وزارة الصناعة والتجارة

قرار رقم (٢٥) لسنة ٢٠٢٤
بإصدار اللائحة الفنية الوطنية لكفاءة الطاقة لمنتجات الإنارة

وزير الصناعة والتجارة:

بعد الاطلاع على القانون رقم (٩) لسنة ٢٠١٦ بشأن المواصفات والمقاييس،

وعلى القرار رقم (٣) لسنة ٢٠١٥ بشأن اعتماد لائحة مصابيح الإنارة المنزلية غير الموجهة،

وعلى اللائحة التنفيذية للقانون رقم (٩) لسنة ٢٠١٦ بشأن المواصفات والمقاييس الصادرة بالقرار رقم (١٥٥) لسنة ٢٠١٧،

وعلى قرار اللجنة الوطنية للمواصفات والمقاييس في اجتماعها السادس والخمسين المنعقد بتاريخ ١٠ ديسمبر ٢٠٢٣ بالموافقة على اعتماد لائحة فنية وطنية لكفاءة الطاقة لمنتجات الإنارة،

وبناءً على عرض وكيل الوزارة،

قُرِّر الآتي:

المادة الأولى

يُعمل بأحكام اللائحة الفنية الوطنية لكفاءة الطاقة لمنتجات الإنارة، المرافقة لهذا القرار.

المادة الثانية

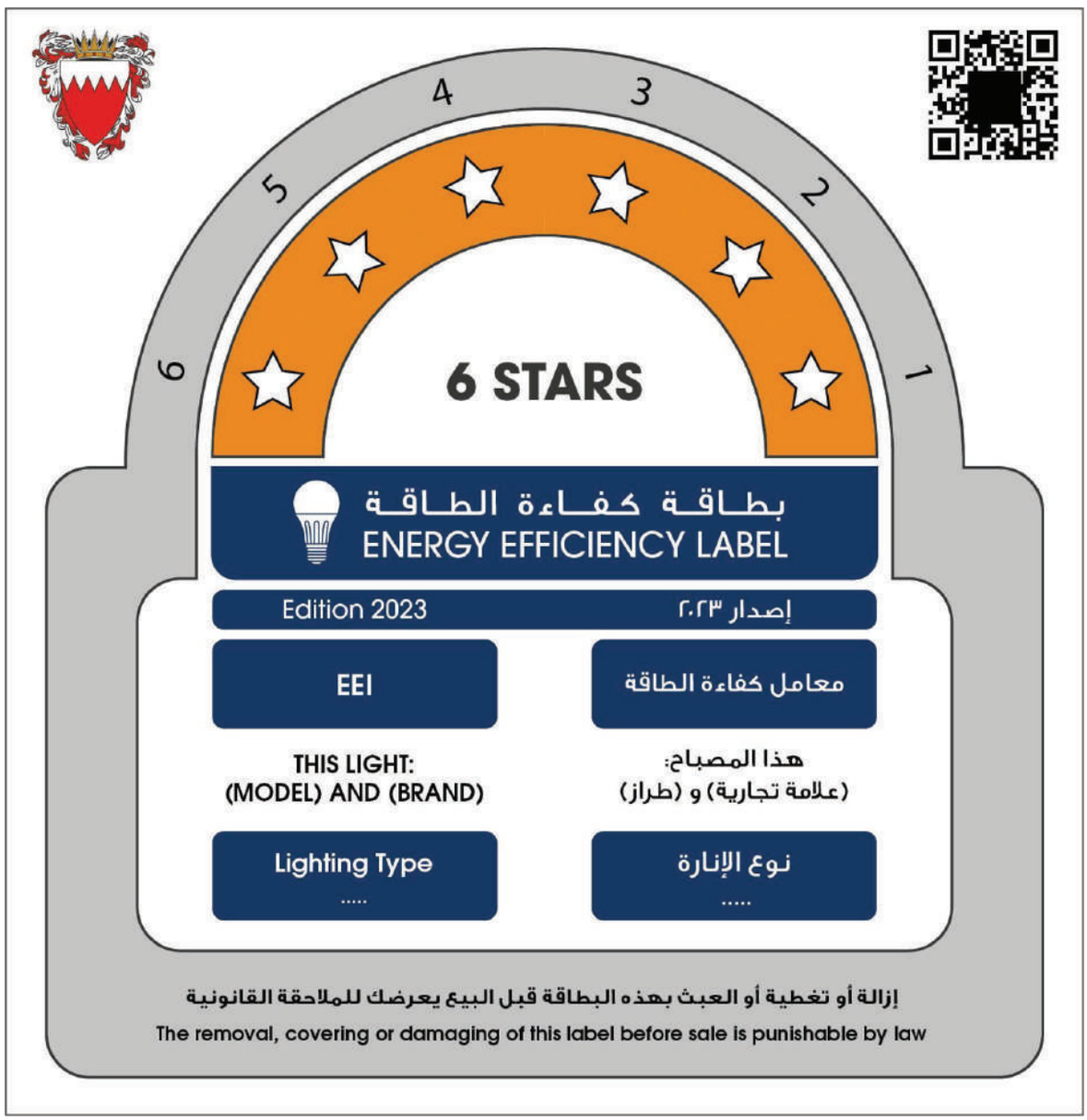
يُلغى القرار رقم (٣) لسنة ٢٠١٥ بشأن اعتماد لائحة مصابيح الإنارة المنزلية غير الموجهة.

المادة الثالثة

على وكيل الوزارة والمعنيين - كُلٌّ فيما يخصه - تنفيذ أحكام هذا القرار، ويُعمل به بعد مضي اثني عشر شهراً من تاريخ نشره في الجريدة الرسمية.

وزير الصناعة والتجارة
عبد الله بن عادل فخرو

صدر بتاريخ: ٣ رمضان ١٤٤٥هـ
الموافق: ١٣ مارس ٢٠٢٤م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6 STARS
بطاقة كفاءة الطاقة
ENERGY EFFICIENCY LABEL
Edition 2023
إصدار ٢٠٢٣
EEI
معامل كفاءة الطاقة
THIS LIGHT:
(MODEL) AND (BRAND)
هذا المصباح:
(علامة تجارية) و (طراز)
Lighting Type
.....
نوع الإنارة
.....
إزالة أو تغطية أو العبث بهذه البطاقة قبل البيع يعرضك للملاحقة القانونية
The removal, covering or damaging of this label before sale is punishable by law

متطلبات كفاءة الطاقة ومتطلبات التشغيل لمنتجات الانارة– الجزء الاول

ENERGY EFFICIENCY, FUNCTIONALITY AND REQUIREMENTS FOR LIGHTING PRODUCTS PART 1

Table of Contents

Table of Tables

1. Scope

This regulation covers indirect and direct general light sources having a luminous flux above60 lumens or below 12,000 lumens of the following technologies:

- Incandescent lamps
- Compact fluorescent lamps with integrated ballast (CFLi)
- Halogen lamps
- Light-emitting diode (LED) lamps (Incandescent retrofit types)
- Light-emitting diode (LED) lamps (Halogen retrofit type)

The table below shows the inclusions and exclusions parameters in this technical regulation:

Regulatory parameters	Indirect lamps	Direct lamps	Luminaires	Control
Electromagnetic compatibility	✓	✓	×	×
Performance	✓	✓	×	×
Functionality requirements	✓	✓	×	×
Marking requirements	✓	✓	×	×
Energy efficiency requirements	✓	✓	×	×
Hazardous chemicals requirements	✓	✓	×	×

✓ Included in this regulation.
× Excluded from this regulation.

Lamps used in special applications or not intended for general lighting purposes are excluded from parts of this regulation as detailed in Annex A.

2. Terms and definitions

For the purpose of this document, the following terms and definitions shall apply.

2.1 General

General Lighting: the full or partial illumination of an area, by replacing or complementing natural light with artificial light in order to enhance visibility in that area.

Homogeneous materials: means one material of uniform composition throughout, or a material consisting of a combination of materials that cannot be disjointed or separated into different materials by mechanical actions such as unscrewing, cutting, crushing, grinding and abrasive processes.

Manufacturer: means the natural or legal person who manufactures products covered by this regulation and is responsible for their conformity with this regulation in view of their being placed on the market and/or put into service under the manufacturer's own name or trademark or for the manufacturer's own use. In the absence of a manufacturer as defined in the first sentence of this point or of an importer, any natural or legal person who places on the market and/or puts into service products covered by this regulation shall be considered a manufacturer.

Product: an equipment, system or part which is included in the list of regulated products under this regulation.

2.2 Technical

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. They may be supplied with an integrated power supply.

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.

Beam angle: means the angle between two imaginary lines in a plane through the optical beam axis, such that these lines pass through the center of the front face of the lamp and through points at which the luminous intensity is 50 % of the center beam intensity, where the center beam intensity is the value of luminous intensity measured on the optical beam axis.

Chromaticity: means the property of a color stimulus defined by its chromaticity coordinates, or by its dominant or complementary wavelength and purity taken together.

Color consistency: means the maximum deviation of chromaticity coordinates (x and y) of a single lamp from a chromaticity center point (cx and cy), expressed as the size (in steps) of the MacAdam ellipse formed around the chromaticity center point (cx and cy). MacAdam ellipses

refer to the regions (in the form of an ellipse) on a chromaticity diagram which contain all colors that are indistinguishable to the average human eye from the color at the center of the ellipse.

Color rendering (Ra): means the effect of an illuminant on the color appearance of objects by conscious or subconscious comparison with their color appearance under a reference illuminant.
Compact fluorescent lamp with integrated ballast (CFLi): means a fluorescent lamp that includes all components necessary for starting and stable operation of the lamp.

Components and sub-assemblies: means parts intended to be incorporated into products which are not placed on the market and/or put into service as individual parts for end- users or the environmental performance of which cannot be assessed independently.

Control device: means an electronic or mechanical device controlling or monitoring the luminous flux of the lamp by other means than power conversion for the lamp, such as timer switches, occupancy sensors and daylight standard devices. In addition, phase cut dimmers shall also be considered as control devices.

Correction factor: any mathematical adjustment made to a calculation to account for deviations in either the sample or the method of measurement. Specifically for this regulation, the correction is needed to be able to apply one formula for different lamp types. The efficacy (lumens per watt) of a certain lamp type can be described by a certain formula. There are however systematic differences that require a correction. As an example, some customers have a strong preference for lamps with an outer bulb as these resemble covered incandescent lamps best. Such lamps are made with an additional outer bulb which is placed over the light generating part. The shape of the efficacy curve is not changed by this outer bulb, but because it absorbs part of the emitted light, the formula needs to be corrected for the additional light loss.

Correlated color temperature (Tc [K]): a specification of the color appearance of the light emitted by a lamp, relating its color to the color of light from a reference source when heated to a particular temperature, measured in degrees Kelvin (K). More specifically, it is the absolute temperature of a blackbody whose chromaticity most nearly resembles that of the light source. A black body is an idealized physical body that absorbs all incident electromagnetic radiation, regardless of frequency or angle of incidence.

