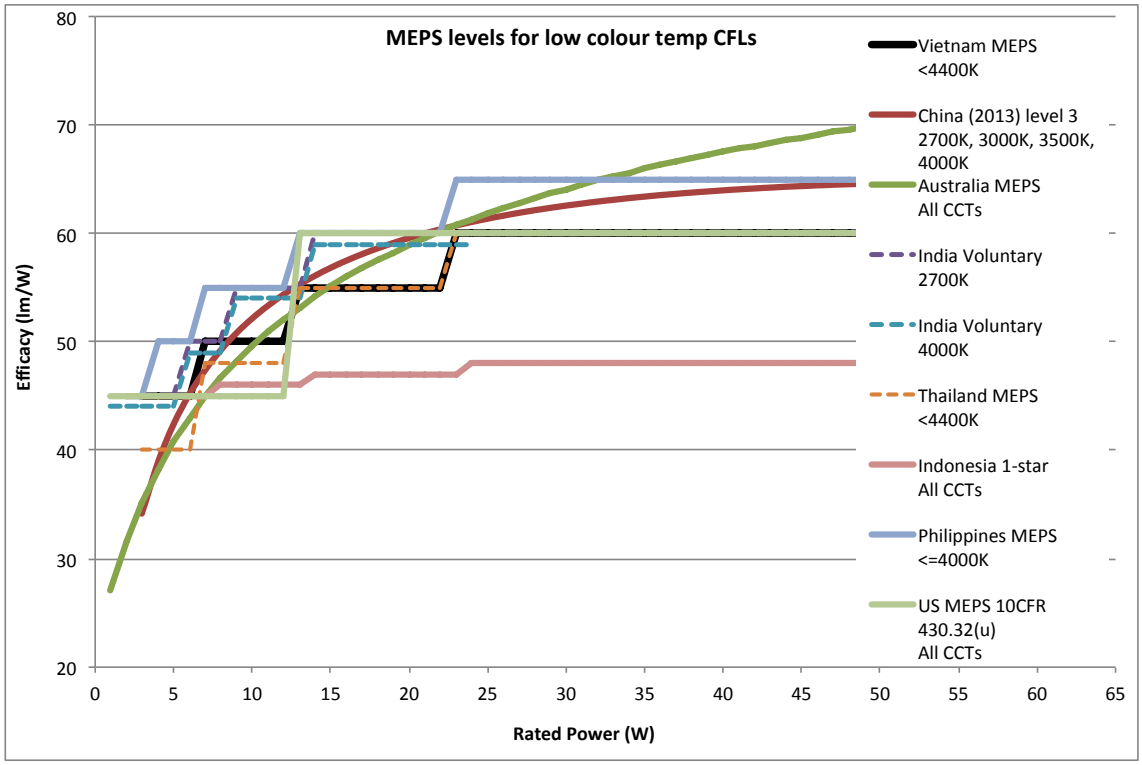
Note that the light output of directional lamps in the US regulation is defined as all forward light emitting from the lamp, as is the case with Australia.

Australia's efficacy requirements for directional lamps are the same as for non-directional, although note that at this time only ELV directional lamps are included in the scope.

J.3 Compact fluorescent lamps with integrated ballast (CFLi)

The mandatory MEPS efficacy requirements for a range of countries' CFLi MEPS programs are shown in the two figures below (non-directional CFLs). Note that many non-efficacy parameters are also regulated by many countries (discussed further below). There may be trade-offs between parameters, meaning that countries that do not regulate some parameters may be able to achieve higher efficacy levels.

[59] http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/58



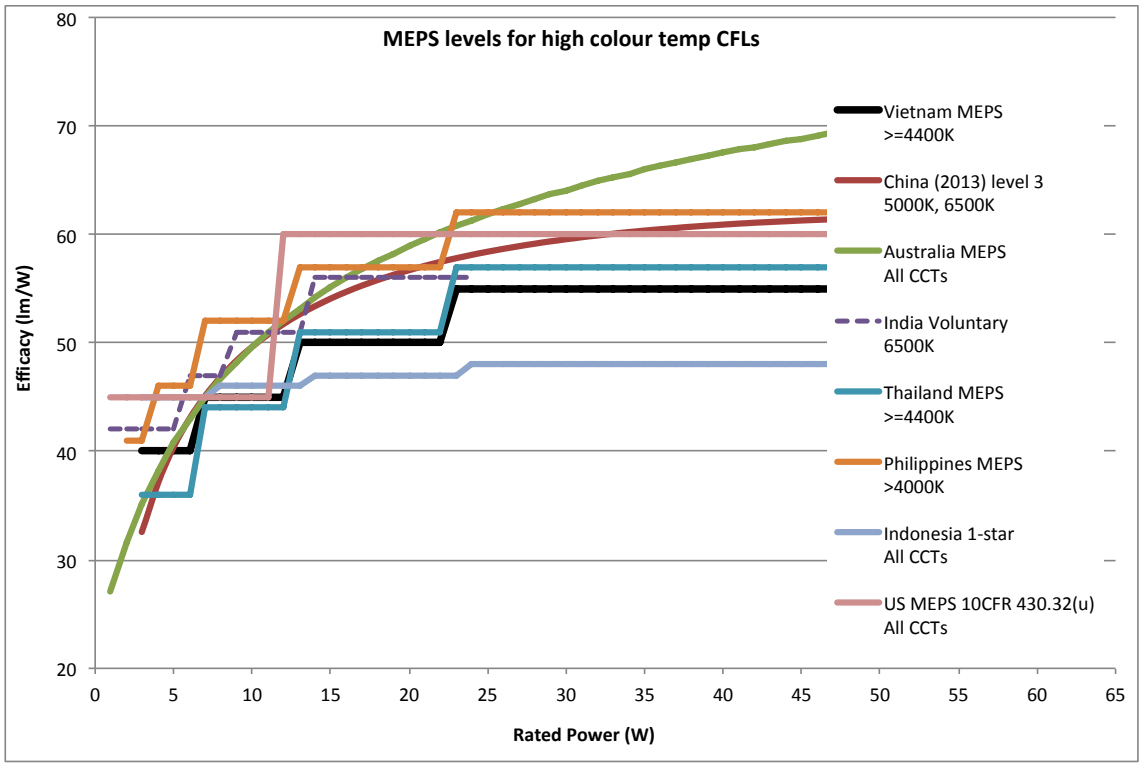


Figure 84 Comparison of MEPS requirements for different countries, low colour temperature CFL (top) and high colour temperature (bottom)

The figure below graphs a range of CFL efficacy testing results, of CFLs purchased in Australia in 2008 [ref]. This figure shows that there is potential to increase the EU MEPS efficacy requirement for CFLs (black line).

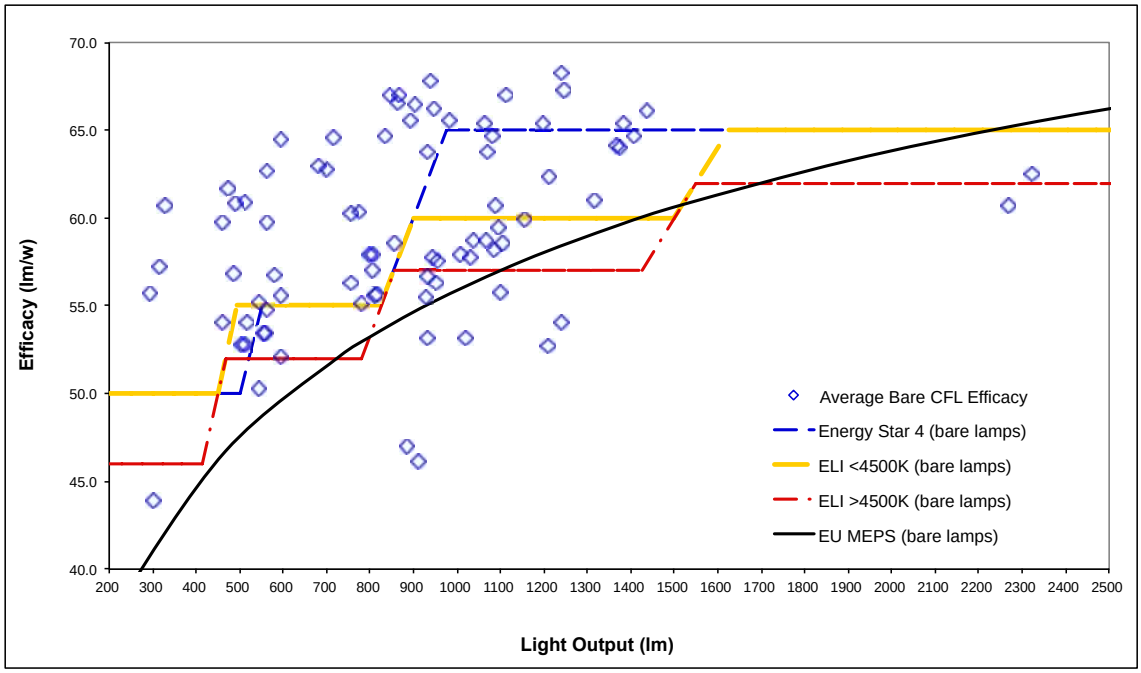


Figure 85 Results of CFP efficacy testing compared to EU MEPS requirements

A 2011 CLASP/en.lighten study[60] entitled Assessment of Opportunities for Global Harmonization of Minimum Energy Performance Standards and Test Standards for Lighting Products summarises mandatory legislation and voluntary standards for CFLi and LED. Comparisons of CFL attributes from this study are shown and discussed below [need to add US MEPS requirements].

The table below shows that a colour rendering index requirement of at least 80 is typical.

Standard	Color Rendering Index Requirement
ALC 2009 (Tier 1,2,3)	>=80
Australia / New Zealand, AS/NZS 4847	Minimum 80
China GB/T 17263.2002	80 for CFLs of RR(6500K) and RZ(5000K) 82 for CFLs of RL(4000K) and RB(3500K) 84 for CFLs of RN(3000K) and RD(2700K)
ELI voluntary standard, March 2011	At least 80, measured in accordance with CIE 13.3.
EU, EC No 244/2009	>=80
IEC 60969-2001 Edition 1.2	IEC 60081
IEC 60969 Ed.2 Draft	Average measured value shall be >=97% (minimum 80) of rated value
Indian Standard (IS) 15111 (Part 2) 2002	N/A
UK EST Lamp Spec, V7.0-2010	>80
US ENERGY STAR (ES) V4.2	80 on average, no more than 3 samples less than 77

Table 24 Colour Rendering Index Requirements

60 http://www.superefficient.org/Resources/~/media/Files/EnLighten%20assessment%20of%20lighting%20MEPS%20harmonization.pdf

The table below shows that a colour variability requirement of 5 SDCM or better is typical.

Standard	CCT and SDCM
ALC 2009	Tier1: Within 7 color steps (SDCM) per the IEC standard Tier1: Within 5 color steps (SDCM) per the IEC standard Tier 3: IEC 60081 Graph D-16 for CCT of 2700K
Australia / New Zealand, AS/NZS 4847	All CCTs are to be approved following IEC 60081 Graph D-16 SDCM: maximum 5 from the target point
China GB/T 17263.2002	Recommend six reference CCTs, others are acceptable on demand. SDCM: maximum 5 from the target point
ELI voluntary standard, March 2011	Must comply with IEC 60969 and the color tolerance shall be within 5SDCM from the target values.
EU, EC No 244/2009	All CCTs *except* for lamps having the following chromaticity coordinates x and y: — x < 0,200 or x > 0,600 — y < – 2,3172 x2 + 2,3653 x – 0,2800 or y > – 2,3172 x2 + 2,3653 x – 0,1000; No requirements on SDCM
IEC 60969-2001 Edition 1.2	Comply with the declaration of manufacturer, vendor or the marking on the lamp. SDCM: maximum 5 from the target point
IEC 60969 Ed.2 Draft	Recommend six reference CCTs. SDCM: maximum 5 from the target point
Indian Standard (IS) 15111 (Part 2) 2002	The standard covers six standardized rated values (CCT) and tolerance areas (SDCM) for fluorescent lamps. (referred to CIE publication 15.2, 1931). For non-standardized products,, rated values shall be assigned by the manufacturer or the vendor. SDCM: maximum 5 from the target point
UK EST Lamp Spec, V7.0-2010	In alignment with EU EC No 244/2009, directive 2005/32/EC SDCM: maximum 5 from the target point
US ENERGY STAR (ES) V4.2	Has to be one out of the six designated CCT values only. SDCM: fall in 7-step ANSI Mac Adam ellipse from the target point

Table 25 Colour Variability Requirements

The table below shows lumen maintenance requirements of various countries. These range from 80-88% at 2000 hours.

Standard	Lumen Maintenance
ALC 2009	Tier 1: 80% of measured 100-hour lumen level after 2,000 hrs Tier 2: 80% of measured 100-hour lumen level after 2,000 hrs Tier 3: 88.1% @ 2,000 hrs 78.1% @ 6,000 hrs 75.1% @ 10,000 hrs
Australia / New Zealand, AS/NZS 4847	On average: 1. At 2 000 h: >= 88 % 2. At 5 000 h: >= 80 % All lamps shall fall within 2 standard deviations of the average.
China GB/T 17263.2002	No less than 80% @ 2000h
ELI voluntary standard, March 2011	The luminous flux of the lamp must be 80% of initial levels at 40% of model's rated lifetime.
EU, EC No 244/2009	At 2 000 h: >= 85 % (>= 80 % if lamps are with second envelope)
IEC 60969-2001 Edition 1.2	No less than manufacturer's declaration
IEC 60969 Ed.2 Draft	Shall meet both of the following requirements: 1. Average measured values shall be >=90% of rated values; 2. Average measured values (@ 40% of lamp life) shall be >=70%
Indian Standard (IS) 15111 (Part 2) 2002	At 2 000 h: >= 85 %

Table 26 Lumen Maintenance Requirements

The table below shows power factor requirements.