Direct Lamp: a lamp having at least 80% light output within a solid angle of πsr corresponding to a cone with an angle of 120˚.

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 vapors.

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.

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.

Halogen lamp control gear: means lamp control gear that transforms mains voltage to extra low voltage for halogen lamps.

Incandescent lamp: means a filament lamp in which the filament operates in an evacuated bulb or is surrounded by inert gas.

Initial luminous flux: means the luminous flux of a lamp after a short operating period according to the applicable standard.

Lamp: means a unit emitting light, 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.

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.

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 a 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.

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.

Lamp lifetime: 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. For all other lamps, 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.

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.

Lamp mercury content: means the mercury contained in the lamp (weight usually specified in mg).

Lamp start time: means the time needed, after the supply voltage is switched on, for the lamp to start fully and remain alight.

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.

Lamp warm-up time: means the time needed after start-up for the lamp to emit a defined proportion of its stabilized luminous flux.

LED lamp: means a lamp incorporating one or more LED modules. The lamp may be equipped with a cap.

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.

LED package: means an assembly having one or more LED(s). The assembly may include an optical element and thermal, mechanical and electrical interfaces.

Light-emitting diode (LED): means a light source which consists of a solid state device embodying a p-n junction. The junction emits optical radiation when excited by an electric current.

Lighting: means the application of light to a scene, objects or their surroundings so that they may be seen by humans.

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.

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.

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. Radiant flux is the measure of the total power of electromagnetic radiation (including infrared, ultraviolet, and visible light).

Luminous intensity (candela or cd): 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.

Materials: means all materials used during the life cycle of a product.

Nominal value: means the value of a quantity used to designate and identify a product.

Indirect lamp: means a lamp that is not a direct lamp.

Power factor: means the ratio of the absolute value of the real power (also known as active power) to the apparent power under periodic conditions.

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.

Rated value: 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.

Self-ballasted lamp: a unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a light source and any additional elements necessary for starting and stable operation of the light source i.e. CFL with integrated ballast (CFLi) or LED retrofit lamp with integrated ballast.

Special purpose lamps: are lamps covered by Annex A3 of this regulation

Switching cycle: means the sequence of switching the lamp on and off at set intervals.

Useful luminous flux (Φ_{use}): means the part of the luminous flux of a lamp falling within the beam angle used for calculating the lamp's energy efficiency.

White light source: means a light source having chromaticity coordinates that satisfy the following requirement:
- $0.270 < x < 0.530$
- $-2.3172\ x^2 + 2.3653\ x - 0.2199 < y < -2.3172\ x^2 + 2.3653\ x - 0.1595$

3. Reference standards

The following list of reference standards applies. However, this regulation supersedes the below reference standards in case of conflicting requirements.

- SASO IEC 60061-1 Specification for lamp caps and holders together with gauges for the control of interchangeability and safety - Lamp caps
- GSO IEC 60064:2011 Tungsten Performance Standard
- GSO (IEC 60357):2017 T-H Performance Standard
- GSO (IEC 60360):2015 Method of measurement of lamp cap temperature rise
- GSO (IEC 60630):2015 Maximum lamp outlines
- SASO IEC 60634 Heat test source (HTS) lamps for carrying out heating tests on luminaires
- GSO IEC 60682:2015 Method of measuring pinch temperatures
- GSO (IEC TR 60887):2021 Glass bulb designation system for lamps
- GSO IEC 60901:2008 Single-capped fluorescent lamps - Performance Standard
- GSO IEC 60969:2007 CFLi Performance requirements
- SASO IEC TR 60972 Classification and interpretation of new lighting products
- GSO IEC 61000-3-2:2008 Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
- GSO IEC 61126:2015 Procedure for constructing maximum outlines
- GSOIEC TR 61341:2014 Method of measurement of center beam intensity and beam angle.
- GSOIEC 61549 :2014Miscellaneous lamp Standard
- GSO IEC TR 62732:2015 Three-digit code for designation of color rendering and correlated color temperature
- IEC 62471-2 Photobiological safety of lamps and lamp systems - Part 2: Guidance on manufacturing requirements relating to non-laser optical radiation safety
- GSO IEC/TS 62504:2013 General lighting – LEDs and LED modules – Terms and definitions

- GSO IEC 62554:2014 Sample preparation for measurement of mercury level in fluorescent lamps
- GSO IEC 62612 :2013 Self ballasted LED lamps > 50V Performance Requirements
- SASO standard to be adopted based on (Project IEC 62663-2) Non-ballasted LED lamps – Performance Requirements
- GSO IEC/PAS 62707-1 :2014LED Binning
- GSO IEC/PAS 62717:2013 LED Modules Performance specifications
- GSO IEC TR 62778:2016 Application of 62471 to light sources and luminaires (blue light) SASO EN 13032-4 Light and lighting - Measurement and presentation of photometric data of lamps and luminaires Part 4: LED light sources and luminaires
- GSO IEC 60064:2011
- IEC 60061-1
- CIE 97
- CIE 63
- CIE 15
- CIE 18.2
- IEC 62671
- IEC 60357
- IEC 60432-2
- IEC 61000-3-2
- IEC 60968
- IEC 60969
- CIE 13.3
- IEC 62612, 11.2
- prEN 13032-4
- CIE 18.2
- IEC 62612, 6
- IEC 62560, 5.2
- CIE 84
- IEC/TR 61341
- EN 60357
- IEC 62560

4. Requirements for indirect and direct lamps

4.1 Energy efficiency requirements

Lamps under the scope of this regulation shall comply with the energy efficiency requirements specified in Annex B (indirect lamps) according to Table 2, and Annex G (direct lamps) according to Table 8.

Energy efficiency classes and the methods of calculating the EEI for lamps are detailed in Annex C (indirect lamps) and Annex G(direct lamps).

4.2 Functionality requirements

Lamps under the scope of this regulation shall comply with the functionality requirements. specified in Annex C (indirect lamps) and Annex G (direct lamps).

4.3 Marking requirements

Instruction manuals supplied with products shall be in the Arabic and English language. Cautionary and/or any safety warnings for the direct user or consumer shall be in the Arabic and English language. The use of internationally accepted pictograms is permitted instead of verbally expressed language.

Lamps listed in the scope of this regulation shall comply with the marking requirements specified in Annex D (indirect lamps) and Annex G (direct lamps).

"Special purpose" lamps (Annex A-3) do not need to comply with the marking requirements specified in Annex D and Annex G. Instead, the following information shall be clearly and prominently indicated on their packaging and in all forms of product information accompanying the lamp when it is placed on the market:

- Brand Name
- Model number
- Rated power(Watt)
- Rated Voltage (Voltage)
- Rated Lumen(lumen)
- Rated color temperature (Kelvin)
- Country of origin
- Their intended purpose

4.4 Hazardous chemicals: Substance restrictions for lamps

Lamps listed in the scope of this regulation shall comply with the maximum hazardous substance limits according to Annex H, Tables 16, 17 and 18.

4.5 Energy efficiency label

Products requiring compliance to energy efficiency requirements shall bear the energy efficiency label as per Annex I.

5. Testing requirements

Lamps listed in the scope of this regulation shall be tested under the requirements mentioned in Annex J

ANNEX A - Exempted products

A 1 - The following are exempted from the requirements of this regulation except for hazardous materials as specified in Annex H:

- Traffic/signal lamps, such as:
  - Signal lamps
  - Aviation/Aircraft lighting – for runways and planes, all exterior applications
  - Train lighting, including signal lighting
  - Water craft lighting, including signal lighting
  - Automotive lighting/lamps
- Heating lamps (infrared), such as:
  - Infrared heat lamps – comfort heating (outdoor and indoor)
  - Infrared heat lamps – industrial
  - Infrared heat lamps – animal rearing
  - Infrared heat lamps – health care

A 2 - The following lamps are only exempted from the energy labelling requirements of this regulation:

- Lamps marketed for operation with batteries
- Lamps 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
- Lamps 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.

These afore-mentioned lamps are not excluded from this regulation when they are marketed for general lighting purposes.

A 3 - The following lamps are considered as "special purpose" and therefore exempt from the energy efficiency, functionality and marking requirements (except marking requirements specified in Section 4.3 of this regulation for "special purpose" lamps):

- Lamps for swimming pools
- Lamps for emitting light as an agent in chemical or biological processes, such as:
  - Pet care (aquarium, terrarium, etc.)
  - Anti-insect lamps
  - Disinfection
  - Tanning
  - Polymerization
  - Photodynamic therapy
  - Horticulture
- Display optic lamps (< 12,000 lumens), such as:
  - Stage and studio lamps
  - Theatre lamps
  - Television (TV) lamps
  - Studio lamps
  - Photo lamps – Flashlights or lamps for the development of pictures
  - Projection lamps
- Light sources that do not comply with the definition of white light sources Household appliances, such as:

- Oven lamps
- Refrigerator lamps
- Sewing machine lamps
- Temperature lamps
- Mirror lamps

- Decorative lighting items.

ANNEX B - Energy efficiency requirements for indirect lamps

The following requirements apply to the following ***indirect*** lamp types:

- Incandescent lamps
- Halogen lamps
- Compact fluorescent lamps with integrated ballast (CFLi)
- Light-emitting diode (LED) lamps (Incandescent retrofit types)
- Light-emitting diode (LED) lamps (Halogen retrofit types)

B1 - Calculation of energy efficiency index

For the calculation of the energy efficiency index (EEI) of a model, its corrected rated power for any control gear losses is compared with its reference power.

The EEI is calculated as follows and rounded to two decimal places:

$$EEI = \frac{P_{cor}}{P_{ref}}$$

P_{cor} is defined as:

For models *without* external control gear, P_{cor} is the rated power (P_{rated}).

For models *with* external control gear, P_{cor} is the rated power (P_{rated}) corrected in accordance with the corrections factors listed below:

Lamps operating on external halogen lamp control gear:
Power corrected for control gear losses (P_{cor}) = P_{rated} × 1.06

Lamps operating on external LED lamp control gear:
Power corrected for control gear losses (P_{cor}) = P_{rated} × 1.10

The rated power P_{rated} of the lamps is measured at their nominal input voltage.

P_{ref} is defined as:

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

For models with Φ_{use} < 1,300 lumen: $P_{ref} = 0.88\sqrt{\Phi_{use}} + 0.049 \times \Phi_{use}$
For models with Φ_{use} ≥ 1,300 lumen: $P_{ref} = 0.07341 \times \Phi_{use}$

The useful luminous flux (Φ_{use}) is defined in accordance with Table 1.

Table 1: Definition of useful luminous flux

Type	Useful luminous flux (Φ_{use})
Indirect lamps	Total rated luminous flux (Φ)

B2 - Maximum allowable EEI for indirect lamps

The maximum allowable EEI for indirect lamps are outlined in Table 2.

Table 2: Maximum energy efficiency index (EEI) for indirect lamps

Lamp type	Incandescent	High voltage halogen[1]	Low voltage halogen	CFLi & LED
EEI	0.95	0.5	0.5	0.24

B3 - Energy efficiency classes

The energy efficiency rating of lamps shall be determined on the basis of their energy efficiency index (EEI) as outlined in Table 3.