Standard	Power Factor Requirements
ALC 2009	Tier 1,2: >=0.5 Tier 3: 0.55 for "normal" , 0.9 for "high"
Australia / New Zealand, AS/NZS 4847	Minimum 0.55; Minimum 0.9 for high PF; Average >=value specified.
China GB/T 17263.2002	Actual value should not be smaller than rated value by over 0.05
ELI voluntary standard, March 2011	Power factor shall be >= 0.5 at maximum power.
EU, EC No 244/2009	Minimum 0.5 if Power <25W; Minimum 0.9 if Power >=25W At Stage 5, Minimum 0.55 for lamps with power <25W; Minimum 0.90 if Power >=25W
IEC 60969-2001 Edition 1.2	N/A
IEC 60969 Ed.2 Draft	Average measured value shall be >=90% of rated value; Minimum 0.50; and 0.90 if high power factor claimed. (measured on average)
Indian Standard (IS) 15111 (Part 2) 2002	Shall comply with the value declared by the manufacturer. (The value of Power Factor is under consideration)
UK EST Lamp Spec, V7.0-2010	Minimum 0.55 if Power <25W; Minimum 0.9 if Power >=25W or claimed as High Power Factor.
US ENERGY STAR (ES) V4.2	Greater than 0.5 on average

Table 27 Power Factor Requirements

The table below shows starting time requirements - these range from 1-4 seconds.

Standard	Lamp Starting Time
ALC 2009	Tier 1,2: 1.5 seconds maximum Tier 3: 2.0 seconds maximum
Australia / New Zealand, AS/NZS 4847	80% of lamp samples shall start within 2 seconds
China GB/T 17263.2002	No longer than 4 seconds for electronic ballast CFL
ELI voluntary standard, March 2011	Must continuously illuminate within 1.5 seconds
EU, EC No 244/2009	Maximum 2 seconds
IEC 60969-2001 Edition 1.2	Comply with manufacturer's declaration
IEC 60969 Ed.2 Draft	80% of lamp samples shall start within 1.5 seconds, with average measured value <=110% of rated value
Indian Standard (IS) 15111 (Part 2) 2002	No longer than 4 seconds
UK EST Lamp Spec, V7.0-2010	Refer to column of "2 sec" in the requirements for "Run-up Time" below.
US ENERGY STAR (ES) V4.2	No longer than 1second

Table 28 Starting Time Requirements

The table below shows run-up time requirements.

Standard	Lamp Run-Up Time
ALC 2009	Tier 1, 2: Up to 3 minutes to reach 80% of light output(should be aligned with changes in IEC standard) Tier 3: >=60% of light output after 1 minute
Australia / New Zealand, AS/NZS 4847	<=60 sec to reach 60% of initial luminous flux.
China GB/T 17263.2002	No longer than 3 min (informative)
ELI voluntary standard, March 2011	Up to 3 minutes to reach 80% of light output
EU, EC No 244/2009	Known as "lamp warm-up to 60% luminous flux":<60 sec; or<120 sec for lamps containing mercury in amalgam form
IEC 60969-2001 Edition 1.2	Comply with manufacturer's declaration
IEC 60969 Ed.2 Draft	Average measured value to 60% of stable luminous flux shall be <= 110% of rated value; Maximum 90 sec.
Indian Standard (IS) 15111 (Part 2) 2002	Within 120 seconds.
UK EST Lamp Spec, V7.0-2010	Class 1: ALL types without a secondary covering or bulb. All wattages up to and including 25W; Class 2: Types with a secondary covering or bulb of 11W and above up to and including 25W; Class 3: Types with a secondary covering or bulb of less than 11W rating; Class7: Lamps with no secondary bulb with wattages >=25 and <= 35. These lamp types must comply with relevant requirements of Classes 1 or 7 as appropriate:

Primary Class	Product	2 sec	60 sec
	Stick		
1	W<11	30	75
1	11<=W<25	35	80
7	25<=W<=35	35	80
	Spiral		
1	W<11	30	75
1	11<=W<15	30	75
1	15<=W<25	30	80
7	25<=W<=35	35	80
	Covered		
3	<11	6	70
2	11<=W<15	10	70
2	15<=W<=25	10	65

US ENERGY STAR (ES) V4.2	1 min for non-amalgam; 3 min for amalgam type, covered and outdoor reflectors

Table 29 Run-up time Requirements

The table below shows lifetime requirements.

Standard	Average Operating Life
ALC 2009	Tier 1: 6000h Tier 2: 8000h Tier 3: 10000h
Australia / New Zealand, AS/NZS 4847	Life of the median lamp (or 11th of sample size of 20) shall be greater than 6000h
China GB/T 17263.2002	No less than 6000h
ELI voluntary standard, March 2011	Must be at least 8,000 hours and lifetime should be clearly indicated in hours on product packaging.
EU, EC No 244/2009	Lamp survival factor at 6000h>=0.5 (life of the median lamp (e.g. 6th of sample size of 11) shall be greater than 6000h); In Stage 5, it required that survival rate is 70% at 6000 hours
IEC 60969-2001 Edition 1.2	No less than manufacturer's declaration
IEC 60969 Ed.2 Draft	The median lamp (or 6th of sample size of 11) shall be greater than rated value, which is 6000h at minimum.
Indian Standard (IS) 15111 (Part 2) 2002	No less than 6000h
UK EST Lamp Spec, V7.0-2010	1. Bare CFLs must be >=10000h for T3 or higher tubes; or >=8000 for T2 or lower tubes; 2. Covered and Reflector CFLs must be>=6000h.
US ENERGY STAR (ES) V4.2	Comply with manufacturer's declaration, but no less than 6000h.

Table 30 Lifetime Requirements

The table below shows rapid switching requirements.

Standard	Rapid Cycle Stress Test /Switching Test
ALC 2009	Tier 1, 2: At least 3,000 cycles based on cycle of 270 seconds off and 30 seconds on Tier 3: N/A
Australia / New Zealand, AS/NZS 4847	>=80% shall operate for number of cycles specified, with a minimum of 3000
China GB/T 17263.2002	N/A
ELI voluntary standard, March 2011	50% of lamp life as switching (i.e., 4000 switches for 8000 hour lamp life claimed). Lamp will be cycled once for every two hours of rated lamp life.

Standard	Rapid Cycle Stress Test /Switching Test
EU, EC No 244/2009	>=half the lamp lifetime expressed in hours; >= 10 000 if lamp starting time > 0.3 s
IEC 60969-2001 Edition 1.2	N/A
IEC 60969 Ed.2 Draft	>=80% of samples shall survive a number of cycles equal to half of the rated lifetime in hours
Indian Standard (IS) 15111 (Part 2) 2002	N/A
UK EST Lamp Spec, V7.0-2010	Same as EC No 244/2009
US ENERGY STAR (ES) V4.2	At least 5 out of 6 samples must survive. Lamp will be cycled once for every two hours of rated lamp life.

Table 31 Rapid Switching Requirements

The table below shows mercury content requirements.

Standard	Mercury Content
ALC 2009	Tier 1,2,3: =<5mg
Australia / New Zealand, AS/NZS 4847	Maximum 5mg.
China GB/T 17263.2002	N/A
ELI voluntary standard, March 2011	Mercury content should be less than 5mg
EU, EC No 244/2009	Maximum 4mg
IEC 60969-2001 Edition 1.2	N/A
IEC 60969 Ed.2 Draft	All samples shall measure <5mg
Indian Standard (IS)	N/A
15111 (Part 2) 2002	
UK EST Lamp Spec, V7.0-2010	N/A
US ENERGY STAR (ES) V4.2	Maximum 5mg for lamps below 25W; 6mg for 25W to 40W

Table 32 Mercury Content Requirements

J.3.1 Korea

MEPS

Category		MEPS (lm/W)	Target (Lm/w) *(see efficiency grades)*
5W ≤ P < 10W	EX-W, EX-N, EX-L	46.1	53.0
	EX-D & etc	45.2	51.9
10W ≤ P < 16W	EX-W, EX-N, EX-L	51.3	58.9
	EX-D & etc	50.4	57.9
16W ≤ P < 21W	EX-W, EX-N, EX-L	58.2	66.9
	EX-D & etc	57.4	66.0
21W ≤ P < 25W	EX-W, EX-N, EX-L	60.0	69.0
	EX-D & etc	59.1	67.9
25W ≤ P ≤ 60W	EX-W, EX-N, EX-L	61.7	70.9
	EX-D & etc	60.9	70.0

EX (Extra, Extraordinary rays): Improved Luminous Flux and Colour Rendering performance with more phosphor (Colour rendering index >= 80). D,N,W,WW,L : Classification according to Colour Temperature: D (Daylight : 5,700~7,100K); N (Neutral White : 4,600~5,400K); W (White : 3,900~4,500K): WW (Warm White : 3,200~3,700K); L (Light : 2,600~3,150K). Source : KS C 7601, KS A 3325

Table 33 Korean MEPS Requirements

Efficiency Grade

R	Switch on and off	Grade
R ≤ 1.00	10,000 times	1
R ≤ 1.00	n/a	2
1.00 < R ≤ 1.05	n/a	3
1.05 < R ≤ 1.10	n/a	4
1.10 < R ≤ 1.15	n/a	5

R= Target(lm/W) / tested efficiency(lm/W)

Table 34 Korean Efficiency Grades

J.4 LED

There are very few countries that have adopted mandatory legislation for LED performance. Known countries include:

- EU
- China and Taiwan
- India
- Malaysia.

The lites.asia group produced a paper[61] in 2013 entitled *Efficient Lighting in Asia: Regional position paper on current status, opportunities and constraints*. The table below is drawn from this study, and shows the status of MEPS and HEPS programs for LEDs in the Asian region.

[61] http://www.lites.asia/downloads/lites-asia-position-paper

Country Name	LEDs									
	MEPS	HEPS	Comparative labelling	Endorsement labelling/	Import registry	Domestic product registry	Mandatory testing	Market surveillance program	Registry of non-compliant products	Fines or penalties
Australia	Under consideration	No	Under consideration	No	Under consideration	Under consideration	Under consideration	Under consideration	No	Under consideration
Bangladesh										
Bhutan										
Brunei Darussalam										
Cambodia	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes
China	Under development	Voluntary (CQC label)	Under consideration	Voluntary (CQC label)	Under consideration	Under consideration	Under consideration	No	No	No
DPR Korea (North)										
Hong Kong			Voluntary (f)							
India	Yes (f)	No (e)	No (e)	No (e)						
Indonesia	Under development	To be considered	To be considered	To be considered	-	-	-	-	-	-
Japan										
Lao PDR	No	No	No	No	Yes	Yes	n/a	n/a	n/a	n/a
Malaysia	Mandatory	-	Voluntary	-	Mandatory	Mandatory	Mandatory	Mandatory	-	Mandatory
Mongolia										
Myanmar										
Nepal										
New Zealand	No	Yes - (ENERGY STAR®)	-	Yes - (ENERGY STAR®)	Yes - (ENERGY STAR®)	-	Yes - ENERGY STAR®)	Yes - (ENERGY STAR®)	-	Yes
Pakistan	-	-	-	-	-	-	-	-	-	-
Papua New Guinea										
Philippines										
Republic of Korea (South)	No	Voluntary	Voluntary	Voluntary	Yes	Yes	Yes	Yes	Yes	Yes
Singapore										
Sri Lanka	Not available currently	Not available currently	Not available currently	Not available currently	No	No	No	No	No	No
Taiwan/Chinese Taipei	Mandatory	-	voluntary	Voluntary	Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	Mandatory
Thailand	-	-	Voluntary	-	-	-	-	-	-	-
Timor-Leste										
Viet Nam	-	-	-	-	-	-	-	-	-	-

Colour Coding:	*Country X*	*Country in Asia Region*
	Country Y	*Country member of ASEAN*
	Country Z	*Country one of the ASEAN "+3"*

Source: lites.asia survey - November 2013[xvii]*; except (e) lites.asia*[xviii]*, (f) UNEP en.lighten initiative*[xix]

Table 35 Status of MEPS and HEPS programs for LEDs in the Asian region

J.4.1 Korea

Detailed High Efficiency Certification Requirements

Dedicated LED lamps with external converter

(Note: Other performance requirements such as minimum lifetime, maximum lumen depreciation, requirements for colour temperature, etc are excluded in this material)

Test method : KS C 7652

Period in Force: 2008.4-

Certification Standard

Wattage	Standards(lm/W)
P ≤ 5	50
5 < P ≤ 10	55
10 < P ≤ 15	58
P > 15	60

Retrofit LED lamps with external converter

Test method : KS C 7651

Period in Force: 2008.4-

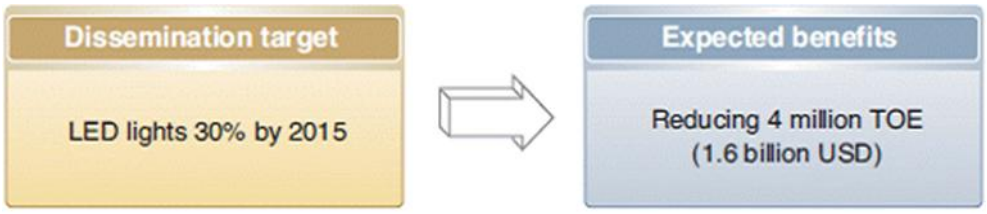
Certification Standard

Wattage	Standards(lm/W)
P ≤ 5	50
5 < P ≤ 10	55
10 < P ≤ 15	58
P > 15	60

Phasing in LED lighting - Targeting share of LED lights up to 30% by 2015

In 2006, MKE announced the "LED lights 15/30 dissemination project". The project aims to increase the share of LED lights to 30% and is thereby expected to save 4 million toe (1,600billion KRW).

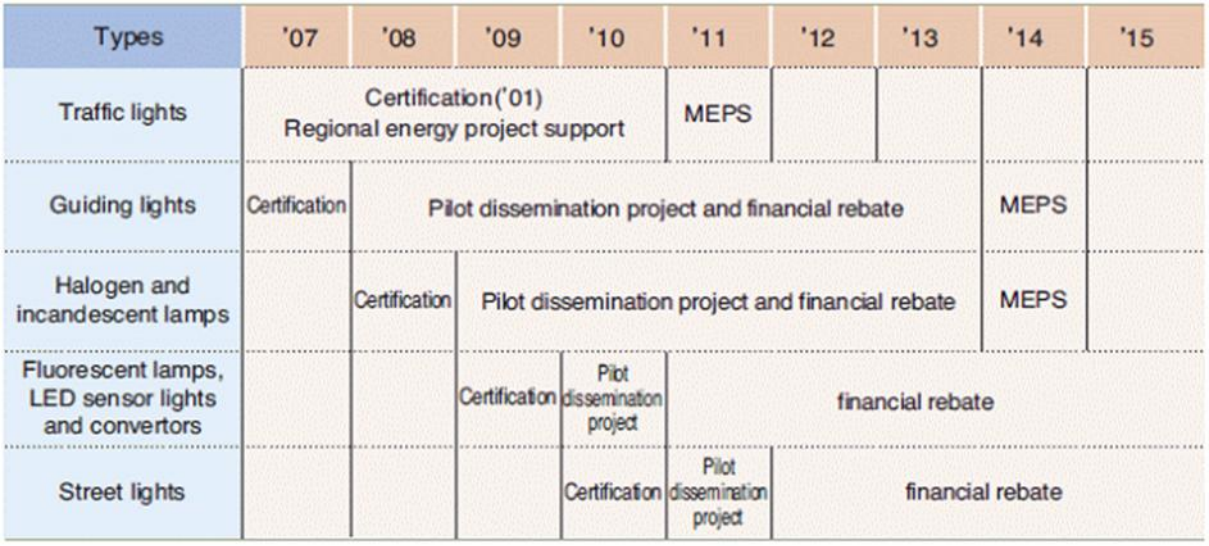
< LED lights 15/30 dissemination project>



Dissemination of LED lights will be implemented by item in accordance with the level of technological development. LED lights will be immediately supplied for traffic lights, guiding lights, and LED lights that replace halogen. For general lights, LED replacements will be used after 2010.

An LED dissemination scenario is shown in the table below which considers the market circumstances and technology development level for each kind of LED lighting equipment.

LED deployment scenario



J.5 Linear fluorescent lamps and ballasts

The table below contains a summary of the scope and exclusions employed by various countries' MEPS programs.

Country	Scope	Exclusions
Canada	rapid-start straight-shaped fluorescent lamp with a nominal overall length of 1200 mm (48 inches), a medium bi-pin base and a nominal power of not less than 28 W rapid-start straight-shaped fluorescent lamp with a nominal overall length of 2400 mm (96 inches), a recessed double-contact base, a nominal power of not less than 95 W and a nominal current of 0.8 A; a rapid-start U-shaped fluorescent lamp with a nominal overall length of not less than 560 mm (22 inches) and not more than 635 mm (25 inches), a medium bi-pin base and a nominal power of not less than 28 W; instant-start straight-shaped fluorescent lamp with a nominal overall length of 2400 mm (96 inches), a single-pin base and a nominal power of not less than 52 W; and any fluorescent lamp that is a physical and electrical equivalent of a lamp described in paragraphs above	fluorescent lamp that is specifically marked and marketed for plant-growth use; cold-temperature fluorescent lamp; coloured fluorescent lamp; fluorescent lamp designed to be impact-resistant; reflectorized or aperture fluorescent lamp; fluorescent lamp designed for use in reprographic equipment; fluorescent lamp primarily designed to produce ultraviolet radiation; or fluorescent lamp with a colour-rendering index of 82 or greater.

Country	Scope	Exclusions
Australia	Double-capped fluorescent lamps length 550-1500mm Nominal lamp power 16 W or more	Lamps with a dominant colour or with an output that is predominantly outside the visible spectrum. Lamps for colour matching and that have a colour rendering index (CRI) greater than 90 and a colour appearance approximating to a point on the black body locus. Lamps that are specifically for use in an industrial or agricultural process. Lamps for medical applications. Lamps that have been given written exemption by the relevant regulatory authority on the grounds that they are for a specific purpose other than general illumination and are clearly distinguishable from lamps for general illumination.
China	Cathode preheating lamp which equips with starter and works on AC frequency circuits Cathode preheating lamp which works on high frequency circuits	

Table 36 Scope and Exclusions for various countries' MEPS programs, LFL and ballasts

The figure below graphs the minimum efficacy requirements for a range of countries. Note that some simplifications have been applied in order to graph the requirements within a single figure. For example, Australian MEPS requirements are described in terms of lamp length, rather than lamp power, which is the case for most other economies. Lamp lengths were therefore converted to lamp power, in order to graph the Australian requirements alongside other economies. This may lead to some confusion, particularly in the case of T5 lamps. In case of any doubt, the legislation and standards for each economy should be consulted for further detail of the various MEPS requirements.

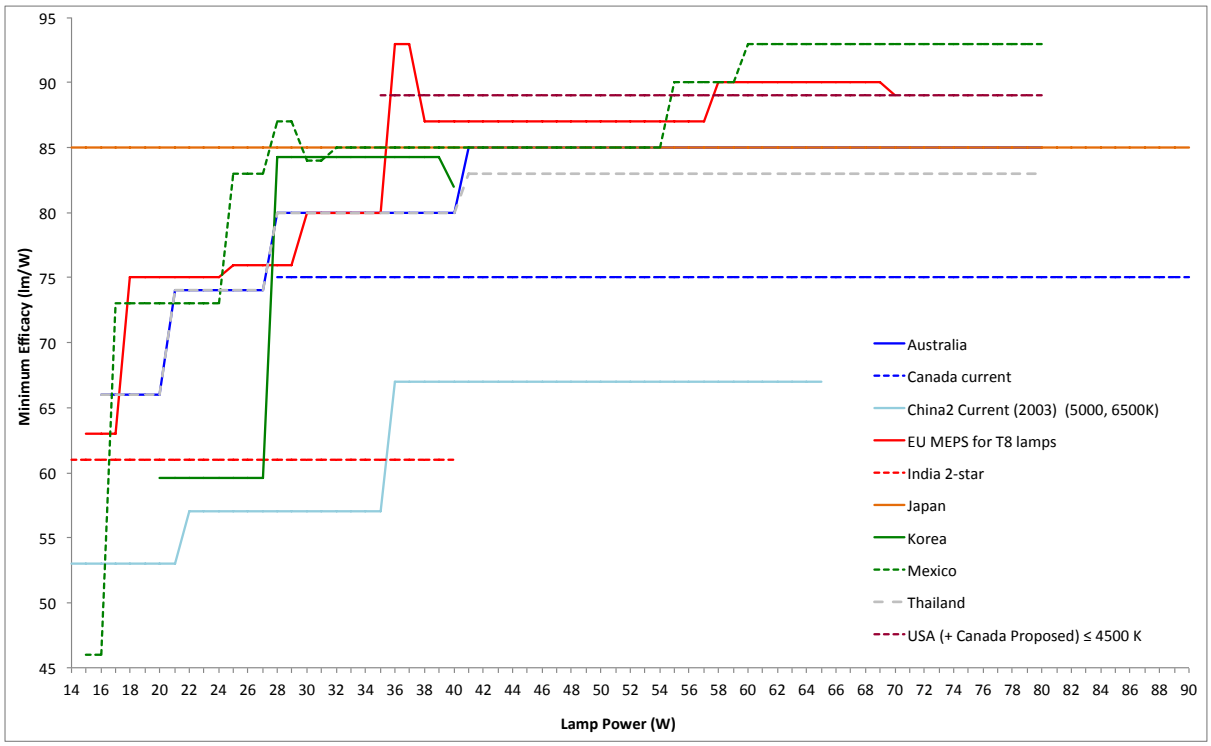


Figure 86 Comparison of MEPS requirements for LFL

From the above figure, we can roughly group the MEPS requirements for these economies into 2 categories:

- High MEPS: MEPS for Australia, Europe, Japan, Korea, Mexico and USA, which require efficacies of 80+ lm/W for 4-foot lamps. Note that Canada currently requires efficacy of 75 lm/W for 4-foot lamps, however Canada has proposed a new MEPS which will harmonize with the USA.
- Low MEPS: countries such as India (note that India has labelling only - no official MEPS program for linear fluorescent lamps exists) and China, which have relatively low requirements for lamps. See section 3.3.1 for an explanation of the Chinese system.

The "high" MEPS requirements (80+ lm/W) will mandate triphosphor lamps, whereas the other MEPS requirements (75 lm/W and lower) will allow halophosphate lamps.

Countries also regulate some non-efficacy parameters for linear fluorescent lamps.

J.5.1 Australia

In Australia, The Equipment Energy Efficiency (E3) Program is a joint initiative of the Australian, Commonwealth, State and Territory governments and the New Zealand Government managed by The Equipment Energy Efficiency (E3) Committee. This committee consists of officials from the Commonwealth, state and territory government agencies as well as representatives of the New Zealand Government. The E3 Committee reports to the Energy Efficiency Working Group and is ultimately directed by the Select Council on Energy Efficiency (SCCC).

MEPS for linear fluorescent lamps are regulated by Greenhouse and Energy Minimum Standards-GEMS62 (Double-capped Fluorescent Lamps) Determination 2012[63].

The scope of linear fluorescent lamp MEPS covers double-capped fluorescent lamps and double-capped lamps with high frequency ballasts ranging from 550mm to 1500mm in length (inclusive) and having a nominal lamp power of 16 Watts or more.

Exclusions: MEPS 2 does not apply to lamps that are clearly not intended for general illumination, specifically:

- Lamps with a dominant colour or with an output that is predominantly outside the visible spectrum.
- Lamps for colour matching and that have a colour rendering index (CRI) greater than 90 and a colour appearance approximating to a point on the black body locus.
- Lamps that are specifically for use in an industrial or agricultural process.
- Lamps for medical applications.
- Lamps that have been given written exemption by the relevant regulatory authority on the grounds that they are for a specific purpose other than general illumination and are clearly distinguishable from lamps for general illumination.

Linear fluorescent lamps manufactured in or imported into Australia or New Zealand must comply with Minimum Energy Performance (MEPS) requirements which are set out in AS/NZS 4782.2. The MEPS for linear fluorescent lamps in AS/NZS 4782.2 are set out as minimum luminous efficacy in lumens per Watt for various lamp sizes. There are also requirements for minimum CRI and mercury content. The test methods[64] for measurement luminous efficacy are set out in AS/NZS 4782.1 and AS/NZS 4782.3.

When measured in accordance with AS/NZS 4782.1 the initial efficacy (at 100 hours) and the maintained efficacy (at 5000 hours) shall exceed the values specified in the table below. Lamps shall also have a CRI which exceeds the value in the table below.

Lamp nominal length L (mm) mandatory	550 < L < 700	700 < L < 1150	1150 < L < 1350	1350 < L < 1500
Lamp typical power (watts)(informative)	16 – 24	17 – 40	28 – 50	35 – 80
Initial Efficacy Maintained Efficacy	*F* 100 > 66.0 and *F*M > 57.5	*F* 100 > 74.0 and *F*M > 61.0	*F* 100 > 80.0 and *F*M > 70.0	*F* 100 > 85.0 and *F*M > 70.0
Minimum CRI	79	79	79	79

Table 37 Australian requirements for LFL, lamps

The maximum quantity of mercury present in fluorescent lamps shall not exceed 15 mg. The quantity of mercury present is determined in accordance with the relevant clauses of AS/NZS 4782.3.

MEPS for Ballasts are regulated by GEMS determination for ballast[65]. Ballasts for fluorescent lamps manufactured in or imported into Australia or New Zealand must comply with Minimum Energy Performance (MEPS) requirements which are set out in AS/NZS 4783.2.

62 GEMS determination is a legislative instrument that sets the regulatory requirements for that product and establishes which version of the relevant standard is applicable – usually the version that existed at the time the determination was made.
63 http://www.comlaw.gov.au/Details/F2012L02127
64 http://www.energyrating.gov.au/regulations/product-standards/overview/asnzs4782/
65 http://www.comlaw.gov.au/Details/F2012L02133

MEPS apply to the following types of ballasts:

- Magnetic and electronic ballasts used with fluorescent lamps with a rated power 10W to 70W
- For use on 50 Hz supplies of 230/240/250V (or a range that includes these)
- Ballasts supplied as separate components or as part of a luminaire.

Ballasts within the scope of MEPS must also be marked with their energy efficiency by way of their Energy Efficiency Index (EEI), the details of which are also specified in AS/NZS 4783.2. AS/NZS 4783.2 also requires that ballasts within the scope of MEPS be designed to comply with the relevant performance requirements of IEC 60921 for magnetic ballasts and IEC 60929 for electronic ballasts. These standards are also published by Standards Australia and New Zealand as AS/NZS 60921 and AS/NZS 60929.

MEPS do not apply to the following types of ballasts:

- Primarily for use on DC supplies or batteries;
- Primarily for the production of light (radiation) outside the visible spectrum;
- To exit signs within the scope of AS/NZS 2293;
- To hazardous area lighting equipment within the scope of AS/NZS 2380, AS/NZS 60079 and AS/NZS 61241.

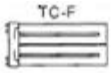
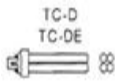
The Minimum Energy Performance Standards (MEPS) requirements are set out as maximum allowable total circuit power when tested in accordance with AS/NZS 4783.1. These are set out in the tables below when tested to AS/NZS4783.1.