Table 3: Energy efficiency classes for indirect lamps

Energy efficiency index (EEI)	
6 Stars	EEI ≤ 0.11
5 Stars	0.11 < EEI ≤ 0.13
4 Stars	0.13 < EEI ≤ 0.18
3 Stars	0.18 < EEI ≤ 0.24
2 Stars	0.24 < EEI ≤ 0.50
1 Stars	0.50 < EEI ≤ 0.95

ANNEX C - Functionality requirements for indirect lamps

The lamp functionality requirements are outlined in Table 4 for indirect compact fluorescent lamps with integrated ballast (CFLi) lamps, Table 5 for indirect LED lamps, and Table 6 for all other indirect lamp types.

For the purposes of testing the number of times the lamp can be switched on and off before failure, the switching cycle shall consist of periods comprising 1 minute on and 3 minutes off.

For the purposes of testing lamp lifetime, lamp survival factor, lumen maintenance and premature failure, the standard switching cycle shall be used.

Table 4: Functionality requirements for indirect compact fluorescent lamps with integrated ballast

Functionality parameter	Requirements
Lamp survival factor at 6,000h	≥ 0.70
Lumen maintenance	At 2,000 h: ≥ 88 % (≥ 83 % for lamps with second lamp envelope) At 6,000 h: ≥ 70%
Number of switching cycles before failure	≥ lamp lifetime expressed in hours ≥ 30,000 if lamp starting time > 0.3 s
Starting time	< 1.5s if P < 10W < 1.0s if P ≥ 10W
Lamp warm-up time to 60% total rated luminous flux (Φ)	< 40 s or < 100 s for lamps containing mercury in amalgam form
Premature failure rate	≤ 2.0 % at 400 h
UVA + UVB radiation	≤ 2.0 mW/klm
UVC radiation	≤ 0.01 mW/klm
Lamp power factor	≥ 0.55 if P < 25 W ≥ 0.90 if P ≥ 25 W
Color rendering (Ra)	≥ 80

Table 5: Functionality requirements for indirect LED lamps

Functionality parameter	Requirement
Lamp survival factor at 6,000h	≥ 0.90
Lumen Maintenance at 6,000h	≥ 0.80
Number of switching cycles before failure	≥ 15,000 if rated lamp life ≥ 30,000h Otherwise: ≥ half the rated lamp life expressed in hours
Starting time	< 0.5s
Lamp warm-up time to 95% Φ	< 2.0s
Premature failure rate	≤ 5.0% at 1,000h
Color rendering (Ra)	≥ 80
Color consistency	Variation of chromaticity coordinates within a six-step MacAdam ellipse or less.
Lamp power factor (PF) for lamps with integrated control gear	P ≤ 2W: no requirement 2W < P ≤ 5 W: PF > 0.4 5W < P ≤ 25 W: PF > 0.5 P > 25W: PF > 0.9

Table 6: Functionality requirements for all other indirect lamps (Excluding compact fluorescent lamps with integrated ballast and LED lamps)

Functionality parameter	Requirement
Rated lamp lifetime	≥ 2,000h
Lumen maintenance	≥ 85% at 75% of rated average lifetime
Number of switching cycles	≥ four times the rated lamp life expressed in hours
Starting time	< 0.2s
Lamp warm-up time to 60% total rated luminous flux (Φ)	≤ 1.0s
Premature failure rate	≤ 5.0% at 200h
Lamp power factor	≥ 0.95

ANNEX D - Marking requirements for indirect lamps

The following should be printed on the bulb with non-removable ink:

- Brand name
- Input voltage
- Rated power (Watt)
- Country of origin

Information shall be visibly displayed prior to purchase to end-users on the packaging[1] and/or on an accompanying catalogue, in addition the information should be displayed on free access websites (English and/or Arabic).

The information does not need to be specified using the exact wording of the list below. It may be displayed using graphs, figures or symbols rather than text:

a. Brand name
b. Model number
c. Rated Input voltage(Volt)
d. Lamp type (Indirect)
e. Country of origin
f. Lamp technology (Incandescent/Halogen/CFLi/LED)
g. Cap type
h. Rated lamp power (Watt)
i. Rated luminous flux (Lumens)
j. Rated efficacy (Lumens/Watt)
k. Rated life time (hours)
l. Rated Number of switching cycles before up to B50 lifetime
m. Rated Color temperature (Kelvin)
n. Rated power factor
o. Rated color rendering (percentage)
p. Lamp mercury content as ***X.X mg*** (applicable only to lamps that contains mercury) (milligrams).
q. Following information shall be displayed on free-access websites or in any other form the manufacturer deems appropriate:
    - how to clean lamp debris in case of accidental lamp breakage and disposal of lamp at the end of life, when relevant;
    - About actual values of the hazardous content, when relevant

[1] Using a print which is not easily removable

ANNEX E - Energy efficiency requirements for direct lamps

The following requirements apply to the following ***direct*** lamp types:

- Incandescent lamps
- Halogen lamps
- Compact fluorescent lamps with integrated ballast (CFLi)
- Light-emitting diode (LED) lamps (Incandescent retrofit types)
- Light-emitting diode (LED) lamps (Halogen retrofit types)

E1 - Calculation of energy efficiency index

The energy efficiency index (EEI) of the lamp is calculated as follows and rounded to two decimal places:

$$EEI = \frac{P_{cor}}{P_{ref}}$$

P_{cor} is defined as:
P_{cor} is the rated power (P_{rated}) measured at nominal input voltage and corrected where appropriate in accordance with Table 7. The correction factors are cumulative where appropriate.

Table 7: Correction factors for direct lamps

Scope of the correction	Corrected power ($Pcor$)
Lamps operating on external halogen lamp control gear	P_{rated} × 1.06
Lamps operating on external LED lamp control gear	P_{rated} × 1.10
Compact fluorescent lamps with color rendering index ≥ 90	P_{rated} × 0.85
Lamps with anti-glare shield	P_{rated} × 0.80

P_{ref} is defined as:

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

For models with Φ_{use} < 1,300 lumen: $P_{ref} = 0.88\sqrt{\Phi_{use}} + 0.049 \times \Phi_{use}$
For models with Φ_{use} ≥ 1,300 lumen: $P_{ref} = 0.07341 \times \Phi_{use}$

Φ_{use} is defined as:

- Rated luminous flux present in a 120° cone ($\Phi_{120°}$) for direct lamps meeting all the following conditions:

- Having a beam angle ≥ 90°
- Being of type different than a filament lamp
- Carrying a warning on their packaging in accordance with point (j) of Annex H (Information requirements on packaging and free access websites)

- Rated luminous flux present in a 90° cone ($\Phi_{90°}$) for all other direct lamps

E2 - Maximum allowable EEI for direct lamps

The maximum allowable EEI for direct lamps are outlined in Table 8.

Table 8: Maximum energy efficiency index (EEI) for direct lamps

Lamp type	Incandescent	High voltage halogen	Low voltage halogen	CFLi & LED
EEI	0.95	0.95	0.95	0.24

E3 - Energy efficiency classes

The energy efficiency rating of lamps shall be determined on the basis of their energy efficiency index (EEI) as outlined in Table 9.

Table 9: Energy efficiency classes for direct lamps

Energy efficiency index (EEI)	
6 Stars	EEI ≤ 0.11
5 Stars	0.11 < EEI ≤ 0.13
4 Stars	0.13 < EEI ≤ 0.18
3 Stars	0.18 < EEI ≤ 0.24
2 Stars	0.24 < EEI ≤ 0.50
1 Stars	0.50 < EEI ≤ 0.95

ANNEX F - Functionality requirements for direct lamps

The lamp functionality requirements are outlined in Table 10 for direct compact fluorescent lamps with integrated ballast, Table 11 for direct LED lamps, and Table 12 for incandescent, halogen, and other direct lamps.

For the purposes of testing the number of times the lamp can be switched on and off before failure, the switching cycle shall consist of periods comprising 1 minute on and 3 minutes off or 5 minutes on and 5 minutes off.

For the purposes of testing lamp lifetime, lamp survival factor, lumen maintenance and premature failure, the standard switching cycle shall be used.

Table 10: Functionality requirements for direct compact fluorescent lamps with integrated ballast (CFLi)

Functionality parameter	Requirements
Lamp survival factor at 6,000 h	≥ 0.70
Lumen maintenance	At 2,000 h: ≥ 83 % At 6,000 h: ≥ 70%
Number of switching cycles before failure	≥ half the lamp lifetime expressed in hours ≥ 30,000 if lamp starting time > 0.3 s
Starting time	< 1.5 s if P < 10 W < 1.0 s if P ≥ 10 W
Lamp warm-up time to 60 % total rated luminous flux (Φ)	< 40 s or < 100 s for lamps containing mercury in amalgam form
Premature failure rate	≤ 5.0 % at 1,000 h
Lamp power factor for lamps with integrated control gear	≥ 0.55 if P < 25 W ≥ 0.90 if P ≥ 25 W
Color rendering (Ra)	≥ 80

Table 11: Functionality requirements for direct LED lamps

Functionality parameter	Requirements
Lamp survival factor at 6,000 h	≥ 0.90
Lumen Maintenance at 6,000 h	≥ 0.80
Number of switching cycles before failure	≥ 15,000 if rated lamp life ≥ 30,000 h otherwise: ≥ half the rated lamp life expressed in hours
Starting time	< 0.5 s
Premature failure rate	≤ 5.0 % at 1,000 h
Color rendering (Ra)	≥ 80
Color consistency	Variation of chromaticity coordinates Within a six-step MacAdam ellipse or less.
Lamp power factor (PF) for lamps with integrated control gear	P ≤ 2 W: no requirement 2 W < P ≤ 5 W: PF > 0.4 5 W < P ≤ 25 W: PF > 0.5 P > 25 W: PF > 0.9

Table 12: Functionality requirements for all other direct lamps (excluding compact fluorescent lamps with integrated ballast and LED)

Functionality parameter	Requirements
Rated lamp lifetime at 50 % lamp survival	≥ 2,000 h for mains voltage types ≥ 4,000 h for extra low voltage lamps
Lumen maintenance	≥ 80 % at 75 % of rated average lifetime
Number of switching cycles	≥ four times the rated lamp life expressed in hours
Starting time	< 0.2 s
Lamp warm-up time to 60 % total rated luminous flux (Φ)	≤ 1.0 s
Premature failure rate	≤ 5.0 % at 200 h
Lamp power factor for lamps with integrated control gear	Power > 25 W: ≥ 0.9 Power ≤ 25 W: ≥ 0.5

ANNEX G - Marking requirements for direct lamps

The following should be printed on the bulb with non-removable ink:

- Brand name
- Input voltage
- Rated power
- Country of origin

Information shall be visibly displayed prior to purchase to end-users on the packaging and/or on an accompanying catalogue, in addition the information should be displayed on free access websites (English and/or Arabic).