Lamp Type and Arrangement	Nominal Lamp Power* Watts	ILCOS Code	Maximum Corrected Total Input Power, Watts						
			Energy Efficiency Index (EEI) Classification						
			A1#	A2	A3	B1	B2	C	D
Linear 	15	FD-15-E-G13-26/450	≤18.0	≤16.0	≤18.0	≤21.0	≤24.0	≤25.0	>25.0
	18	FD-18-E-G13-26/600	≤21.0	≤19.0	≤21.0	≤24.0	≤27.0	≤28.0	>28.0
	30	FD-30-E-G13-26/895	≤33.0	≤31.0	≤33.0	≤36.0	≤39.0	≤40.0	>40.0
	36	FD-36-E-G13-26/1200	≤38.0	≤36.0	≤38.0	≤41.0	≤44.0	≤45.0	>45.0
	38	FD-38-E-G13-26/1047	≤40.0	≤38.0	≤40.0	≤43.0	≤46.0	≤47.0	>47.0
	58	FD-58-E-G13-26/1500	≤59.0	≤55.0	≤59.0	≤64.0	≤68.0	≤70.0	>70.0
	70	FD-70-E-G13-26/1800	≤72.0	≤68.0	≤72.0	≤77.0	≤81.0	≤83.0	>83.0

NOTES:
1. Refer to AS/NZS 61231, International Lamp Coding System (ILCOS).
2. Applies only to mains frequency magnetic ballasts with two-wire connection and with an external starter.
* Nominal values shown may have different rating values. Refer to the relevant lamp data sheet.
# Refer Clause 5.3.2

Lamp Type and Arrangement	Nominal Lamp Power* Watts	ILCOS Code	Maximum Corrected Total Input Power, Watts						
			Energy Efficiency Index (EEI) Classification						
			A1#	A2	A3	B1	B2	C	D
Linear	15	FD-15-E-G13-26/450	≤18.0	≤16.0	≤18.0	≤21.0	≤23.5	≤25.0	>25.0

	18	FD-18-E-G13-26/600	≤21.0	≤19.0	≤21.0	≤24.0	≤26.5	≤28.0	>28.0
	30	FD-30-E-G13-26/895	≤33.0	≤31.0	≤33.0	≤36.0	≤38.5	≤40.0	>40.0
	36	FD-36-E-G13-26/1200	≤38.0	≤36.0	≤38.0	≤41.0	≤43.5	≤45.0	>45.0
	38	FD-38-E-G13-26/1047	≤40.0	≤38.0	≤40.0	≤43.0	≤45.5	≤47.0	>47.0
	58	FD-58-E-G13-26/1500	≤59.0	≤55.0	≤59.0	≤64.0	≤67.5	≤70.0	>70.0
	70	FD-70-E-G13-26-1800	≤72.0	≤68.0	≤72.0	≤77.0	≤80.5	≤83.0	>83.0
NOTES: 1. Refer to AS/NZS 61231, International Lamp Coding System (ILCOS). 2. Applies only to mains frequency magnetic ballasts with two-wire connection and with an external starter. * Nominal values shown may have different rating values. Refer to the relevant lamp data sheet. # Refer Clause 5.3.2									

Lamp Type and Arrangement	**Nominal Lamp Power* Watts**	**ILCOS Code**	**Maximum Corrected Total Input Power, Watts**						
			Energy Efficiency Index (EEI) Classification						
			A1#	**A2**	**A3**	**B1**	**B2**	**C**	**D**
Linear 	15	FD-15-E-G13-26/450	≤18.0	≤16.0	≤18.0	≤21.0	≤23.0	≤25.0	>25.0
	18	FD-18-E-G13-26/600	≤21.0	≤19.0	≤21.0	≤24.0	≤26.0	≤28.0	>28.0
	30	FD-30-E-G13-26/895	≤33.0	≤31.0	≤33.0	≤36.0	≤38.0	≤40.0	>40.0
	36	FD-36-E-G13-26/1200	≤38.0	≤36.0	≤38.0	≤41.0	≤43.0	≤45.0	>45.0
	38	FD-38-E-G13-26/1047	≤40.0	≤38.0	≤40.0	≤43.0	≤45.0	≤47.0	>47.0
	58	FD-58-E-G13-26/1500	≤59.0	≤55.0	≤59.0	≤64.0	≤67.0	≤70.0	>70.0
	70	FD-70-E-G13-26-1800	≤72.0	≤68.0	≤72.0	≤77.0	≤80.0	≤83.0	>83.0
Compact 2 Tube 	18	FSD-18-E-2G11	≤21.0	≤19.0	≤21.0	≤24.0	≤26.0	≤28.0	>28.0
	24	FSD-24-E-2G11	≤27.0	≤25.0	≤27.0	≤30.0	≤32.0	≤34.0	>34.0
	36	FSD-36-E-2G11	≤38.0	≤36.0	≤38.0	≤41.0	≤43.0	≤45.0	>45.0
	40	FSDH-40-L/P-2G11	≤46.0	≤44.0	≤46.0	-	-	-	-
	55	FSDH-55-L/P-2G11	≤46.0	≤44.0	≤46.0	-	-	-	-
Compact 4 Tube Flat 	18	FSS-18-E-2G10	≤21.0	≤19.0	≤21.0	≤24.0	≤26.0	≤28.0	>28.0
	24	FSS-24-E-2G10	≤27.0	≤25.0	≤27.0	≤30.0	≤32.0	≤34.0	>34.0
	36	FSS-36-E-2G10	≤38.0	≤36.0	≤38.0	≤41.0	≤43.0	≤45.0	>45.0
Compact 4 Tube (not flat) 	10	FSQ-10-E-G24q = 1 FSQ-10-I-G24d = 1	≤13.0	≤11.0	≤13.0	≤14.0	≤16.0	≤18.0	>18.0
	13	FSQ-10-E-G24q = 1 FSQ-10-I-G24d = 1	≤16.0	≤14.0	≤16.0	≤17.0	≤19.0	≤21.0	>21.0
	18	FSQ-18-E-G24q = 2 FSQ-18-I-G24d = 2	≤21.0	≤19.0	≤21.0	≤24.0	≤26.0	≤28.0	>28.0
	26	FSQ-26-E-G24q = 3 FSQ-26-I-G24d = 3	≤29.0	≤27.0	≤29.0	≤32.0	≤34.0	≤36.0	>36.0
Compact 6 Tube	18	FSM-18-I-GX24d = 2	≤21.0	≤19.0	≤21.0	≤24.0	≤26.0	≤28.0	>28.0

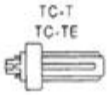
Lamp Type and	Nominal	ILCOS Code	Maximum Corrected Total Input Power, Watts						
		FSM-18-E-G24q = 2							
	26	FSM-26-I-GX24d = 3 FSM-13-E-G24q = 1	≤29.0	≤27.0	≤29.0	≤32.0	≤34.0	≤36.0	>36.0
	32	FSSMH-32-L/P-GX24q=4	≤39.0	≤36.0	≤39.0	-	-	-	-
	42	FSMH-42-L/P-GX24q = 4	≤49.0	≤46.0	≤49.0	-	-	-	-
Compact 2D (double D) 	10	FSS-10-E-GR10q FSS-10-L/P/H-GR10q	≤13.0	≤11.0	≤13.0	≤14.0	≤16.0	≤18.0	>18.0
	26	FSS-16-I-GR8 FSS-16-E-GR10q FSS-16-L/P/H-GR10q	≤19.0	≤17.0	≤19.0	≤21.0	≤23.0	≤25.0	>25.0
	21	FSS-21-E-GR10q FSS-21-L/P/H-GR10q	≤24.0	≤22.0	≤24.0	≤27.0	≤29.0	≤31.0	>31.0
	28	FSS-28-I-GR8 FSS-28-E-GR10q FSS-28-L/P/H-GR10q	≤31.0	≤29.0	≤31.0	≤34.0	≤36.0	≤38.0	>38.0
	38	FSS-38-E-GR10q FSS-38-L/P/H-GR10q	≤40.0	≤38.0	≤40.0	≤43.0	≤45.0	≤47.0	>47.0
	55	FSS-55-E-GRY10q = 3 FSS-55-L/P/H-GRY10q = 3	≤63.0	≤59.0	≤63.0	-	-	-	-
NOTE: Refer to AS/NZS 61231, International Lamp Coding System (ILCOS) *** Nominal values shown may have different rating values. Refer to the relevant lamp data sheet.**									

Table 38 Australian requirements for LFL, ballasts

Test Standards: Regulatory standards for ballasts are published jointly by Standards Australia and Standards New Zealand and are the following:

- AS/NZS 4783.1:2001: Performance of electrical lighting equipment – Ballasts for fluorescent lamps Part 1: Method of measurement to determine energy consumption and performance of ballast-lamp circuits.
- AS/NZS 4783.2:2002: Performance of electrical lighting equipment – Ballasts for fluorescent lamps Part 2: Energy labelling and minimum energy performance standards requirements.

J.5.2 Canada

The *Energy Efficiency Act* was passed by the Canadian Parliament in 1992.It provides for the making and enforcement of regulations concerning minimum energy-performance levels for energy-using products, as well as the labelling of energy-using products and the collection of data on energy use. The first *Energy Efficiency Regulations* came into effect in February 1995. Linear fluorescent lamps were among the earlier batch of regulated products. The Regulations are administered by Natural Resources Canada (NRCan). The lamp regulations are currently under review as part of Amendment 13[66] to the Energy Efficiency Regulations.

The MEPS for fluorescent lamps (including LFLs) in Canada was introduced in Amendment 1 of the *Energy Efficiency Regulation*. The MEPS is named "Energy Efficiency Regulations Technical Requirements for Energy-Using Products - General Service Fluorescent Lamps" and is administered by Natural Resources Canada.

The standard covers a variety of fluorescent lamps with different shapes, configurations and powers. The detailed scope is as follows:

- a rapid-start straight-shaped fluorescent lamp with a nominal overall length of 1200 mm (48 inches), a medium bi-pin base and a nominal power of not less than 28 W
- a rapid-start straight-shaped fluorescent lamp with a nominal overall length of 2400 mm (96 inches), a recessed double-contact base, a nominal power of not less than 95 W and a nominal current of 0.8 A;
- a rapid-start U-shaped fluorescent lamp with a nominal overall length of not less than 560 mm (22 inches) and not more than 635 mm (25 inches), a medium bi-pin base and a nominal power of not less than 28 W;
- an instant-start straight-shaped fluorescent lamp with a nominal overall length of 2400 mm (96 inches), a single-pin base and a nominal power of not less than 52 W; and
- any fluorescent lamp that is a physical and electrical equivalent of a lamp described in paragraphs (a), (b), (c) or (d);

but does not include:

- a fluorescent lamp that is specifically marked and marketed for plant-growth use;
- a cold-temperature fluorescent lamp;
- a coloured fluorescent lamp;
- a fluorescent lamp designed to be impact-resistant;
- a reflectorized or aperture fluorescent lamp;
- a fluorescent lamp designed for use in reprographic equipment;
- a fluorescent lamp primarily designed to produce ultraviolet radiation; or
- a fluorescent lamp with a colour-rendering index of 82 or greater.

The minimum efficacies for general service fluorescent lamps are listed in the table below

[66] See http://www.nrcan.gc.ca/energy/regulations-codes-standards/6853 for details

Lamp type	Nominal lamp wattage	Average CRI	Minimum average lamp efficacy (lm/w)
1200 mm (48 in.) medium bi-pin base, rapid-start	> 35 W	69	75.0
	≤ 35 W	45	75.0
560 to 635 mm (22 to 25 in.) U-shaped, rapid-start	> 35 W	69	68.0
	≤ 35 W	45	64.0
2400 mm (96 in.) High output, recessed double-contact base, rapid-start	> 100 W	69	80.0
	≤ 100 W	45	80.0
2400 mm (96 in.) Slimline, single-pin base, instant-start	> 65 W	69	80.0
	≤ 65W	45	80.0
Where CRI = colour-rendering index and lm/W = lumens per watt			

Table 39 Canadian requirements for LFL, lamps

Both ENERGUIDE label and EnergyStar label programs are implemented in Canada. However linear fluorescent lamps are not included in either program.

The MEPS for fluorescent lamp ballasts is the "Energy Efficiency Regulations Technical Requirements for Energy-Using Products - Fluorescent Lamp Ballasts" and is administered by Natural Resources Canada.

Applies to fluorescent lamp ballasts:

- used to start and operate fluorescent lamps by providing a starting voltage and current, limiting the current during normal operation, and where necessary to facilitate lamp operation, providing cathode heating
- designed for input of 120, 277 or 347 volts, and
- designed to operate with an F32T8, F34T12, F40T10 or F40T12 rapid-start fluorescent lamp or an F96T12IS, F96T12ES, F96T12HO or F96T12HO ES fluorescent lamp

The detailed requirements of the MEPS are listed in the table below.

Application for Operation of:	Ballast Input Voltage V	Total Nominal Lamp Wattage W	Minimum Ballast Efficacy Factor
One F40T12 Lamp*	120	40	2.29
	277	40	2.29
	347	40	2.22
Two F40T12 Lamps	120	80	1.17
	277	80	1.17
	347	80	1.12
Two F34T12 Lamps	120	68	1.35
	277	68	1.35
	347	68	1.29
Two F96T12(IS) Lamps**	120	150	0.63
	277	150	0.63
	347	150	0.62
Two F96T12(ES) Lamps	120	120	0.77
	277	120	0.77
	347	120	0.76
Two 110W F96T12 HO Lamps	120	220	0.390
	277	220	0.390
	347	220	0.390
Two F96T12 HO(ES) Lamps	120	190	0.42
	277	190	0.42
	347	190	0.41
Two F32TS Lamps	120	64	1.250
	277	64	1.230
	347	64	1.200
*Also for use on 40W/48T10/RS lamps **Also for use on 60W/96T12/IS lamps			

Table 40 Canadian requirements for LFL, ballasts

Other Requirements:

- All ballasts must have a power factor of at least 0.9 except for ballasts designed for 120 volt input and to operate F32T8 rapid-start fluorescent lamps that have a colour rendering index greater than 75 where the power factor must be at least 0.5.
- BEF = relative light output for rapid-start lamps/power input (watts)
- BEF = relative lamp power for instant-start lamps/power input (watts)
- BEF = relative light output for instant-start lamps (high frequency *ballasts*)/power input (watts)
- Test Procedure:
- Test Standard: CSA C654-M91
- Samples:
- Aging: per ANSI C82.2
- Ambient temp: per ANSI C82.2
- Ambient relative humidity: per ANSI C82.2
- Voltage and frequency: ANSI C82.2
- Methodology: per ANSI C82.2
- Key equipment: per ANSI C82.2
- Tolerances: ANSI C82.2

- Calculations/algorithms/assumptions: ANSI C82.2

J.5.3 China

Since 1989, China has implemented over 48 MEPS for energy-using products. China's mandatory comparative labelling scheme started in 2005 and now covers over 29 categories of products. A voluntary energy efficiency program named the Voluntary Energy-saving Certification Mark is also in place and now covers over 100 products. Linear fluorescent lamps (also known as double-capped fluorescent lamps) are covered both in the MEPS program and the voluntary Energy-saving Certification program.