The information does not need to be specified using the exact wording of the list below. It may be displayed using graphs, figures or symbols rather than text:

a. Brand name
b. Model number
c. Rated Input voltage (Volt)
d. Rated lamp power (Watt)
e. Lamp type (Direct)
f. Country of origin
g. Lamp technology (Incandescent/Halogen/CFLi/LED)
h. Cap type
i. Rated luminous flux (Lumens)
j. Rated efficacy (lumens/watt)
k. Rated life time (hours)
l. Rated Color temperature(Kelvins)
m. Rated Number of switching cycles before premature failure.
n. Warm-up time up to 60 % of the full light output
o. Rated color rendering (percentage)
p. Lamp mercury content as ***X.X mg*** (applicable only to lamps that contains mercury) (milligrams
q. Place the information to refer to in the event of an accidental breakage of the lamp to find instructions on how to clean lamp debris provided on the manufacturer's website or any other form the manufacturer deems appropriate.
r. A warning if the lamp cannot be dimmed or can be dimmed only on specific dimmers; in the latter case, a list of compatible dimmers shall be also provided on the manufacturer's website or any other form the manufacturer deems appropriate.
s. Following information are optional:
    - If designed for optimum use in non-standard conditions (such as ambient temperature Ta ≠ 25 °C or specific thermal management is necessary), provide information on those conditions.

- If the lamp's beam angle is ≥ 90° and its useful luminous flux as defined in Annex F is to be measured in a 120° cone, a warning that the lamp is not suitable for accent lighting.
- If the lamp cap is a standardized type also used with filament lamps, but the lamp's dimensions are different from the dimensions of the filament lamp(s) that the lamp is meant to replace, provide a drawing comparing the lamp's dimensions to the dimensions of the filament lamp(s) it replaces.
- An indication that the lamp is of a type listed in the first column of Table 13 may be displayed only if the luminous flux of the lamp in a 90° cone ($\Phi 90^{\circ}$) is not lower than the reference luminous flux indicated in Table 13 for the smallest wattage among the lamps of the type concerned. The reference luminous flux shall be multiplied by the correction factor in Table 14. For LED lamps, it shall be in addition multiplied by the correction factor in Table 15.
- An equivalence claim involving the power of a replaced lamp type may be displayed if the lamp type is listed in Table 13 and if the luminous flux of the lamp in a 90° cone ($\Phi 90^{\circ}$) is not lower than the corresponding reference luminous flux in Table 13. The reference luminous flux shall be multiplied by the correction factor in Table 14. For LED lamps, it shall be in addition multiplied by the correction factor in Table 15. The intermediate values of both the luminous flux and the claimed equivalent lamp power (rounded to the nearest 1 W) shall be calculated by linear interpolation between the two adjacent values.

t. Following information shall be displayed on free-access websites or in any other form the manufacturer deems appropriate:
   - how to clean lamp debris in case of accidental lamp breakage and disposal of lamp at the end of life, when relevant;
   - About actual values of the hazardous content, when relevant

Table 13: Reference luminous flux for equivalence claims

Type	Power (W)	Reference $\Phi_{90^{\circ}}$ (lm)
Extra-low voltage reflector type		
MR11 GU4	20	160
	35	300
MR16 GU 5.3	20	180
	35	300
	50	540
AR111	35	250

	50	390
	75	640
	100	785
Mains-voltage blown glass reflector type		
R50/NR50	25	90
	40	170
R63/NR63	40	180
	60	300
R80/NR80	60	300
	75	350
	100	580
R95/NR95	75	350
	100	540
R125	100	580
	150	1,000
Mains-voltage pressed glass reflector type		
PAR16	20	90
	25	125
	35	200
	50	300
PAR20	35	200
	50	300
	75	500
PAR25	50	350
	75	550
PAR30S	50	350
	75	550
	100	750
PAR36	50	350
	75	550
	100	720
PAR38	60	400
	75	555
	80	600
	100	760
	120	900

Table 14: Multiplication factors for lumen maintenance

Lamp type	Luminous flux multiplication factor
Halogen lamps	1.00
Compact fluorescent lamps	1.08
LED lamps	1.15

Table 15: Multiplication factors for LED lamps

LED lamp beam angle	Luminous flux multiplication factor
20° ≤ beam angle	1.00
15° ≤ beam angle < 20°	0.90
10° ≤ beam angle < 15°	0.85
beam angle < 10°	0.80

ANNEX H - Hazardous substances limits

The following limits for hazardous substances apply.

Table 16: Maximum content limits of hazardous substances for lamps in the scope of this regulation

Descriptions	Tolerated maximum concentrated values of substance by weight in
Lead(Pb)	0.1%
Cadmium (Cd)	0.01%
Hexavalent chromium (Cr6+)	0.1%
Polybrominated biphenyls (PBB)	0.1%
Polybrominated diphenyl ether (PBDE)	0.1%

Table 17 outlines the limit on mercury content per light bulb, which applies to single capped compact fluorescent lamps (integrated ballast) for general lighting purposes. All other lamp types in this regulation shall not have mercury limits.

Table 17: *Maximum mercury content limits for lamps in the scope of this regulation (applies to single capped compact fluorescent lamps with integrated ballast for general lighting purposes only)*

Lamp type	Limit
≥30 W and <150 W	5.0 mg
<30 W	2.5 mg
<30 W with long lifetime (> 15,000 h)	3.5 mg
With circular or square structural shape or other non-linear with tube diameter ≤ 17 mm	7.0 mg

Table 18 outlines exemptions to the hazardous substance limits set in this annex. Eligible products or components have no limit on the levels of the relevant hazardous substance.

Table 18: Exemptions for lamps in the scope of this regulation

Description	Requirements
Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound	No limit
Lead in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher	No limit
Cadmium and its compounds in electrical contacts	No limit
Lead as an alloying element in aluminum containing up to 0,4 % lead by weight	No limit
Copper alloy containing up to 4 % lead by weight	No limit
Lead in high melting temperature type solders (i.e. lead- based alloys containing 85 % by weight or more lead)	No limit
Lead and cadmium in printing inks for the application of enamels on glasses, such as borosilicate and soda lime glasses	No limit
Lead in glass of fluorescent tubes not exceeding 0.2% by weight	No limit

ANNEX I - Energy efficiency label

I-1 - Determining the energy efficiency class

The energy efficiency class for each product shall be determined as outlined in Table 3 in Annex B-3 (indirect lamps) and as outlined in Table 9 in Annex E-3 (direct lamps).

I-2 - Design and placement of the label

Design and placement of the label is based on the design provided in Annex XX,

The label shall be printed on the most prominent part of the individual product packaging to be easily visible to the end-user.

ANNEX J – Testing methodologies

J-1 – General testing methodologies

The following is the list of reference standards for testing energy efficiency, functionality, and safety requirements.

Table 19: Reference standards for indirect incandescent light bulbs

Parameter	Reference	Remarks
EEI	IEC 60064, 3.4.1 for power; CIE 84 for basics of luminous flux measurement; IEC 60064, 3.4.2 for luminous flux	The average EEI value shall be calculated from the arithmetic mean of each product's individual EEI.
Lamp caps	IEC 60064 in conjunction with IEC 60061-1	
Lamp survival factor	CIE 97	
Rated lifetime, lamp lifetime	IEC 60064,	
Lumen maintenance, lamp lumen maintenance factor	IEC 60064, 3.5	
Number of switching cycles	—	Reliable, accurate and reproducible measurement procedures shall be used.
Starting time	—	Not relevant for incandescent lamps.
Lamp warm-up time	—	Not relevant for incandescent lamps.
Premature failure rate	IEC 60064, 3.5	
Lamp power factor	—	Not relevant for incandescent lamps

		(power factor equals 1).
Chromaticity coordinates	CIE S 010 (or ISO 23539) for basics on photometry, CIE 15 for basics on colorimetry, CIE 63 for spectroradio-metric measurement	
CCT	CIE 15	
CRI	—	Not relevant for incandescent lamps (CRI is 100).
Luminance	CIE 18.2	
Specific effective UV radiant power	IEC 62471	
Dimensions	IEC 60064	

Table 20: Reference standards for indirect halogen light bulbs

Parameter	Reference	Remarks
Lamp efficacy, luminous efficacy	IEC 60357, 1.4.5 CIE 84 for basics of luminous flux; EN 60357, 1.4.4 for power	The average efficacy value shall be calculated from the arithmetic mean of each product's individual efficacy.
Lamp caps	IEC 60432-2, 1.1 for halogen for domestic and general lighting; EN 60432-3, 2.3 for halogen (not for vehicles); in conjunction with EN 60061-1	
Lamp survival factor	CIE 97	
Rated lifetime, lamp lifetime	IEC 60357, 1.4	
Lumen maintenance, lamp lumen maintenance factor	IEC 60357, 1.4	
Number of switching cycles	—	Reliable, accurate and reproducible measurement procedures shall be used.
Starting time	—	Not relevant for halogen incandescent lamps.

Lamp warm-up time	—	Not relevant for halogen incandescent lamps.
Premature failure rate	IEC 60357,	
Lamp power factor (only for lamps with integrated controlgear)	IEC 61000-3-2	
Chromaticity coordinates	CIE S 010 (= ISO 23539) for basics on photometry, CIE 15 for basics on colorimetry, CIE 63 for spectroradio-metric measurement	
CCT	CIE 15	
CRI	—	Not relevant for halogen incandescent lamps (CRI is 100).
Luminance	CIE 18.2	
Specific effective UV radiant power	IEC 62471	
Lamp dimensions	IEC 60357	

Table 21: Reference standards for indirect Compact Fluorescent Light bulbs with integrated control gear

Parameter	Reference	Remarks
Lamp efficacy, luminous efficacy	IEC 60969, at present 34A/1701/CDV for luminous flux; CIE 84 for basics of luminous flux; 34A/1701/CDV for power	The average efficacy value shall be calculated from the arithmetic mean of each product's individual efficacy.
Lamp caps	IEC 60968 in conjunction with IEC 60061-1	
Lamp survival factor	CIE 97	
Rated lifetime, lamp lifetime	IEC 60969, at present 34A/1701/CDV Annex F	
Lumen maintenance, lamp lumen maintenance factor	IEC 60969, at present 34A/1701/CDV Annex C	
Number of switching cycles	IEC 60969, at present 34A/1701/CDV Annex E	
Starting time	IEC 60969, at present 34A/1701/CDV Annex A	

Lamp warm-up time	IEC 60969, at present 34A/1701/CDV Annex B	The run-up time shall be used instead.
Premature failure rate	IEC 60969, at present 34A/1701/CDV Annex F	
Lamp power factor (only for lamps with integrated controlgear)	IEC 61000-3-2	
Chromaticity coordinates	CIE 15	
CCT	CIE 15	
CRI	CIE 13.3	
Luminance	CIE 18.2	
Specific effective UV radiant power	IEC 62471	
Lamp dimensions	IEC 60969, at present 34A/1701/CDV Table 3	
Dimmability	—	Reliable, accurate and reproducible measurement procedures shall be used.