The MEPS for linear fluorescent lamps in China was first introduced in 2003 and revised in 2013. The standard, "Minimum allowable values of energy efficiency and the energy efficiency grades of double-capped fluorescent lamps for general lighting service" (GB 19043-2013), defines energy efficiency tiers, energy efficient performance requirements, minimum energy performance requirements, as well as the test methods associated for linear fluorescent lamps. The standard was co-issued by Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) and The Standardization Administration of the People's Republic of China (SAC).

The MEPS program covers linear fluorescent lamps for general purposes. The standard is applicable to two types of lamps under this scope:

- Cathode preheating lamp which equips with starter and works on AC frequency circuits;
- Cathode preheating lamp which works on high frequency circuits.

The MEPS classified LFLs into three energy efficiency tiers, with Tier 1 being the most efficient and Tier 3 being the least efficient. Tier 3 is the minimum energy performance requirement, which must be met by all LFLs entering the market. The table below details the energy efficiency tier requirements for different LFL products. Requirements for lamps with different colour temperature also differed. The initials representing different colour temperatures in the two tables below. In addition, all LFLs must satisfy the requirements for lumen maintenance and product life which were set in Double-capped fluorescent lamps - Performance specifications (GB/T 10682-2010).

The MEPS also specified that LFLs with Tier 2 efficiencies were regarded as energy efficient products.

	Diameter (mm)	Rated power (W)	Additional Info	Initial luminous efficacy (lm/W)					
				RR, RZ			RL, RB, RN and RD		
				Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3
Cathode preheating lamp which equips with starter and works on AC frequency circuits	26	18		70	64	50	75	69	52
		30		75	69	53	80	73	57
		36		87	80	62	93	85	63
		58		84	77	59	90	82	62
Cathode preheating lamp which works on high frequency circuits	16	14	High luminous efficacy series	80	77	69	86	82	75
		21	High luminous efficacy series	84	81	75	90	86	83
		24	High lumen series	68	66	65	73	70	67
		28	High luminous efficacy series	87	83	77	93	89	82
		35	High luminous efficacy series	88	84	75	94	90	82
		39	High lumen series	74	71	69	79	75	71
		49	High lumen series	82	79	75	88	84	79
		54	High lumen series	77	73	67	82	78	72
		80	High lumen series	72	69	63	77	73	67
	26	16		81	75	66	87	80	75
		23		84	77	76	89	86	85
		32		97	89	78	104	95	84
		45		101	93	85	108	99	90

Table 41 Chinese requirements for LFL, lamps

Definition for colour temperatures (China):

	Colour Temp. (K)
RR	6500
RZ	5000
RL	4000
RB	3500
RN	3000
RD	2700

Table 42 Definition for Colour Temperatures in China

LFLs were included in the endorsement labelling program, the CQC Energy Conservation Certification program implemented by China Quality Certification Centre.

LFLs must meet all the requirements in “Energy Conservation Certification Rules for Double-Capped Fluorescent Lamps for General Lighting Service (CQC31-465132-2013)” in order to be endorsed for the CQC Energy Conservation Certification label

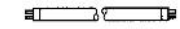
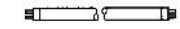
The scope, test method, and evaluation of the CQC certification program are very similar to the mandatory MEPS program. Requirements for CQC certification are the same as the Tier 2 requirements set in the mandatory MEPS program.

The MEPS for tubular fluorescent lamps in China were first introduced in 1999 and revised in 2013. The standard, "Minimum allowable values of energy efficiency and the energy efficiency grades of ballasts for tubular fluorescent lamps" (GB 19043-2012), defines energy efficiency tiers, energy efficient performance requirements, minimum energy performance requirements, as well as the test methods associated for ballasts. The standard was co-issued by Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) and The Standardization Administration of the People's Republic of China (SAC).

Several international standards and regulations including, "Measurement method of total input power of ballast-lamp circuits" (EN 50294) and EU regulations (EC) No. 245/2009 and (EU) No. 347/2010, were used as reference in the development of the Chinese standard.

This standard is applicable to Magnetic ballasts and electronic ballasts with rated power between 4W to 120W and works under 220V and 50Hz AC power supply.

The MEPS covers both electronic and Magnetic ballasts but the requirements for energy efficiency tiers are different. The MEPS classified electronic ballasts without brightness control into three energy efficiency tiers, with Tier 1 being the most efficient and Tier 3 being the least efficient. Tier 3 is the minimum energy performance requirement, which must be met by all electronic ballasts entering the market. The table below details the energy efficiency tier requirements for electronic ballasts. Ballasts with brightness control should be tested at 100% of luminous output and in addition, they must meet the maximum system input power requirement when tested at 25% luminous output, as specified below

Lamps information					Ballasts efficiency (%)		
Type and illustration		**Nominal power (W)**	**International code**	**Rated power (W)**	**Tier 1**	**Tier 2**	**Tier 3**
T8		15	FD-15-E-G13-26/450	13.5	87.8	84.4	75.0
T8		18	FD-18-E-G13-26/600	16	87.7	84.2	76.2
T8		30	FD-30-E-G13-26/900	24	82.1	77.4	72.7
T8		36	FD-36-E-G13-26/1200	32	91.4	88.9	84.2
T8		38	FD-38-E-G13-26/1050	32	87.7	84.2	80.0
T8		58	FD-58-E-G13-26/1500	50	93.0	90.9	84.7
T8		70	FD-70-E-G13-26/1800	60	90.9	88.2	83.3
T5		4	FD-4-E-G5-16/150	3.6	64.9	58.1	50.0
T5		6	FD-6-E-G5-16/225	5.4	71.3	65.1	58.1
T5		8	FD-8-E-G5-16/300	7.5	69.9	63.6	58.6
T5		13	FD-13-E-G5-16/525	12.8	84.2	80.0	75.3
T2		6	FDH-6-L/P-W4.3x8.5d-7/220	5	72.7	66.7	58.8
T2		8	FDH-8-L/P-W4.3x8.5d-7/320	7.8	76.5	70.9	65.0
T2		11	FDH-11-L/P-W4.3x8.5d-7/420	10.8	81.8	77.1	72.0
T2		13	FDH-13-L/P-W4.3x8.5d-7/520	13.3	84.7	80.6	76.0
T5-E		14	FDH-14-G5-L/P-16/550	13.7	84.7	80.6	72.1
T5-E		21	FDH-21-G5-L/P-16/850	20.7	89.3	86.3	79.6
T5-E		24	FDH-24-G5-L/P-16/550	22.5	89.6	86.5	80.4

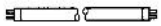
T5-E		28	FDH-28-G5-L/P-16/1150	27.8	89.8	86.9	81.8
T5-E		35	FDH-35-G5-L/P-16/1450	34.7	91.5	89.0	82.6
T5-E		39	FDH-39-G5-L/P-16/850	38	91.0	88.4	82.6
T5-E		49	FDH-49-G5-L/P-16/1450	49.3	91.6	89.2	84.6
T5-E		54	FDH-54-G5-L/P-16/1150	53.8	92.0	89.7	85.4
T5-E		80	FDH-80-G5-L/P-16/1150	80	93.0	90.9	87.0
T8		16	FDH-16-L/P-G13-26/600	16	87.4	83.2	78.3
T8		23	FDH-23-L/P-G13-26/600	23	89.2	85.6	80.4
T8		32	FDH-32-L/P-G13-26/1200	32	90.5	87.3	82.0
T8		45	FDH-45-L/P-G13-26/1200	45	91.5	88.7	83.4

Table 43 Chinese requirements for LFL, ballasts (1)

Note that MEPS covers ballasts used for tubular fluorescent lamps in various shapes (double-capped linear, single-capped linear, and circular etc.) but only ballasts related to linear fluorescent lamps are listed in these tables.

For Magnetic ballasts, the MEPS only set the minimum energy performance requirements, as shown in the table below. The MEPS did not set tier classification for Magnetic ballasts.

For electronic ballasts without brightness control, Tier 2 efficiencies were regarded as energy efficient products. For electronic ballasts with brightness control, products tested at 100% of luminous output have to meet Tier 2 requirements in order to be regarded as energy efficient product. In addition, electronic ballasts with brightness control tested at 25% of luminous output must meet Tier 2 maximum requirement as set in the table below.

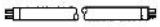
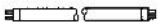
Lamps information					Ballasts efficiency (%)
Type and illustration		**Nominal power (W)**	**International code**	**Rated power (W)**	
T8		15	FD-15-E-G13-26/450	15	62.0
T8		18	FD-18-E-G13-26/600	18	65.8
T8		30	FD-30-E-G13-26/900	30	75.0
T8		36	FD-36-E-G13-26/1200	36	79.5
T8		38	FD-38-E-G13-26/1050	38.5	80.4
T8		58	FD-58-E-G13-26/1500	58	82.2
T8		70	FD-70-E-G13-26/1800	69.5	83.1
T5		4	FD-4-E-G5-16/150	4.5	37.2
T5		6	FD-6-E-G5-16/225	6	43.8
T5		8	FD-8-E-G5-16/300	7.1	42.7
T5		13	FD-13-E-G5-16/525	13	65.0

Table 44 Chinese requirements for LFL, ballasts (2)

Maximum system power input for ballasts with brightness-control tested at 25% luminous output (China: GB 17896-2012):

Energy efficiency tiers	System input power (P_{in})
Tier 1	$0.5P_{Lnom}/\ _{b1}$
Tier 2	$0.5P_{Lnom}/\ _{b2}$
Tier 3	$0.5P_{Lnom}/\ _{b3}$
$_{b1}$, $_{b2}$, and $_{b3}$ refer to the efficiency of Tier 1, 2, and 3 ballasts	

Table 45 Chinese requirements for LFL, ballasts (3)

Ballasts for tubular fluorescent lamps were not included in the China Energy Labels programs, which is the mandatory labelling program associated with MEPS for selected products.

Ballasts for tubular fluorescent lamps were included in the endorsement labelling program, the CQC Energy Conservation Certification program implemented by China Quality Certification Centre.

Ballasts for tubular fluorescent lamps must meet all the requirements in "Energy Conservation Certification Rules for Ballasts for Tubular Fluorescent Lamps (CQC31-461225-2012)" in order to be endorsed for the CQC Energy Conservation Certification label.

"High efficiency lighting product promotion program" was one of the earliest and largest incentive program implemented to promote energy efficient products. The Ministry of Finance and the National Development and Reform Commission co-issued the "Interim measures for financial subsidy and fund management for the high efficiency lighting product promotion program" in 2007[67], marking the inception of the program.

The program covered high efficiency lighting products such as fluorescent lamps for general lighting purposes, tri-phosphor linear fluorescent lamps (T8 and T5), metal-halide lamps, high-pressure sodium lamps, LED lamps, as well as ballasts associated with these products. The program used an indirect approach to provide the subsidy. Lighting program companies were required to participate in a bidding process in order to be included in the subsidy program. The subsidy was granted to the bid-winning companies who would sell their products to the consumers at reduced prices. For bulk purchasers, the subsidy was 30% of the price for each product, and for residential consumers, the subsidy was 50% of the price for each product. The products manufactured by the bid-winning companies must meet the energy-saving requirements. A program label was also required to be printed on the package of the subsidized products. By December 2011, the program had subsidized over 500 million units of efficient lighting products, resulting in 20 TWH electricity savings and 20 million tons of CO_2 reduction, cumulatively.

Efficient lighting products are also supported by the China's "Government procurement program for efficient products". This is a mandatory program for government procurements and is administered by both the Ministry of Finance and the National Reform and Development Commission. It covered a variety of products among which LFLs are included. MoF and NDRC co-issued and regularly updated the mandatory procurement list for efficient product, and the government was only allowed to purchase products from the list. The first procurement list was published in 2004. The 15th procurement list, which is also the newest and current list, was published in January 2014.

67 http://www.sdpc.gov.cn/hjbh/hjjsjyxsh/t20080508_210085.htm

J.5.4 India

India has a mandatory comparative labelling program for linear fluorescent lamps for which the lowest labelling level is effectively a MEPS. The comparative labelling includes various tiers ranging from 1 to 5 star in ascending order of efficiency. The Bureau of Energy Efficiency (BEE) is the implementing agency for energy performance standards. The energy performance standard for LFLs was implemented in 2009. There is no defined timeline for revision of these standards at the moment, however these are likely to be revised once the revision of the Indian standard for safety and performance for LFLs takes place at the Bureau of Indian Standards (BIS).

Energy performance standards for linear fluorescent lamps in India are listed in the Schedule for linear fluorescent lamps [68] and notified in regulation[69]. The scope, test method, parameters to be tested, and label design are referred to in the schedule.

The label is comparative and shall include the following information:

- Lumen per watt at 100, 2000 and 3500 hours of use
- Star rating of the product based on energy efficiency performance

The labelling program covers linear fluorescent lamps for General lighting service which covers 4 feet linear fluorescent lamps for wattages up to 40W and 6500K colour temperature for halo-phosphates and 6500K, 4000K & 2700K for tri-phosphate category.

The energy efficiency tiers for LFLs for various categories of star rating are mentioned below:

Star Rating	*	**	***	****	*****
Lumens per Watt at 0100 hrs of use	<61	>=61 & <67	>=67 & <86	>=86 & <92	>=92
Lumens per Watt at 2000 hrs of use	<52	>=52 & <57	>=57 & <77	>=77 & <83	>=83
Lumens per Watt at 3500 hrs of use	<49	>=49 & <54	>=54 & <73	>=73 & <78	>=78

Table 46 Indian requirements for LFL, lamps

The products should conform to minimum requirements of IS 2418 (part I) and (part II) – 1977 to participate in BEE S&L Program.