Table 22: Reference standards for indirect Light Emitting Diode light bulbs

Parameter	Reference	Remarks
Lamp efficacy	IEC 62612, 9.3 efficacy. To be corrected according to IM 244 with correction factor.	The average efficacy values shall be calculated from the arithmetic mean of each product's individual efficacy.
Rated lifetime, lamp lifetime	—	Reliable, accurate and reproducible measurement procedures shall be used. For LED lamps, EN 62612 provides procedures for 6,000 h testing time.
Lamp survival factor	IEC 62612, 11.2	The compliance criteria of the regulations shall be applied.
Lumen maintenance, lamp lumen maintenance factor	IEC 62612, 11.2	The compliance criteria of the regulations shall be applied.
Number of switching	IEC 62612, 11.3.3	
Starting time	—	Reliable, accurate and reproducible measurement procedures shall be used.
Lamp warm-up time	—	Reliable, accurate and reproducible measurement procedures shall be used.

Premature failure rate	IEC 62612, 11.2	An additional read point at 1,000 h and the compliance criteria according to the regulations shall be applied.
Lamp power factor	IEC 61000-3-2	
Chromaticity coordinates	prEN 13032-4	
CCT	prEN 13032-4	
CRI	prEN 13032-4	
Luminance	CIE 18.2	
Specific effective UV radiant power	IEC 62471	
UVA+UVB	IEC 62471	
Lamp dimensions	IEC 62612, 6	
Dimmability	IEC 62560, 5.2	The presence of a symbol or warning shall be checked.
Lamp caps	IEC 62560	

Table 23: Reference standards for direct incandescent light bulbs

Parameter	Reference	Remarks
EEI	CIE 84 for general conditions of luminous flux measurement. L2(AP)005 for cone luminous	The average EEI value shall be calculated from the arithmetic mean of each product's individual EEI.
Rated lifetime	IEC 60064,	
Lumen maintenance	IEC 60064, 3.5	
Number of switching cycles	—	Reliable, accurate and Reproducible measurement procedures shall be used.
Starting time	—	Not relevant for incandescent lamps.
Lamp warm-up time	—	Not relevant for incandescent lamps.
Premature failure rate	IEC 60064, 3.5	
Lamp power factor	—	Not relevant for incandescent lamps (power factor equals 1).

Chromaticity coordinates	CIE S 010 (= ISO 23539) for basics on photometry, CIE 15 for basics on colorimetry, CIE 63 for spectroradio-metric measurement	
CRI	—	Not relevant for incandescent lamps (CRI is 100).
Equivalence claim for retrofit lamps	—	Not relevant for incandescent lamps.
Beam angle	IEC/TR 61341	
Peak intensity	IEC/TR 61341	

Table 24: Reference standards for direct halogen light bulbs

Parameter	Reference	Remarks
EEI	CIE 84 for general conditions of luminous flux measurement. L2(AP)005 for cone luminous flux. EN 60357, 1.4.4 for power.	The average EEI value shall be d from the arithmetic mean of each individual EEI.
Rated lifetime	EN 60357, 1.4	
Lumen maintenance	EN 60357, 1.4	
Number of switching cycles	—	Reliable, accurate and reproducible measurement procedures shall be used. EN 60357, A.3 duty cycle, may partially be used.
Starting time	—	Not relevant for halogen incandescent lamps.
Lamp warm-up time	—	Not relevant for halogen incandescent lamps.
Premature failure rate	EN 60357, ~~Annex A~~	
Lamp power factor	—	Not relevant for halogen incandescent lamps (power factor equals 1).
Chromaticity coordinates	CIE S 010 (= ISO 23539) for basics on photometry, CIE 15 for basics on colorimetry, CIE 63 for spectroradio-metric measurement	

CRI	—	Not relevant for halogen incandescent lamps (CRI is 100).
Equivalence claim for retrofit lamps	—	See measurement of luminous flux and power under parameter EEI.
Beam angle	IEC/TR 61341, further conditions EN 60357	
Peak intensity	IEC/TR 61341, further conditions EN 60357	
Lamp type (MR11, GU4, etc.	EN 60357	

Table 25: Reference standards for direct Compact Fluorescent Light bulbs with integrated control gear

Parameter	Reference	Remarks
EEI	CIE 84 for general conditions of luminous flux measurement; L2(AP)005 for cone luminous flux; IEC 60969, at present 34A/1701/CDV for power.	The average EEI value shall be calculated from the arithmetic mean of each product's individual EEI.
Rated lifetime	IEC 60969, at present 34A/1701/CDV Annex F	
Lamp survival factor	IEC 60969, at present 34A/1701/CDV Annex F	
Lumen maintenance	IEC 60969, at present 34A/1701/CDV Annex C	
Number of switching cycles	IEC 60969, at present 34A/1701/CDV Annex E	
Starting time	IEC60969, at present 34A/1701/CDV Annex A	
Lamp warm-up time	IEC 60969, at present 34A/1701/CDV Annex B	The run-up time shall be used instead.
Premature failure rate	IEC 60969, at present 34A/1701/CDV Annex F	
Lamp power factor	IEC 61000-3-2	
Chromaticity coordinates	CIE 15	
CCT	CIE 15	

CRI	CIE 13.3	
Spectral power distribution	CIE 63	
Lamp dimensions	IEC 60969, at present 34A/1701/CDV Table 3	
Beam angle	IEC/TR 61341	
Peak intensity	IEC/TR 61341	
Lamp type (MR11, GU4, etc.	IEC 60968 at present 34A/1624/CD - caps	
Cone luminous flux	L2(AP)005	
Cap	IEC 60968	

Table 26: Reference standards for direct Light Emitting Diode light bulbs

Parameter	Reference	Remarks
EEI	CIE 84 for general conditions of luminous flux measurement; L2(AP)005 for cone luminous flux; IEC 62612, 9.3 for efficacy; IEC 62612, 9.1 and for luminous flux, IEC 62612, 8.1 and for power	The average EEI value shall be calculated from the arithmetic mean of each product's individual EEI.
Rated lifetime, lamp lifetime	—	Reliable, accurate and reproducible measurement procedures shall be used.
Lamp survival factor	IEC 62612, 11.2	The compliance criteria of the regulations shall be applied.
Lumen maintenance	IEC 62612, 11.2	The compliance criteria of the regulations shall be applied.
Number of switching cycles	IEC 62612, 11.3.3	
Starting time	—	Reliable, accurate and reproducible measurement procedures shall be used. The method described in 34A/1701/CDV (for CFLi) may be adapted.

Lamp warm-up time	—	Reliable, accurate and reproducible measurement procedures shall be used. The method described in 34A/1701/CDV (for CFLi) may be adapted.
Premature failure rate	IEC 62612, 11.2	An additional read point at 1,000h and the compliance criteria according to the regulations shall be applied.
Lamp power factor (only for lamps with integrated control gear)	IEC 61000-3-2	
CCT	prEN 13032-4	
CRI	prEN 13032-4	
Colour consistency	EN 62612, 10.1	
Spectral power distribution	CIE 63	
Lamp dimensions	IEC 62612, 6	
Beam angle	IEC 62612, 9.2	
Peak intensity	IEC 62612, 9.2	
Dimmability	IEC 62560, 5.2	The presence of a symbol or warning shall be checked.
Lamp type (MR11, GU4, etc.)	See parameter “cap”.	
Cone luminous flux	L2(AP)005	
Cap	IEC 62560	

Measurement of mercury content for CFLi:

The applicant shall provide a test report stating that the mercury content has been measured using the method described below. The report shall state the average mercury content, calculated by analyzing ten lamps, and then deleting the highest and lowest values before calculating the arithmetic mean of the remaining eight values.

The test method for the mercury content is as follows. The arc tube is first separated from its plastic surrounds and associated electronics. The associated lead wires are cut as close to the glass seal as possible. The arc tube is taken to a fume cupboard and is cut into segments. The segments are placed in a suitably sized robust screw-capped plastic bottle to which is added a 1 inch diameter porcelain ball and 25 ml of high purity concentrated nitric acid (70 %). The bottle is sealed and shaken for a few minutes to reduce the arc tube to fine particle size; the stopper is periodically loosened to eliminate any possibility of pressure build-up. The contents of the bottle are allowed to react for 30 minutes during which time the contents are periodically agitated. The contents of the bottle are then filtered through an acid resistant filter paper and collected in a 100 ml graduated volumetric flask. Potassium dichromate is then added to the flask so that the final concentration is 1,000 ppm with respect to chromium. The flask is then made up to volume with pure water. Matched standards are made up on a concentration range up to 200 ppm mercury. The solutions are analyzed using flame atomic absorption at a wavelength of 253,7 nm with background correction on. From the results obtained and knowledge of the solution volume,

the original mercury content of the light bulb can be computed. The competent body may agree adaptations to the details of this test method if they are necessary for technical reasons, and these shall be applied in a consistent manner.
As alternative methods, measurements according to IEC 62554 "Sample preparation for measurement of mercury level in fluorescent lamps" and/or IEC 62321 "Determination of certain substances in electrotechnical products" series are accepted.

J-2 – Enforcer additional testing methodologies

The enforcer may draw a sample of batch of a minimum of twenty lamps of the same model from the same manufacturer, where possible obtained in equal proportion from four randomly selected sources, unless specified otherwise in Table 27.
The model shall be considered to comply with the requirements laid down in this regulation if:

- The lamps in the batch are accompanied by the required and correct product information, and
- All parameters listed in Table 27 are met

Table 27

Parameter	Procedure
Lamp survival factor at 6,000 h (for LED lamps only)	The test shall end • when the required number of hours is met, or • when more than two lamps fail, whichever occurs first Compliance: a maximum of two out of every 20 lamps in the test batch may fail before the required number of hours Non-compliance: otherwise
Number of switching cycles before failure	The test shall end when the required number of switching cycles is reached, or when more than one out of every 20 lamps in the test batch have reached the end of their life, whichever occurs first Compliance: at least 19 of every 20 lamps in the batch have no failure after the required number of switching cycles is reached Non-compliance: otherwise
Starting time	Compliance: the average starting time of the lamps in the test batch is not higher than the required starting time plus 10 %, and no lamp in the sample batch has a starting time longer than two times the required starting time Non-compliance: otherwise
Lamp warm-up time to 60 % Φ	Compliance: the average warm-up time of the lamps in the test batch is not higher than the required warm-up time plus 10%, and no lamp in the sample batch has a warm-up time that exceeds the required warm-up time multiplied by 1.5 Non-compliance: otherwise

Premature failure rate	The test shall end • when the required number of hours is met, or • when more than one lamp fails, whichever occurs first. Compliance: a maximum of one out of every 20 lamps in the test batch fails before the required number of hours Non-compliance: otherwise
Color rendering (Ra)	Compliance: the average Ra of the lamps in the test batch is not lower than three points below the required value, and no lamp in the test batch has a Ra value that is more than 3,9 points below the required value Non-compliance: otherwise
Lumen maintenance at end of life and rated lifetime	For these purposes, 'end of life' shall mean the point in time when only 50 % of the lamps are projected to survive or when the average lumen maintenance of the batch is projected to fall below 70 %, whichever is projected to occur first Compliance: the lumen maintenance at end of life and the
(for LED lamps only)	lifetime values obtained by extrapolation from the lamp survival factor and from the average lumen maintenance of the lamps in the test batch at 6,000 h are not lower than respectively the lumen maintenance and the rated lifetime values declared in the product information minus 10 % Non-compliance: otherwise
Equivalence claims for retrofit lamps according to points (l) and (m) of Annex H	If only the equivalence claim is verified for compliance, it is sufficient to test 10 lamps, where possible obtained approximately in equal proportion from four randomly selected sources Compliance: the average results of the lamps in the test batch do not vary from the limit, threshold or declared values by more than 10 % Non-compliance: otherwise
Beam angle	Compliance: the average results of the lamps in the test batch do not vary from the declared beam angle by more than 25 % and the beam angle value of each individual lamp in the test batch does not deviate by more than 25 % of the rated value Non-compliance: otherwise
Peak intensity	Compliance: the peak intensity of each individual lamp in the test batch is not less than 75 % of the rated intensity of the model Non-compliance: otherwise

Energy efficiency index[2]	Compliance: The Energy Efficiency Index (EEI) value for lamps in the scope of this regulation shall be less than or equal to the specified values in Tables 2 and 8, when calculated at both rated and average tested power and luminous flux. Furthermore, the average EEI of the sample tested should be within 10% of the rated EEI, and each bulb in the sample should have an EEI value within 10% of the sample's average EEI. Non-compliance: otherwise
Other parameters	Compliance: the average results of the lamps in the test batch do not vary from the limit, threshold or declared values by more than 10 %. Non-compliance: otherwise.