India has comparative labelling program for Ballasts which is under voluntary regime. Currently, no updates are scheduled for revision of energy performance standards of ballasts.

Energy performance standards for Ballasts in India are listed in the Schedule for Ballasts[70]. The scope, the test method, parameters to be tested, and label design are referred to in the schedule.

The label is comparative and shall include the following information:

- Type of ballast
- Ballast efficiency percentage
- Star rating of the product based on energy efficiency performance

68 http://220.156.189.29/Content/Files/Schedule2_TFL.pdf
69 http://220.156.189.29/Content/Files/TFLnoti.pdf
70 http://220.156.189.29/Content/Files/Schedule2_TFL.pdf

The labelling program covers magnetic ballasts and electronic ballasts for linear fluorescent lamps and single capped fluorescent lamps. It also includes built in ballasts where the ballast is inbuilt in the luminaire. The ballasts which are integral to the lamps are excluded from the program.

The energy efficiency tiers of ballasts for various categories of star rating are mentioned below:

Star Rating	Category
1 Star	≥B1 and < A3
2 Star	≥A3 and < A2
3 Star	≥A2 and < A2 BAT
4 Star	≥A2 BAT and <A1
5 Star	= A1
Lumens per Watt at 3500 hrs of use	<49

Table 47 Indian requirements for LFL, ballasts

- BAT Best Available Technology
- B1 Magnetic ballasts
- A3, A2, A2 (BAT) Non Dimmable Electronic ballasts
- A1 Dimmable Electronic ballasts

The detailed requirements for ballasts for fluorescent lamps are specified in Annexure-I of the schedule[71].

J.5.5 United States

Energy standards for linear fluorescent lamps in the US are set by the Department of Energy (DOE) and are listed in the Code of Federal Regulations (CFR) Title 10 – Energy, Part 430 - Energy conservation program for consumer products[72]. The scope, the test method for measuring average lamp efficacy (LE), colour rendering index (CRI), and correlated colour temperature (CCT) of electric lamps are also referred to in the CFR.

The regulation applies to general service fluorescent lamps which should meet the requirements listed in the table below since 1995.

DOE standards since 1995.

71 http://220.156.189.29/Content/Files/Schedule-15ballast.pdf
72 http://www.ecfr.gov/cgi-bin/text-idx?SID=833a295c99e4190254009eae99aff072&node=10:3.0.1.4.18&rgn=div5#10:3.0.1.4.18.3.9.2

Lamp Type	Nominal lamp wattage	Minimum CRI	Minimum average lamp efficacy (lm/W)
4-foot medium bipin	>35W	69	75
	≤35W	45	75
2-foot U-shaped	>35W	69	68
	≤35W	45	64
8-foot slimline	>65W	69	80
	≤65W	45	80
8-foot high output	>100W	69	80
	≤100W	45	80

Table 48 US requirements for LFL, lamps (1)

In addition, general service fluorescent lamps manufactured after July 14, 2012, shall meet or exceed the lamp efficacy standards in the table below.

Additional DOE standards effective July 14, 2012:

Lamp Type	Correlated colour temperature	Minimum average lamp efficacy (lm/W)
4-foot medium bipin (T8 – T12)	≤4,500K	89
	>4,500K and ≤7,000K	88
2-foot U-shaped (T8 – T12)	≤4,500K	84
	>4,500K and ≤7,000K	81
8-foot slimline (T8 – T12)	≤4,500K	97
	>4,500K and ≤7,000K	93
8-foot high output (T8 – T12)	≤4,500K	92
	>4,500K and ≤7,000K	88
4-foot miniature bipin standard output (T5)	≤4,500K	86
	>4,500K and ≤7,000K	81
4-foot miniature bipin high output (T5HO)	≤4,500K	76
	>4,500K and ≤7,000K	72

Table 49 US requirements for LFL, lamps (2)

The DOE are currently developing new regulations for fluorescent lamps with the Notice of Proposed Rulemaking published in April 2014. Under the current timetable the regulations are expected to be adopted in December 2014 with the new regulations taking effect in December 2017.

Note that at the time of writing of this report, an exemption from the current MEPS was in place, for certain manufacturers, which was granted from July 2012 until July 2014 (US DOE 2013). This exemption allows certain manufacturers to adhere to the previous MEPS (75 lm/W for4-foot T8 lamps) for 2 years. Manufacturers were required to apply for this exemption and it was granted to several successful applicants, including the major lamp manufacturers.

Labelling requirements for lighting products in the US are described in the Code of Federal Regulations (CFR) Title 16: Commercial Practices, Part 305 — Energy and water use labelling for consumer products under the energy policy and conservation act ("energy labelling rule")[73].

Fluorescent lamps ballasts and luminaires are covered and should be labeled to include information such as light output, estimated energy cost, life, correlated colour temperature, and the wattage.

Linear fluorescent lamps in the US are not eligible to earn the ENERGY STAR, an endorsement label under the Environmental Protection Agency (EPA) voluntary program to identify and promote energy–efficient products.

The current regulation for ballasts for fluorescent lamps is as follows:

Scope:

- Ballasts that operate the following linear fluorescent lamp combinations:
  - One F40T12 lamp
  - Two F96T12 lamps
  - Two F40T12 lamps
  - Two F96T12/ES lamps
  - One F34T12 lamp
  - Two F96T12HO lamps
  - Two F34T12 lamps
  - Two F96T12HO/ES lamps
- Input voltage 120-277 Volts; 60 Hz

Energy Efficiency Metric:

- Ballast Efficacy Factor (BEF) = "The ratio of the ballast factor, specified as a percentage, to the ballast input power in watts. Ballast efficacy factor is only meaningful when used to compare ballasts operating the same type and number of lamps. Also called the ballast efficiency factor."

Application for operation of:	Ballast input voltage	Total nominal lamp watts	Ballast efficacy factor
One F40 T12 lamp	120/277	40	2.29
Two F40 T12 lamps	120/277	80	1.17
Two F96T12 lamps	120/277	150	0.63
Two F96T12HO lamps	120/277	220	0.39
One F34T12 lamp	120/277	34	2.61
Two F34T12 lamps	120/277	68	1.35
Two F96T12/ES lamps	120/277	120	0.77
Two F96T12HO/ES lamps	120/277	190	0.42

Table 50 US requirements for LFL, ballasts (1)

73 http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=167b0413204fe810e1112a68ced1cabe&n=16y1.0.1.3.29&r=PART&ty=HTML#16:1.0.1.3.29.0.16.14

Commencing in November 2014 the new metric will be Ballast Luminous Efficiency (BLE) = ballast input power divided by the lamp arc power of a lamp-and-ballast system, as per the following table.

BLE = A/(1+B*average total lamp arc power ^ -C) where A, B, and C are as follows:

Description	A	B	C
Instant start and rapid start ballasts (not classified as residential) that are designed to operate 4-foot medium bi-pin lamps 2-foot U-shaped lamps 8-foot slimline lamps	0.993	0.27	0.25
Programmed start ballasts (not classified as residential) that are designed to operate 4-foot medium bi-pin lamps 2-foot U-shaped lamps 4-foot miniature bi-pin standard output lamps 4-foot miniature bi-pin high output lamps	0.993	0.51	0.37
Instant start and rapid start ballasts (not classified as sign ballasts) that are designed to operate 8-foot high output lamps	0.993	0.38	0.25
Programmed start ballasts (not classified as sign ballasts) that are designed to operate 8-foot high output lamps	0.973	0.70	0.37
Instant start and rapid start residential ballasts that operate 4-foot medium bi-pin lamps 2-foot U-shaped lamps 8-foot slimline lamps	0.993	0.41	0.25
Programmed start residential ballasts that are designed to operate 4-foot medium bi-pin lamps 2-foot U-shaped lamps	0.973	0.71	0.37

Table 51 US requirements for LFL, ballasts (2)

Other Requirements:

- PF > 0.9 for commercial; PF > 0.5 for residential

Test Procedure:

- Based on: ANSI C82.2
- Samples: four
- Aging: per ANSI C82.2
- Ambient temp: per ANSI C82.2
- Ambient relative humidity: per ANSI C82.2
- Voltage and frequency: ANSI C82.2
- Methodology: per ANSI C82.2
- Key equipment: per ANSI C82.2
- Tolerances: ANSI C82.2
- Calculations/algorithms/assumptions: ANSI C82.2

J.5.6 Korea

Period in Force: 2010.1~ strengthening and expansion of the scope
MEPS

Category			MEPS(lm/W)	Target (Lm/w) *(see efficiency grades)*
tubular	20W	EX-W EX-N EX-L	59.6	78.6
		EX-D & etc	57.5	75.9
	28W 32W	EX-W EX-N EX-L	84.3	97.0
		EX-D & etc	82.6	95.0
	40W	EX-W EX-N EX-L	82.0	102.5
		EX-D & etc	80.0	100.0
Circular	32W	EX-W EX-N EX-L	60.0	69.6
		EX-D & etc	58.0	67.2
	40W	EX-W EX-N EX-L	66.0	76.5
		EX-D & etc	64.0	74.2
Compact	FPX 13W FDX 26W	EX-W EX-N EX-L	53.0	66.2
		EX-D & etc	51.0	63.7
	FPL 27W	EX-W EX-N EX-L	59.0	73.7
		EX-D & etc	57.0	71.2
	FPL 32W FPL 36W FPL 45W FPL 55W	EX-W EX-N EX-L	68.0	85.0
		EX-D & etc	66.0	82.5

Table 52 Korean requirements for LFL, lamps (1)

Efficiency Grade[74]

1) tubular 20W

R	Grade
R ≤ 1.00	1
1.00 < R ≤ 1.08	2
1.08 < R ≤ 1.16	3
1.16 < R ≤ 1.24	4
1.24 < R ≤ 1.32	5

R= Target (lm/W) / tested efficiency (lm/W)

2) tubular (28W, 32W, 40W and compact)

R	Grade
R ≤ 1.00	1
1.00 < R ≤ 1.10	2
1.10 < R ≤ 1.15	3
1.15 < R ≤ 1.20	4
1.20 < R ≤ 1.25	5

R= Target (lm/W) / tested efficiency(lm/W)

3) circular

R	Grade
R ≤ 1.00	1
1.00 < R ≤ 1.04	2
1.04 < R ≤ 1.08	3
1.08 < R ≤ 1.12	4
1.12 < R ≤ 1.16	5

R= Target(lm/W) / tested efficiency(lm/W)

Table 53 Korean requirements for LFL, lamps (2)

J.6 HID Lamps

The only known economies with MEPS for HID lamps are the EU and China, although Korea is expected to introduce regulation in the near future and the US is also considering the issue and already has indirect regulation of mercury vapour lamps.

[awaiting information for China]

J.7 HID Ballasts

HID ballasts are regulated in the EU, Canada, China and the US.

[74] Used for labelling and for signalling likely future performance requirements

Canada

Ballasts type	Lamp rated wattage	Minimum rated ballast efficiency (%)
Magnetic Probe Start	150-500	94
Pulse Start	150-500	88
Non Pulse Start Electronic	150-250	90
	251-500	92

Table 54 Canadian requirements for HID ballasts

USA

Designed to be Operated with Lamps of the Following Rated Lamp Wattage	Tested Input Voltage††	Minimum Ballast Efficiency Standard Equation† (%)
≥ 50 W and ≤ 100 W	Tested at 480 V	(1/(1+1.24× P^(-0.351))) – 0.0200
	All others	1/(1+1.24×P^(-0.351))
>100 W and <150* W	Tested at 480 V	(1/(1+1.24×P^(-0.351))) – 0.0200
	All others	1/(1+1.24×P^(-0.351))
≥ 150** W and ≤ 250 W	Tested at 480 V	0.880
	All others	For ≥ 150 W and ≤ 200 W: 0.880 For >200 W and ≤ 250 W: 1/(1+0.876×P^(-0.351))
>250 W and ≤ 500 W	Tested at 480 V	For >250 and <265 W: 0.880 For ≥ 265 W and ≤ 500 W: (1/(1+0.876×P^(-0.351))) – 0.010
	All others	1/(1+0.876×P^(-0.351))
>500 W and ≤ 1000 W	Tested at 480 V	For >500 W and ≤ 750 W: 0.900 For >750 W and ≤ 1000 W: 0.000104×P+0.822 For >500 W and ≤ 1000 W: may not utilize a probe-start ballast
	All others	For >500 W and ≤ 750 W: 0.910 For >750 W and ≤ 1000 W: 0.000104×P+0.832 For >500 W and ≤ 1000 W: may not utilize a probe-start ballast

* Includes 150 W fixtures rated only for 150 W lamps; rated for use in wet locations, as specified by the National Fire Protection Association (NFPA) 70, section 410.4(A); and containing a ballast that is rated to operate at ambient air temperatures above 50 °C, as specified by UL 1029.
** Excludes 150 W fixtures rated only for 150 W lamps; rated for use in wet locations, as specified by the NFPA 70, section 410.4(A); and containing a ballast that is rated to operate at ambient air temperatures above 50 °C, as specified by UL 1029.
† P is defined as the rated wattage of the lamp the fixture is designed to operate.
†† Tested input voltage is specified in 10 CFR 431.324.

Table 55 US requirements for HID ballasts

Annex K. LIGHTINGEUROPE COMMENTS ON DRAFT TEXT

An early draft version of the Task 1 report was commented by LightingEurope. These comments are listed below, together with the text from the report to which they apply. In some cases, a reply of the study team is also included (in *green italic*). [75]

Page	Text in report *Reply of study team to comments from LE*	Comment from LightingEurope
7	As regards legislation, international comparison of minimum efficacy and functionality requirements in this report shows that the current EU lighting legislation has the broadest product scope and overall the most stringent requirements worldwide. This means that with further expansion of the scope, the EU will be 'breaking new ground', i.e. it cannot build on experience from elsewhere.	This new ground should not be overdone. It should be tried to use existing definitions which are very well established in European standardization systems. Many EU Member States have been shaked off in correctly evaluating and assessing the regulation and they are even more unable to enforce it (e.g. by Market Surveillance Authorities)
7	When the 'graphical' lamp label and the product information requirements of the EU legislation are taken into account, the EU labelling/information requirements are, in comparison to most countries, very comprehensive.	Danger of over speeding and creating a non level playing field. Compliant products are expensive therefore market players – look for using grey zones of the Regulations
8	primary performance parameter	Which have to be measured quick and easy by Market Surveillance Authorities and the amount of parameters have to be limited to a minimum, beside efficiency.
8	*'Luminaire'* means an apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes all the parts necessary for supporting, fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply [1]; Footnote 1: Regulation 245/2009 uses the same definition, but at the end of the definition additionally specifies: "but not the light sources themselves". This has been removed in 1194/2012 to accommodate integrated LED luminaires. *The report presents the definitions for 'luminaire', 'lamp' and light source' used in the existing regulations and the differences between them. It also tries to describe the implications of these definitions, i.e. how they can be interpreted. The report does not express an opinion as to which definition is preferable. When integrating existing regulations into one, a choice will have to be made. This choice could be the IEC 62504 definition.* *Considering also the comments from LE, a good choice of definitions is an issue for a new regulation.* *Thanks for additional information from IEC 62504.* *The definition of 'luminaire' above leaves the presence of the light sources open, so there does not seem to be the need signalled by LE to always supply the luminaire with the light sources mounted.*	LightingEurope does not agree with the deletion of the sentence reported in the footnote. That sentence is still valid. The majority of luminaires has provisions for a light source that can be inserted and removed. A luminaire without the light source is still a luminaire. For the special case of luminaires with integrated LED light sources, an extension of the definition can be given, like "If the luminaire contains a LED light source in a way that the light source cannot be removed without destroying the ensemble, the luminaire is defined as one unit together with the LED light source and the relevant term is still 'luminaire'." I would also like to point out that losing the existing definition of a luminaire means that each luminaire in a store shall be equipped with light sources. Equipping the luminaire with light sources does not mean having the light sources in a separate package. It means that the light sources are inserted into the proper places of the luminaire, similar to the integrated type. The proposed update of IEC 62504 defines: "apparatus, which distributes, filters or ~~transforms~~ redirects the light ~~transmitted~~ emitted from one or more ~~lamps~~ light source(s) and which includes, except the ~~lamps~~ light source(s) themselves, if replaceable, all the parts necessary for fixing and protecting the ~~lamps~~ light source(s) and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply…"

[75] As the report has slightly changed with respect to the commented version (also in reaction to the comments themselves) the references to page numbers is approximate.

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9	'*Lamp*' means a unit whose performance can be assessed independently and which consists of one or more light sources. It may include additional components necessary for starting, power supply or stable operation of the unit or for distributing, filtering or transforming the optical radiation, in cases where those components cannot be removed without permanently damaging the unit	CIE S 017 (and IEC 60050) defines lamp as: "source made in order to produce optical radiation, usually visible." I see no reason why deviating from the experts opinion in CIE. Also, a lamp exists certainly without assessment ("…can be assessed…"). The term "lamp" as mentioned by VITO seems to relate to a special kind of lamp with integrated control gear. For a general definition of the term "lamp" that special definition is wrong. In the update of IEC 62504 the following definition of an electrical lamp is proposed: "electric light source provided with one or more cap(s)"
9	'*Light source*' means a surface or object designed to emit mainly visible optical radiation produced by a transformation of energy. The term 'visible' refers to a wavelength of 380-780 nm	The proposed update of IEC 62504 is: "primary light source with the means for connecting to the electric supply and usually designed to be incorporated into a luminaire"
9	In the case of a '**light source**' the focus is on what actually emits light. In the most limited meaning it is only the surface that actually emits light [2]. In the more extensive meaning of 'object designed to emit *light*' the term becomes quite flexible however, apparently covering everything from a classical light bulb to a completely integrated LED-luminaire. Footnote 2: Compare the definition of LES = 'Light Emitting Surface' in the Zhaga Interface Specifications for LED lighting products, http://www.zhagastandard.org/specification , see also section H.21 in Annex H	Here seems to be a misunderstanding. Zhaga has invented the term "LES" (light emitting surface) not in order to find a term and definition for "light source", but to delimit the size of an optical element.
9	Under the above definitions, a classical incandescent light bulb or a halogen capsule could be termed 'lamp' as well as 'light source'. *'light bulb' is intended here as the entire object: glass envelope + filament + cap.*	No. The bulb of an incandescent lamp is just an envelope around the filament. The bulb is not a light source
9	Comparing the definitions, a 'lamp' can also come close to being a 'luminaire' [3]. Footnote 3: This is also expressed by the ILV-definition for a lamp: "source made in order to produce optical radiation, usually visible. NOTE This term is also sometimes used for certain types of luminaires." (for ILV see section H.3 in Annex H). The ILV definitions for 'luminaire' and 'light source' are similar to the definitions above.	No. The NOTE in the ILV shall not indicate that a luminaire can be a lamp. The intention of the NOTE is to provide the reader with the colloquial usage of the word "lamp". The end-user often points onto the luminaire, saying "lamp" while meaning the luminaire.
10	Considering these definitions the term 'ballast' indicates a subtype of 'control gear'. 'Ballast' is limited to use on discharge lamps (which excludes LED-drivers) and its main function is to limit lamp current, while 'control gear' is more generic, not being limited to a certain lamp type and potentially having a more extensive range of functions. *Accepted: 'driver' has been substituted by 'control gear' as far as possible. Footnotes added to report to clarify this point.*	Basically, I agree. Only the "limited" use of 'ballast' is not fully correct. Ballasts can also be for example converters for halogen lamps. Apart of this discussion, it should be avoided to speak about "drivers". The IEC language for this type of device is "control gear".
10	In the International Lighting Vocabulary of 2011 the term 'control gear' does not appear. The term 'ballast' is	Correct, therefore for IEC 62504 has included:

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	defined in almost the same way as above but it has a note which leaves additional functionality open. *Accepted: the definition from IEC 62504 has been added as a footnote to the report.*	"3.6.1 control gear for LED module, LED control gear unit inserted between the electrical supply and one or more LED modules, which serves to supply the LED module(s) with its (their) rated voltage or rated current, and may consist of one or more separate components and may include means for dimming, correcting the power factor and suppressing radio interference, and further control functions…"
10	The need might arise to add a definition for 'LED Driver'. In that case the following definition as used by Zhaga could be considered:	No. The preference should be given to the international IEC standard 62504, see above, although IEC 62504 and the Zhaga definition do not differ largely.
10	'Control Gear' is distinguished from 'Control Device'. Given the availability of a certain supplied power, 'control gear' manages to make the lamp function correctly, while a 'control device' manages the availability of the power. A 'control device' decides when to switch on/off the power supply and which level of power to supply (dimming) [8]. Footnote 8: A 'control device' may also have additional functions such as monitoring the quantity of light or the room occupancy, or emitting signals to change the colour of the lamps, etc.	This description is correct only together with the footnote. Examples of control devices are given in the IEC series 62386.
11	'*Light emitting diode (LED)*' means a light source which consists of a solid state device embodying a p-n junction *of inorganic material*. The junction emits optical radiation when excited by an electric current	IEC 62504 defines LED: "solid state device embodying a p-n junction, emitting incoherent optical radiation when excited by an electric current" I suggest to apply the international definition.
11	'*LED package*' means an assembly having one or more LED(s). The assembly may include an optical element and thermal, mechanical and electrical interfaces;	IEC 62504 defines LED package: "…single electrical component encapsulating principally one or more LED dies, possibly including optical elements and thermal, mechanical, and electrical interfaces" I suggest to apply the international definition.
11	'*LED lamp*' means a lamp incorporating one or more LED modules. The lamp may be equipped with a cap; *The IEC62504 definitions for LED, package and lamp have been added to the report as footnotes.*	IEC 62504 defines a LED lamp: "LED light source provided with (a) cap(s) incorporating one or more LED module(s) and possibly including one or more of the following; electrical, optical, mechanical, and thermal components, interfaces and control gear" I suggest to apply this definition. The component "cap" is already part of the definition of "lamp".
11	On the other hand the LED-definition in the new standard IEC 62504 seems to include both LEDs and OLEDs. This standard does not specifically mention OLEDs, and no distinction is made between organic and non-organic. *LE explanation has been added in footnote to text*	The reason for this is that the term "OLED" is given in the safety standard for OLED, IEC 62868 (in preparation), document 34A/1786/FDIS: "light emitting semiconductor consisting of an electroluminescent zone made of organic compounds, situated between two electrodes"
12	As regards '*LED lamps*' the definition from existing regulations states that they '*may be equipped with a cap*'. This seems to be in contrast with the vision of LightingEurope where the presence of the socket is the main characteristic of a LED-lamp [12] and which distinguishes it from a LED-module. Footnote 12: According to the Lighting Europe document on classification of LED-products (Annex G): "LED Lamps include LED replacement lamps having a socket which is also used for the conventional	These are confusing terms. A "socket" is that part of a system that accepts the cap of the lamp. Therefore, a lamp cannot have a socket, but a cap.

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	(non-LED) lamps that can be replaced. LED Lamps may also come with new types of sockets that have not been used for conventional lamps. The main characteristic is the presence of a socket that allows the easy installation of the LED Lamp into a corresponding luminaire by an ordinary person (regardless whether the socket is also used for conventional lamps or not)." *Accepted. Where applicable 'socket' has been replaced by 'cap'.*	
12	a LED-lamp has a socket that enables easy installation of the lamp by an ordinary person	It does not have a socket. A socket can be found in the wall or elsewhere.
12	Zhaga does not use the term 'LED lamp' but uses 'LED Light Engine' instead, being simply defined as: *"a combination of one Electronic Control Gear and one or more LED Modules."* Regarding the term 'LED Light Engine' the standard IEC 62504 states that: '*The scope of this term is not clear enough to be part of this document at present. A universal definition is under consideration.*' *Footnote added with explanation from LE.*	Zhaga is revisiting the concept of LED Light Engine. They have discovered that the interface between LED module and control gear needs to be specified. Therefore, the term LED light engine should not enter into any regulation.
13	reflect on the definition for 'LED Module' (with or without Driver) *Accepted.*	~~driver~~ control gear
13	reflect on the definition for 'LED Lamp' (with or without Socket) *Accepted.*	~~socket~~ cap
13	In addition, considering that the definition for 'LED' might explicitly exclude OLEDs, a definition for OLEDs might be required	See remark above
14	allow for comparison between functionally equal lighting products	This is currently not given on the market because of non level playing has been created – most Member States don't fulfil Market Surveillance requirement of the Regulation – functionality requirements to be reduced to a minimum amount. In addition it is of importance to set parameters in a clear and well distinguishable way to enable Member States to enforce the regulation without any ambiguities.
14	percentage of UVA + UVB radiation percentage of UVC radiation	Separation of UV A+B and UVC is not comparable to existing standards e.g. EN 62471! Actinic UV (200...400nm) and UVA (315...400) is usual
15	lamp power factor (for lamps with integrated control gear) *The report in some occasions also uses 'displacement factor'. A more detailed explanation can be found in par. 3.1 of the report and also involves 'distortion factor' and 'true power factor'. IEC62504 in some occasions still refers to 'power factor', see one of the LE comments to page 10.* *Footnote added with the LE opinion.*	"Displacement factor" instead of "power factor" is the correct terminology to be used. "Power factor" in this context is a confusing and meaningless term. There are initiatives within international standardization bodies to adapt terminology accordingly. The timeframe of this adaptation of terminology is expected to be concluded in due course. Consequently all new EU lighting regulation from its first draft document need to take into account the new terminology in order to avoid any confusion.

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16	Different from 'office lighting' or 'street lighting', in the case of 'domestic lighting' there are no clearly defined lighting requirements, there is no clearly defined task area to be lit, and the lighting is generic 'ambient lighting' or 'decorative lighting', so there is no need/possibility to use illuminance. In addition the reflective properties of the variety of objects and walls found in a domestic environment are difficult to establish, so 'luminance' is not a suitable parameter.	This should be kept in any case
16	for down-lighting luminaires the useful luminous flux is measured over 180˚ *This section reports the contents of an old preparatory study and reference seems to be correct. See also discussion on this topic in section 4.1 of the report.*	In footnote 21 a useful flux within 120° cone is stated
18	Par.1.3.3, Discussion: *<the original text to which the comment applied has been rewritten completely>*	To calculate energy consumption as target to define finally the energy efficiency only the used energy per a certain time is to be considered. As common calculation W per Year has been established. But this can only be regulated in lighting areas and locations where lighting application rules are existing. This is not the case in the domestic area.
18	In regulation 245/2009 on tertiary lighting (office, streets) the efficacy requirements are formulated in a different way by specifying directly a minimum efficacy in terms of lm/W in function of the lamp wattage	HPS and MH are a non-changeable wattage system. In regard of HPS and MH in combination of existing light points no energy saving will be generated with the regulation, unless the installed system will be renovated by considering new poll spacing or different technology like LED.
23	(non-directional household) lamps having the following chromaticity coordinates x and y: $x < 0{,}200$ or $x > 0{,}600$ $y < -2{,}3172\ x^2 + 2{,}3653\ x - 0{,}2800$ or $y > -2{,}3172\ x^2 + 2{,}3653\ x - 0{,}1000$; *The definition IS from 244/2009, article 1a. "(non-directional household)" has been added intentionally here to better describe the non-covered lamps.* *The definition in 245/2009 is different, as also remarked in the report.*	This definition is not congruent to the one in Reg.244/2009 and 245/2009.
23	(c) (non-directional household) lamps having: 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB); *The definition is from 244/2009, article 1d and seems to be reported correctly. "(non-directional household)" has been added intentionally here to better describe the non-covered lamps.* *The amendments of regulation 347/2010 apply to 245/2009, not to 244/2009.*	Here wrong wording. Correct definition, see Reg. 347/2010, 1. (c)
23	the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB);	Exception of UV-radiators. Some FL or HID lamps can be within this definition