[2] The tolerances for variation indicated above relate only to the verification of the measured parameters by the authorities and shall not be used by the supplier as an allowed tolerance on the values in the technical documentation to achieve a more efficient energy class.The declared values shall not be more favorable for the supplier than the values reported in the technical documentation

متطلبات كفاءة الطاقة ومتطلبات التشغيل لمنتجات الانارة– الجزء الثاني

ENERGY EFFICIENCY, FUNCTIONALITY AND REQUIREMENTS FOR LIGHTING PRODUCTS PART 2

Table of contents

Table of tables

1. Scope

This regulation establishes requirements for the placing on the market of the below listed lamp types, control gears (ballasts) able to operate such lamps, even when they are integrated into other energy-using products, and directional / non-directional integrated luminaires integrated luminaires (provided with non-replaceable lamps).
This regulation is applicable to:

- Lamps and luminaires with a luminous flux above 60 lumens
- Incandescent lamps with a luminous flux above or equal 12,000 lumens
- Halogen lamps with a luminous flux above or equal 12,000 lumens
- Compact fluorescent lamps with integrated ballast (CLFi) with a luminous flux above or equal 12,000 Lumens
- Compact fluorescent lamps without integrated ballast (CFLni)
- Fluorescent Lamps (all types)
- High Intensity Discharge Lamps, such as:
    - Mercury Vapour Lamps
    - High/ Low Pressure Sodium Lamps
    - Quartz Metal Halide Lamps
    - Ceramic Metal Halide Lamps
- LED Lamps (including 'retrofit LED lamps' with a luminous flux above or equal 12,000 Lumens).

The types of products covered in this regulation are summarized in the table below

Table 1: List of products covered

Regulatory parameters	CFLni	LFL and other Fluorescent	LED (1)	High Intensity Discharge (HID)	Control gear	Luminaires
Energy Efficiency	✓	✓*	✓	✓	✓	✓
Functionality	✓	✓*	✓	✓ **	X	✓ **
Marking information	✓	✓*	✓	✓	✓	✓
Energy efficiency labelling	✓	✓	✓	✓	X	✓
Hazardous substances	✓	✓	✓	✓	X	X

(1) LED lamps not covered by (*energy efficiency, functionality and requirements for lighting products Part 1)*
* Applicable to non-directional lamps only
** Information is required based on self-declaration
✓ Included in this Standard
✘ Excluded from this Standard

Annex A lists the conditions for exclusion/exemption from this regulation.

For luminaires, scope of this regulation is limited to integrated luminaires.

All products within this regulation including the exempted/excluded ones shall be registered according to Clause 5.

2. Reference Standards

The following list of reference standards applies:

2.1 Functional and energy performance standards

• SASO 2870	Part I - Energy efficiency, functionality and labelling requirement for lighting products
• GSO IEC 60081:2007	Double-capped fluorescent lamps - Performance specifications
• IEC 60662	High-pressure sodium vapour lamps - Performance specifications
• GSO IEC 60901:2008	Single capped fluorescent lamps – Performance standard
• GSO IEC 60921:2008	Ballasts for tubular fluorescent lamps – Performance requirements
• GSO IEC 61231:2014	International Lamp Coding System (ILCOS)
• GSO IEC 61167:2016	Metal halide lamps - Performance specifications
• GSO IEC 62321-4:2016	Determination of certain substances in electrotechnical products – Part 4: Mercury in polymers, metals and electronics
• GSO IEC 60442-1:2014	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
• GSO IEC 62554:2014	Sample preparation for measurement of mercury level in fluorescent lamps
• GSO IEC/PAS 62717:2013	LED modules for general lighting – Performance requirements
• GSO IEC PAS 62722-1:2013	Luminaire performance – General requirements
• GSO IEC/PAS 62722-2-1:2013	Luminaire performance – Particular requirements for LED luminaires
• GSO IEC 60188:2007	High-pressure mercury vapour lamps - Performance specifications
• EN 50294	Measurement method of total input power of ballast-lamp circuits
• IES LM-9	Electric and photometric measurements of fluorescent lamps
• IES LM-10	Approved Method for Photometric Testing of Outdoor Fluorescent Luminaires
• IES LM-41	Hardware Monitor with Thermal Diode Inputs and Bus
• IES LM-66	Electrical and photometric measurements of Single-ended compacts fluorescent lamps
• IES LM-79	Electrical and photometric measurements of Solid State lighting products
• IES LM-80	Measurement lumen maintenance of LED Light sources
• IES LM-82	Method for characterisation of LED light Engines and Integrated LED lamps for Electrical properties as a function of the temperature
• IES TM21	Projecting long term lumen maintenance of LED sources
• IES TM28	Projecting long term luminous flux maintenance of LED sources and luminaires
• ANSI C78.377	Electric Lamps — Specifications for the Chromaticity of Solid-state Lighting Products

Notes:

- Methods and reports edited by the CIE (International Commission for Illumination) are not listed, but referenced within the IEC (International Electrotechnical Committee) standards listed above and in Annex J.
- IES standards can be used as equivalent to the IEC standards covering the same scope.

3. Terms and definitions

For the purpose of this document, the following terms and definitions shall apply.

3.1 General

End-user: Average person buying or expected to buy a lamp or a luminaire for purposes that are outside his trade, business, craft or profession.

General Lighting: The full or partial illumination of an area, by replacing or complementing natural light with artificial light in order to enhance visibility in that area.

Homogeneous materials: Means one material of uniform composition throughout, or a material consisting of a combination of materials that cannot be disjointed or separated into different materials by mechanical actions such as unscrewing, cutting, crushing, grinding and abrasive processes.

Manufacturer: Means the natural or legal person who manufactures products covered by this Standard and is responsible for their conformity with this Standard in view of their being placed on the market and/or put into service under the manufacturer's own name or trademark or for the manufacturer's own use. In the absence of a manufacturer as defined in the first sentence of this point or of an importer, any natural or legal person who places on the market and/or puts into service products covered by this Standard shall be considered a manufacturer.

Point of sale: Physical location where the product is displayed or offered for sale to the end-user.

Product: An equipment, system or part of a system, which is included in the list of regulated products under this Standard.

Registration system: Energy Efficiency platform used by manufacturers and importers to register products in Bahrain's market.

Shall: Where "shall" or "shall not" is used for a provision, that provision is mandatory if compliance with the standard is claimed

Should: "Should" is used to indicate provisions which are desirable as good practice, but which are not mandatory

Standard: Refers directly to this Standard - "ENERGY EFFICIENCY, FUNCTIONALITY AND LABELLING REQUIREMENTS FOR LIGHTING PRODUCTS PART 2".

3.2 Technical

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.

Beam angle: Means the angle between two imaginary lines in a plane through the optical beam axis, such that these lines pass through the center of the front face of the lamp and through points at which the luminous intensity is 50% of the center beam intensity, where the center beam intensity is the value of luminous intensity measured on the optical beam axis.

Category of luminaire: Luminaires which fall into the same criteria for energy efficiency and functional requirements.

Chromaticity: Means the property of a color stimulus defined by its chromaticity coordinates, or by its dominant or complementary wavelength and purity taken together.

Clear lamp: 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.

Color consistency: Means the maximum deviation of chromaticity coordinates (x and y) of a single lamp from a chromaticity center point (cx and cy), expressed as the size (in steps) of the MacAdam ellipse formed around the chromaticity center point (cx and cy). MacAdam ellipses refer to the regions (in the form of an ellipse) on a chromaticity diagram which contain all colors that are indistinguishable to the average human eye from the color at the center of the ellipse.

Color rendering (CRI / Ra): Means the effect of an illuminant on the color appearance of objects by conscious or subconscious comparison with their color appearance under a reference illuminant.

Compact fluorescent lamp (CFL): means a unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a fluorescent lamp and any additional components necessary for starting and stable operation of the lamp

Compact fluorescent lamp without integrated ballast (CFLni): Means a single capped fluorescent lamp that does not include all components necessary for starting and stable operation of the lamp (operated on external ballast).

Components and sub-assemblies: Means parts intended to be incorporated into products which are not placed on the market and/or put into service as individual parts for end- users or the environmental performance of which cannot be assessed independently.

Control device: Means an electronic or mechanical device controlling or monitoring the luminous flux of the lamp by other means than power conversion for the lamp, such as timer switches, occupancy sensors and daylight standard devices. In addition, phase cut dimmers shall also be considered as control devices.

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 displacement 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 control devices or power supplies.

Correction factor: Any mathematical adjustment made to a calculation to account for deviations in either the sample or the method of measurement. Specifically for this Standard, the correction is needed to be able to apply one formula for different lamp types.

Correlated color temperature (CCT / Tc [K]): a specification of the color appearance of the light emitted by a lamp, relating its color to the color of light from a reference source when heated to a particular temperature, measured in degrees Kelvin (K). More specifically, it is the absolute temperature of a blackbody whose chromaticity most nearly resembles that of the light source. A black body is an idealized physical body that absorbs all incident electromagnetic radiation, regardless of frequency or angle of incidence.

Directional (direct) Lamp or Luminaire: a lamp or a luminaire having at least 80% light output within a solid angle of πSr corresponding to a cone with an angle of 120˚.

Displacement factor (Df): expressed by cos φ_1, where φ_1 is the phase angle between the fundamental of the main supply voltage and the fundamental of the main current (to be checked).

Discharge lamp: means a lamp in which the light is produced, directly or indirectly, by an electric discharge through a gas, a metal vapor or a mixture of several gases and vapors.