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	Footnote added with LE comment	
24	(non-directional) blended high intensity discharge lamps having : - 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm, - 11 % or more of total radiation of the range 250-780 nm in the range of 630-780 nm, - 5 % or more of total radiation of the range 250-780 nm in the range of 640-700 nm, *The "and" connecting the three conditions was missing and has been added. "(non-directional)" has been added intentionally here to better describe the non-covered lamps.*	Here wrong wording. Correct definition, see 347/2010, 1. (c)
24	Question: Exactly what types of lamps are intended in points (b) (630-780 nm, 640-700 nm), (d), (e), (f), (g), (h)? What was the reason for their exemption and is that reason still valid? *It is not clear to which exemption the first part of the comment refers.* *The second part of the comment first seems to say that the restriction to E27, E40, PGZ12 is no longer necessary, extending requirements also to other lamp bases, but this is contradicted by the next sentence ??*	Some 1000W und 2000W are concerned and the high wattages HID lamps without outer bulb require this exception, as well as other special purpose light sources. The restrictions to bases E27, E40, PGZ12 was limiting the effects mostly to street lighting. It seems logical to extend the requirements also to other lamp bases. The reasons for the exceptions applied are still valid.
25	(i) (non-directional)(FLni and HID) products intended for use in applications other than general lighting and products which do not provide a general lighting function *The wording IS from 347/2010. "(non-directional)(FLni and HID)" has been added intentionally here to better describe the non-covered lamps.*	-Not fully correct wording, see 347/2010 1. (d)
25	Article 1 of the Regulation specifies as an exemption not covered by any regulation: LED modules if they are marketed as part of luminaires that are placed on the market in less than 200 units per year. Question: What is the background for this? Only 200 units / year? *Footnote added with the LE-explanation. Question deleted.*	Industry should have the freedom for small special application/expensive luminaire-series making LED-modules which might be not conform to the given parameters, thus the limitation on 200 luminaires per year , which was seen as a reasonable quantity during the preparation of the Regulation. It was to prevent the situation where a short run product or custom product required a full test regime that could in principle require the production of more test samples than products actually sold to customers.
26	(v) the lighting products have to withstand extreme physical conditions (such as vibrations or temperatures below – 20 °C or above 50 °C);	This loophole would allow ordinary incandescent lamp to be placed on the market.
29	A comprehensive and detailed discussion of the definitions of 'special purpose products' used in the existing regulations can be found in the Omnibus study (see also Task 0 report).	Reference to our LE position of the Stage 6 Working Document including a definition recommendation. The Special Purpose Definition in general has to be reviewed.
30	Question: Do Stakeholders agree with the energy estimate for SPL ? Any additional information available ?	This figure appears to be arbitrary and is by no means supported by empiric evidence. LightingEurope does not agree and does not recognize the figures in this chapter.

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	Footnote added with the LE-opinion. The figures are a first rough estimate by VHK and motivated in Annex D.	
31	Shock-proof lamps. The reason for this is that around 16 million units/year of these lamps are abusively sold in the EU for general lighting services, thus undermining regulation 244/2009/EC *The 295 million seems to refer to the 2012 sales of MV GLS lamps < 200W. The 16 million is estimated in the Omnibus study and refers only to shock-proof lamps that are not sold for shock-proof applications but abusively for general lighting. The two figures indicate different types of lamps.*	wrong number. Correct is 295 million (Eurostat and Task 2 report)
31	Question: See note 67; can Lighting Europe clarify their position on 'shock proof' lamps ? *The authors do not know which position paper is referred to. On the LE website no position paper on shock-proof lamps has been found.* *The question has been deleted from the report.*	LightingEurope position paper has been made available and submitted to authors of report
31	"*lighting products that have to withstand extreme physical conditions (such as **vibrations** or temperatures below – 20 °C or above 50 °C)*"	This sentence creates again a loophole for incandescent lamps
31	Article 2.4, that defines 'special purpose lamp' as a '*lamp not intended for household room illumination because of its technical parameters or because the related product information indicates that it is unsuitable for household room illumination*'; *Footnote added with LE comment*	The 'or' in this paragraph is misleading terminology impacting negatively on the unmistakeable reading of the Regulation.
32	The preliminary estimate for the total EU-28 energy consumption for 'shock proof' and similar lamps is around 1 TWh (Annex D.15). This only includes lamps actually used for the intended 'shock proof' application, not those abused for general lighting services. *Footnote added with LE comment*	Altogether, including these abused lamps, the consumption amounts to 11 TWh
32	Non-white lamps Exemption status in existing regulations 874/2012 (labelling): - not explicitly excluded, see comments below. - might be excluded because non-compliant with other regulations.	LightingEurope would support respective discussion.
33	*(on difference of definitions for non-white)* Question: Was there a rationale for having different definitions? Is there a preference / advantage in one of the definitions over the other? *Footnote added with LE comment. Question remained for what regards the rationale for having different definitions*	Preference is with definition in Reg. 245/2009 and Reg. 1194/2012
34	Question: What was the exact reason for the introduction of the	It was to avoid the unintentional phase out of Mercury Blended UV lamps that are needed for pet care

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	347/2010 amendments on UV? *Footnote added with LE explanation. Question deleted.*	application.
35	Question: Was there a reason for no longer having the explicit UV-exemptions in 1194/2012 and 874/2012? *The omission of the example is in 874/2012, not in 1194/2012. In both regulations, the explicit exclusion by means of range of wavelengths is not present. Comment from LE not understood.*	The omission of the specific example for (exempted) UV lamps is based on the non-inclusion of these lamps in Reg. 1194/2012.
36	The exceptions in 245/2009 for blended HID-lamps for 630-780 and 640-700 nm are very specific and need clarification.	A respective proposal needs to be elaborated based on this report
37	For lamps in swimming pools the exemption from 245/2009 is less clear.	Based on this report clear proposals for unmistakeable formulation need to be elaborated.
38	The largest consumers are 'aquarium lamps' (3.5 TWh/year), 'lamps for swimming pools' (2.2 TWh/year) and 'lamps used in vending machines' (2.5 TWh/year). *These are VHK estimates, rough and preliminary. They are motivated in Annex D.*	Who has calculated these figures??
38	In regulations 1194/2012 and 874/2012 these lamps are exempted if their primary purpose is not considered to be lighting (but the examples do not explicitly exclude decorative lamps).	An explicit definition of "decorative" is to be elaborated.
39	1.4.2.9. TV/Movie/Photo/Theatre/Event/Stadium lighting In regulation 245/2009 these lamps are exempted because they are '*intended for use in applications other than general lighting*'. This specifically refers to '*substantially uniform lighting of an area without provision for special local requirements*' which is in contrast with the aim of many lamps in this group.	This is the wording of the definition for general lighting. Lamps that are not intended for that purpose and where this is mentioned explicitly in the product information are exempt of the requirements of 245. The sentence here in the Omnibus text is not clear.
40	Backlighting They are also exempted from regulation 874/2012 if marketed for operation on batteries. *All these paragraphs on special lamp types are a first attempt to analyse if, why and how they are exempted from the existing regulations. The intention is to identify the potential existing problems with the definitions of special purpose lamps which should be useful for the future task of writing a new definition. The interpretations are by the authors; no legal check has been made.*	Does Reg. 874/2012 support this conclusion? Legal check may be required.
41	The exemption of grow-lights in regulation 245/2009 is therefore uncertain. *See above.*	Does Reg. 874/2012 support this conclusion? Legal check may be required.
41	Question: Are food-display-lights being abused for general lighting purposes? Is exemption really necessary? *Footnote added with LE-explanation. Question deleted.*	Until now we do not perceive any abusing of food-display lights for general lighting purposes. Lighting design possibilities require the exemption.

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47	Question: Stakeholders are explicitly invited to provide information, opinions and comments regarding Directional Mains-Voltage lamps in relation to regulation 1194/2012 annex III point 1.1. *The comment is not to-the-point. Further discussion on this point is required.*	PAR lamps for studio and entertainment applications. They have special shape and base, so in household they cannot be used. Must be excluded from phase out
50	FIPEL lighting This technology is clearly in a research and development phase. No commercial products seem to be available yet. The technology could be considered when determining BAT or BNAT.	It is to early making conclusions for OLED -> technology should be exempted
60	Luminaires designed to operate all the lamp types considered in this study are also inside the scope of the current preparatory study, in particular as regards the compatibility with energy-efficient lamps and the compatibility with energy-saving lighting controls (dimmers). Considering the large variety of shapes and materials used for luminaires, the material-use efficiency, production aspects and end-of-life aspects of luminaires cannot be included.	That aspect should be kept in any case.
94	GPP-Criteria for Office Lighting Question: According to the GPP website this is under development for mid-2014. Development led by industry (Eco-lighting project, LE ?). It seems likely that these new criteria will substitute the current ones for Indoor Lighting (otherwise the distinction between the two is not so clear) and that this actually is the announced revision for Indoor Lighting. Can LE confirm this ? *OK. Paragraph has been rewritten and question removed.*	Yes, we do confirm.

LIST OF FIGURES

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ACRONYMS

a	Annum, year
ANSI	American National Standards Institute
BAT	Best Available Technology
BAU	Business As Usual
BEF	Ballast Efficacy Rating
BGF	Ballast Gain Factor (due to dimming)
BLE	Ballast Luminous Efficiency
BMF	Ballast Maintenance Factor
bn / bln	Billion (10^9)
BNAT	Best Non-Available Technology
BOM	Bill Of Materials
CCFL	Cold-Cathode Fluorescent Lamp
CCT	Correlated Colour Temperature

cd	candela
CDR	Commission Delegated Regulation
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
CIE	International Commission on Illumination
CFL	Compact fluorescent lamps
CFLi	CFL with integrated ballast
CFLni	CFL without integrated ballast
CISPR	Comité International Spécial des Perturbations Radioélectriques
CN / CN8	Combined Nomenclature (coding)
cor	corrected
CRI	Colour Rendering Index
DLS	Directional light sources
DEFRA	UK Department for Environment, Food and Rural Affairs
E14, E27	Screw-type lamp caps for general purpose lamp
EC	European Commission
ECEEE	European Council for an Energy Efficient Economy
ECG	Electronic Control Gear
ECO	Scenario considering ecodesign or energy labelling measures
ED	Ecodesign / Ecodesign Directive
EEI	Energy Efficiency Index
ELC	European association of lighting manufacturers, now part of Lighting Europe
ELD	Energy Labelling Directive
ELV	Extra Low Voltage
EMC	Electro-Magnetic Compatibility
EoL	End of Life
ErP	Energy related Product
ESL	Electron Stimulated Luminescence
ESO	European Standardisation Organisation
EU	European Union
FIPEL	Field-Induced Polymer Electroluminescent Lighting
FU	Functional Unit
G4, GY6.35	Low-voltage halogen lamp types, 2 pin cap, single ended
G9	Mains-voltage halogen lamp, 2-pin cap, single ended
GLS	General Lighting Service (a.k.a. incandescent lamp)
h	Hour
HF	High Frequency
Hg	Mercury
HID	High-Intensity Discharge
HL	Halogen
HPM	High-Pressure Mercury
HPS	High-Pressure Sodium

HS	Harmonised System (coding)
HW	High Wattage
Hz	Hertz
IEC	International Electrotechnical Commission
IES / IESNA	Illuminating Engineering Society (of North America)
ILCOS	International Lamp COding System
ILV	International Lighting Vocabulary
IR, IRC	Infrared, Infrared coating
IR	Incandescent Reflector Lamp
ISA	International Solid State Lighting Alliance
ISO	International Organization for Standardisation
LBS	Lampen-Bezeichnungs-System
LCC	Life Cycle Cost
LE	Lighting Europe (lighting manufacturers association)
LED	Light Emitting Diode
LENI	Lighting Energy Numerical Indicator
LER	Luminaire Efficacy Rating
LFL	Linear Fluorescent Lamp
LLCC	Least Life Cycle Cost
LLE	LED Light Engine
LLMF	Lamp Lumen Maintenance Factor
lm, Φ	Lumen, unit of luminous flux Φ
LMF	Luminaire Maintenance Factor
LOR	Light Output Ratio
LPD	Lighting Power Density [W/(m².lx)] (Pr EN 13201-5)
LV	Low Voltage (typical 12V)
LW	Low Wattage
max	maximum
MEErP	Methodology for Ecodesign of Energy-related Products
MEPS	Minimum Efficacy Performance Standard
MH	Metal Halide
min	minimum
mn / mln	Million (10^6)
MOCVD	Metal Oxide Chemical Vapour Deposition
Mt	Mega tonnes (10^9 kg)
MV	Mains Voltage (typical 230V)
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne (coding)
NDLS	Non-directional light sources
nec	Not elsewhere classified
NEMA	National Electrical Manufacturers Association
OJ	Official Journal of the European Union
OLED	Organic Light Emitting Diode

P	Rated power
par	paragraph
ProdCom	PRODuction COMmunautaire (coding)
-R	Reflector
R	Electrical Resistance
R7s	Mains-voltage linear halogen lamp, double ended
Ra	Colour rendering index, unit
ref	reference
RGB	Red Green Blue
s	Second (as unit for time)
SCHER	Scientific Committee on Health and Environmental Risks
SCENHIR	Scientific Committee on Emerging and Newly Identified Health Risks
SPL	Special Purpose Lamp
SPP	Special Purpose Product
sr	steradian
SSL	Solid State Lighting
TBC	To Be Confirmed
TBW	To Be Written / To Be Worked
TC	Technical Committee
TWh	Tera Watt hour (10^12)
UF	Utilisation Factor
UK	United Kingdom
ULOR	Upward Light Output Ratio
US(A)	United States of America
UV	Ultraviolet (subtypes UVA, UVB, UVC)
UVA	near UV-Black Light, 315-400 nm
UVB	middle UV-Erythemal, 280-315 nm
UVC	far UV-Germicidal, 100-280 nm
V	Volt
VHK	Van Holsteijn en Kemna
VITO	Vlaamse Instelling voor Technologisch Onderzoek
W	Watt
yr	year