Downlight luminaire: category of LED luminaire that direct the light downward and can be recessed, surface mounted or suspended.
Note: See definition of directional lamp for correspondence, but do not include linear fluorescent troffers or linear luminaire forms such as linear fluorescent pendants, typically used to illuminate office spaces.

Efficiency Base based (EBb_{FL}): 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 : $EBb_{FL} = \frac{P_{lamp}}{\left(1+\frac{38}{36}P_{lamp}+2\sqrt{\frac{P_{lamp}}{36}}\right)}$
- When $P_{lamp} \geq 100$ W : $EBb_{FL} = 0.91$

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

Family of product (or Model Group): group of light sources or luminaires that have the same characteristics, distinguished by common features of materials, components and/or method of processing.

Fluorescent lamp: means a discharge lamp of the low pressure mercury type in which most of the light is emitted by one or several layers of phosphors excited by the ultraviolet radiation from the discharge. Fluorescent lamps are supplied either with or without integrated ballasts

Fluorescent lamps without integrated ballast: means single and double capped fluorescent lamps without integrated ballast

High intensity discharge lamp (HID): means an electric discharge lamp in which the light producing arc is stabilized by wall temperature and the arc has a bulb wall loading in excess of 3 watts per square centimeter

Initial luminous flux: means the luminous flux of a lamp after a short operating period according to applicable standard

Integrated luminaire: means a complete unit consisting of non-replaceable light emitting elements and a matched driver together with part to distribute light, to position and protect the light emitting elements and to connect directly the unit to a branch circuit. Integrated luminaire might be provided with or without control gear.

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

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

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

Lamp lifetime: 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. For all other lamps, lamp lifetime means the period of operating time after which the fraction of the total number of lamps which continues to operate corresponds to the lamp survival factor of the lamp under defined conditions and switching frequency

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

Lamp mercury content: means the mercury contained in the lamp (weight usually specified in mg)

Lamp start time: means the time needed, after the supply voltage is switched on, for the lamp to start fully and remain alight

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

Lamp warm-up time: means the time needed after start-up for the lamp to emit a defined proportion of its stabilized luminous flux

LED Light-emitting diode: means a light source which consists of a solid state device embodying a P-N junction. The junction emits optical radiation when excited by an electric current

LED lamp: means a lamp incorporating one or more LED modules. The lamp may be equipped with a cap.

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.

LED package: means an assembly having one or more LED(s). The assembly may include an optical element and thermal, mechanical and electrical interfaces.

Lighting: means the application of light to a scene, objects or their surroundings so that they may be seen by humans.

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.

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.

Accent luminaire (lighting) a directional luminaire employed to emphasize a particular object of surface feature, or draw attention to a part of the field of view. This includes line-voltage directional track lighting.

Color Tunable Lamp/Luminaire: For the purpose of this specification, a color tunable luminaire has functionality that allows the end user to alter the color appearance of the light generated by the luminaire. This tuning must include white light that is capable of meeting the specification's color requirements, and can alter the color appearance along the black body curve, or may also extend to colors beyond the defined correlated color temperature ranges (e.g. 2,700K and 5,000K) outside of the seven step MacAdam ellipse or the ANSI quadrangles**.**

Cove Mount (Luminaire): Lighting comprising light sources shielded by a ledge or horizontal recess, and distributing light over the ceiling and upper wall. For purposes of this specification, cove mount luminaires feature luminaire optics over the lamps, LED packages, arrays or modules, LED light engines or integrated LED lamps.

Downlight Luminaire: category of LED directional luminaire that direct the light downward and can be recessed, surface mounted or suspended.
Note: See definition of directional lamp for correspondence, but do not include linear fluorescent troffers or linear luminaire forms such as linear fluorescent pendants, typically used to illuminate office spaces**.**

Enclosed fixture or enclosed luminaire: contains enclosed lamp compartment(s) where ventilation openings are less than 3 square inches per lamp in the lamp compartment or where the cross-sectional area of the opening of the lamp compartment is less than the than the maximum cross sectional area of the lamp compartment

Flood luminaire (or lamp): luminaire (or lamp) designed to project or diffuse a comparatively uniform level of illumination over a large space area

Floor Lamp (Luminaire): a portable luminaire on a high stand suitable for standing on the floor with those same objects when illuminated by a reference source of comparable color temperature

Non replaceable light source: light source which is a non-replaceable part of the luminaire either because it cannot be replaced without breaking or destroying the

luminaire or because it is enclosed under a cover fixed by screw or similar fixing means designed to be used only once and which is not possible to be opened.

Outdoor Post-Mounted Luminaire: outdoor luminaire supported by a post inserted into the ground and mounted between 4 feet and 10.5 feet above grade**.**

Outdoor Security Luminaire: Wall mounted luminaires intended to light areas immediately adjacent to a building's perimeter

Portable Desk Task Light (Luminaire): light fixture resting on a desk that directs light to a specific surface or area to provide illumination for visual tasks such as reading and writing, and employs a plug for its electrical connection.

Portable Floor Task Light (Luminaire): light fixture resting on the floor that directs light to a specific surface or area to provide illumination for visual tasks such as reading and writing and provided with plug connection**.**

Portable Luminaire: lighting unit that is not permanently fixed in place**.**

Residential Luminaire: luminaire marketed and intended to be used in a residential environment notwithstanding use in commercial, business and industrial environments.

Spot Color Shifting Dimming Luminaire: A luminaire with dimming capability designed to simulate the behavior of incandescent lamps where the chromaticity gradually shifts to a lower value as the product is dimmed. This function is not considered color tunable for the purposes of this specification, unless it can also be tuned to different colors at full output

Torchiere luminaire: an indirect floor luminaire that send all or nearly all of its light upward

Under-cabinet luminaire: luminaire installed below an upper cabinet to direct light down to the work surface of a countertop or desk for task lighting

Wall sconce (mounted) luminaire: wall mounted luminaire not intended to accent an object or a task area within a space

Wrap lens luminaire: surface mounted luminaire with an elongated aspect ratio and a single optic covering the light source that direct less than 90% of light downward

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. Radiant flux is the measure of the total power of electromagnetic radiation (including infrared, ultraviolet, and visible light).

Luminous intensity (candela or cd): 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.

Materials: means all materials used during the life cycle of a product.

Nominal value: means the value of a quantity used to designate and identify a product.

Non clear lamp: is a lamp that does not comply with the specifications of the definition of "Clear lamp", including compact fluorescent lamps

Non-directional (indirect) lamp or luminaire: means a lamp or a luminaire that is not a directional lamp or luminaire.

Power factor: means the ratio of the absolute value of the real power (also known as active power) to the apparent power under periodic conditions.

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.

Rated value: 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.

Retrofit lamp: means a lamp which can replace another lamp with similar performances and different technology using the same cap

Second lamp envelope: 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.

Self-ballasted lamp: a unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a light source and any additional elements necessary for starting and stable operation of the light source i.e. CFL with integrated ballast (CFLi) or LED retrofit lamp with integrated control gear.

Special purpose lamps: are lamps designed essentially for other types of applications (such as traffic signals, terrarium lighting, or household appliances) and clearly indicated as such on accompanying product information shall not be subject to the requirements outlined in this Standard.

Switching cycle: means the sequence of switching the lamp on and off at set intervals.

Useful luminous flux (Φ_{use}): means the part of the luminous flux of a lamp falling within the beam angle used for calculating the lamp's energy efficiency.

Ultra Violet (UV): means a light source with emission in the non-visible spectrum and characterized with a wave length between 10 and 400 nm. Wave lengths between 315 and 400 nm are defined as Ultra Violet A (UVA) and wave lengths between 280 and 315 nm are defined as Ultra Violet B (UVB).

Warm-start: feature that is performed to reset a previously running system after an unintentional shutdown or limited interruption of the lighting emission.

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

- $0.270 < x < 0.530$
- $-2.3172\ x^2 + 2.3653\ x - 0.2199 < y < -2.3172\ x^2 + 2.3653\ x - 0.1595$

4. Requirements for non-directional/directional lamps, control gears and luminaires

4.1 Energy efficiency requirements

Lamps within the scope of this regulation shall comply with the energy efficiency requirements specified in Annex B for non-directional lamps and Annex D for directional lamps.

For Incandescent, Halogen, and CFLi with luminous flux above or equal to 12,000 lumens the tests and criteria described in
(ENERGY EFFICIENCY, FUNCTIONALITY AND REQUIREMENTS FOR LIGHTING PRODUCTS PART 1) apply.

For LED lamps, tests and criteria described in
(ENERGY EFFICIENCY, FUNCTIONALITY AND REQUIREMENTS FOR LIGHTING PRODUCTS PART 1) apply.

Energy efficiency classes and the methods of calculating the EEI for lamps are also detailed in Annex B for non-directional lamps and Annex D for directional lamps.

Ballasts and control gears shall comply with the Energy Efficiency Requirements specified in Annex G.

Luminaires in the scope of this standard (integrated luminaires) shall comply with energy efficiency requirements expressed in Annex L of this standard.

4.2 Functionality requirements

Lamps within the scope of this Standard shall comply with the functionality requirements specified in Annex C (non-directional lamps) and Annex E (directional lamps).

For Incandescent, Halogen, and CFLi with luminous flux above or equal to 12,000 lumens the tests and criteria described in
(ENERGY EFFICIENCY, FUNCTIONALITY AND REQUIREMENTS FOR LIGHTING PRODUCTS PART 1) apply.

For LED lamps, tests and criteria described in
(ENERGY EFFICIENCY, FUNCTIONALITY AND REQUIREMENTS FOR LIGHTING PRODUCTS PART 1) apply.

Integrated luminaires listed in the scope of this regulation shall comply with requirements specified in Annex C, E and L, when applicable.

4.3 Marking requirements

Instruction manuals supplied with products and available on website shall be:

- Cautionary and/or any safety warnings for the direct user or consumer shall be in the Arabic and English language. The use of international accepted pictograms is permitted instead of verbally expressed language.
- And available on a Website (English only is permitted).

Lamps, ballasts and luminaires listed in scope of this regulation shall comply with the marking requirements specified in Annex F (directional lamps, non-directional lamps and luminaires) and Annex G.2 (ballasts / control gears).

“Special purpose” products (Annex A.1) do not need to comply with the marking requirements
specified in Annex F. Instead, the following information shall be clearly and prominently indicated on their packaging and in all forms of product information accompanying the lamp when it is placed on the market:

- Brand Name
- Model number
- Rated power(Watt)
- Rated Voltage (Voltage)
- Rated Lumen(Lumen)
- Rated color temperature (Kelvin)
- Country of origin
- Their intended purpose

Products listed in Annex A.1.2 shall fulfill the documentation and information requirements specified for them in the same Annex.

4.4 Energy efficiency label

Lamps and integrated luminaires in the scope of this regulation shall have a label printed directly on the individual packaging of the product.

Products listed in Annex A.1 and ballasts/control gears are excluded from the energy labelling requirements.

Products listed in Annex A .2 shall have a label printed or put as a sticker directly on the individual packaging of the product.

4.5 Hazardous chemicals: Substance restrictions for lamps and control gears

Products specified in scope of this regulation , Annex A.1 and A.2 shall comply with the maximum hazardous
substances limits according to Annex I.

5. Registration requirements

Table 2: Type of documents required

Type of test	Type of document
Energy Efficiency	• For lamps: test report for each model • For luminaires: factory test report for a representative model of the family, including a family specification overview •For control gear: test report

Functionality (Ra, color temperature, and other aspects)	• For lamps: test report for a representative model of the family, including a family specification overview • For luminaires: factory test report for a representative model of the family, including a family specification overview
Endurance (Lamps survival factor, lumen maintenance, switching On/off)	• For lamps: test report for a representative model of the family, including a family specification overview • For luminaires: factory report for a representative model of the family, including a family specification overview
Environment (Hazardous substances)	Test report or self-declaration for a representative model of the family, including a family specification overview

ANNEX A – Exemptions

The following list the exclusions and exemptions of this standard for products within the scope of this standards except for LED lamps which exemptions are covered by (*Energy Efficiency, Functionality And Requirements For Lighting Products Part 1*)

A.1 – Products exempted, except from hazardous substances requirements

The following products shall be exempt from the provisions of Section 4.1 to 4.4 of this standard, provided that in all forms of product information it is stated that they are not intended for general lighting use within the meaning of this Regulation, or that they are intended for use in applications listed below:

A.1.1 - Lamps exempted for special end-use purpose

- Traffic/signal lamps, such as:
  - Signal lamps
  - Aviation/Aircraft lighting for runways and planes, all exterior applications
  - Train lighting, including signal lighting
  - Water craft lighting, including signal lighting
  - Automotive lighting/lamps

- Heating lamps (infrared), such as:
  - Infrared heat lamps – comfort heating (outdoor and indoor)
  - Infrared heat lamps – industrial
  - Infrared heat lamps – animal rearing
  - Infrared heat lamps – health care

- Luminaires not connected to the mains, such as:
  - Luminaires powered with solar cells (for outdoor illumination, …)

- Decorative lighting items.

A.1.2 - lighting products exempted as used for non-primary lighting purpose/applications

- Products intended for use in applications other than general lighting and products incorporated into products which do not provide a general lighting function, e.g.:

  - Emission of light as an agent in chemical or biological processes (such as polymerization, photodynamic therapy, horticulture, pet care, anti-insect products)
  - Image capture and image projection (such as camera flashlights, photocopiers, video projectors)
  - Lamps for swimming pools
  - Pet care (aquarium, terrarium, etc.)
  - Anti-insect lamps
  - Disinfection
  - Tanning
  - Display optic lamps (> 12,000 lumens), such as:

- Stage and studio lamps
- Theatre lamps
- Television (TV) lamps
- Studio lamps
- Photo lamps – Flashlights or lamps for the development of pictures
- Projection lamps

- Traffic/signal lamps
  - Emergency lighting luminaires and emergency sign luminaires;
  - Control gears (ballasts) intended for use in luminaires designed to operate lamps in emergency conditions;
  - Lamps and Luminaires intended for use in potentially explosive atmospheres and medical devices;
  - Lamps and Luminaires marketed for operation with batteries only
  - Lamps and Luminaires 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 Standard
  - Lamps and Luminaires that cannot be tested across references standards

The intended purpose shall be stated for each product in the product information, and the technical documentation file drawn up for the purposes of conformity assessment shall list the technical parameters that make the product design specific for the stated intended purpose.

These aforementioned Lamps and Luminaires are not excluded from this Standard when they are marketed for general lighting purposes.

A.1.3 – Products exempted for technical reasons

The following lamps shall be exempted from the provisions of Sections 4.1 to 4.4 of this standard, provided that the technical documentation file drawn up for the purposes of conformity assessment states which of the technical parameters listed hereunder provide(s) a basis for their exemption:

- 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; and
  - 11 % or more of total radiation of the range 250-780 nm in the range of 630-780 nm; and
  - 5 % or more of total radiation of the range 250-780 nm in the range of 640-700 nm;
- blended high intensity discharge lamps having:
  - the peak of the radiation for Ultra Violet A (UVA) and Ultraviolet B (UVB);
- 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) color compensating filter value limit (cc). CIE coordinates x=0.330 y=0.335 and x=0.415 y=0.377;
  - a diameter of 38 mm (T12) and equipped with an external ignition strip.
- single capped fluorescent lamps having a diameter of 16 mm (T5) 2G11 4 pin base, Tc = 3,200 K with chromaticity coordinates x=0.415 y=0.377 and CCT/Tc = 5,500 K with chromaticity coordinates x=0.330 y=0.335
- high intensity discharge lamps with CCT/Tc > 7,000 K
- high intensity discharge lamps having a specific effective UV output > 2 mW/klm
- high intensity discharge lamps not having lamp cap E27, E40, PGZ12
- light sources that do not comply with the definition of white light sources

A.2 - lighting products accepted with limited labelling requirements

Lighting products intended to be used in projects (and not to be displayed or sold through point-of-sale) shall have a special label printed or put as a sticker directly on the individual packaging of the product. All lighting products registered with the special label shall not be displayed and/or sold through point of sale.

A.3 - Products exempted from provision of section 4.5 of this regulation

The following products are exempted from requirements on hazardous substances (Clause 4.5)

- Luminaires
- Control gears

Content of the hazardous substances shall be given as information during the registration process.

ANNEX B – Energy efficiency requirements for non-directional lamps

B.1 - Calculation of energy efficiency index for non-directional lamps

For the calculation of the energy efficiency index (EEI) of a model, its corrected (electric) power P_{cor} for any control gear losses is compared with its reference power P_{ref} (based on the luminous flux emitted).

The EEI is calculated as follows and rounded to two decimal places:

$$EEI = \frac{P_{cor}}{P_{ref}}$$

P_{cor} is defined as:
For models *without* external control gear, P_{cor} is the rated power (P_{rated}).

For models *with* external control gear P_{cor} is the rated power (P_{rated}) corrected in accordance with the corrections factors listed below:

The rated power P_{rated} of the lamps/luminaires is measured at their nominal input voltage.

Table 3: Correction factors for calculation of P_{cor}

Lamp parameter	Corrected Power P_{cor}
Discharge lamp with cap GX53	P_{rated} x 0.75
Non clear lamps with color rendering index (Ra) ≥ 90 and $P_{ref} \leq (0.5 \times (0.88\sqrt{\Phi_{use}} + 0.049\Phi_{use}))$	P_{rated} x 0.85
Dissharge lamp with color rendering index ≥90 and Color Temperature ≥5000 K	P_{rated} x 0.76

Non clear lamps with second envelope and $P_{ref} \leq (0.5 \times (0.88\sqrt{\Phi_{use}} + 0.049\Phi_{use}))$	P_{rated} x 0.95
LED lamps requiring external power supply	P_{rated} x 1.10
Clear lamps with second enveloppe	P_{rated} x 0.90
Fluorescent lamps of 16mm diameter (T5 lamps) and 4 pin single capped fluorescent lamps operating on external fluorescent lamp control gear	P_{rated} x 1.10
Other lamps operating on external fluorescent lamp control gear	$P_{rated} \times \frac{0.24\sqrt{\Phi_{use}} + 0.0103 \times \Phi_{use}}{0.15\sqrt{\Phi_{use}} + 0.0097 \times \Phi_{use}}$
Lamps operating on external high-intensity discharge lamp control gear	P_{rated} x 1.10
Lamps operating on low-pressure vapor lamp control gear	P_{rated} x 1.15
Lamps with anti-glare shield	P_{rated} x 0.80
Note: the correction factors in Table 3 are cumulative when appropriate and also applicable to the products exempted or excluded (see Annex B)	

The following correction factor applies to the rated luminous flux Φ_{use}

Table 4: Correction of the rated Luminous flux values for fluorescent lamps with high color temperature and/or high color rendering and/or second lamp envelope

Lamp parameter	Corrected luminous flux ($\Phi_{use;cor}$)
Color Temperature ≥ 5,000 K	$\Phi_{use;cor} = \Phi_{use}$ x 1.10
95 ≥ Color Rendering Index (Ra) > 90	$\Phi_{use;cor} = \Phi_{use}$ x 1.20
Color Rendering Index (Ra) > 95	$\Phi_{use;cor} = \Phi_{use}$ x 1.30
Second lamp envelope	$\Phi_{use;cor} = \Phi_{use}$ x 1.10
Note: the correction factors in Table 4 are cumulative when appropriate and also applicable to the products exempted or excluded (see Annex A).	

$\boldsymbol{P_{ref}}$ is defined as:

P_{ref} is the reference power obtained from the rated value of the useful luminous flux moderated with factor of Table 4 (when applicable) using of the model ($\Phi_{use;cor}$) by the following formulae:

For models with Φ_{use} < 1300 lumen: $P_{ref} = 0.88\sqrt{\Phi_{use;cor}} + 0.049 \times \Phi_{use;cor}$

For models with Φ_{use} ≥ 1300 lumen: $P_{ref} = 0.07341 \times \Phi_{use;cor}$

For non-directional lamps, the useful luminous flux ($\Phi_{use;cor}$) is the total rated luminous flux (Φ_{use}).

B.2 - Maximum allowable Energy Efficiency index for non-directional lamps

The maximum allowable EEI for non-directional lamps are outlined in Table 5.

Table 5: Maximum Energy Efficiency Index (EEI)

Lamps types	Date of enforcement : 6 months after publication in the Official Gazette			
	CFLni	LFL Other fluorescent	LED	High Intensity Discharge (HID)
Maximum Values	0.24	0.24	0.24	0.50

B.3 - Energy efficiency classes for non-directional lamps

The energy efficiency rating of lamps shall be determined on the basis of their energy efficiency index (EEI) as outlined in Table 6.

Table 6: Energy efficiency classes for non-directional lamps

Energy efficiency index (EEI)	Equivalent energy efficiency class (Stars)
EEI ≤ 0.09	6
0.09< EEI ≤ 0.11	5
0.11 < EEI ≤ 0.13	4
0.13 < EEI ≤ 0.18	3
0.18 < EEI ≤ 0.24	2
0.24 < **EEI** ≤ 0.5	1

B.4 - Annual energy consumption

The annual energy consumption E_y is calculated on a basis of 1,000h of operation according to the following:

$$E_y = P_{cor} \leftrightarrow \frac{D_{op}}{1000} \qquad \text{[kWh}\}$$

with

P_{cor}: Corrected power (rated) [W]
D_{op}: Duration of operation [h]
1,000: Conversion factor [-]

ANNEX C – Functionality and endurance requirements for non-directional lamps and luminaires

C.1 - Functionality and endurance requirements for non-directional fluorescent lamps

Fluorescent lamps without integrated ballast-shall have at least the lamp lumen maintenance factors in Table 7:

Table 7: Lamp lumen maintenance: factors for single and double-capped fluorescent lamps

Lamp types	Operating hours			
	2,000h	4,000h	8,000h	16,000h
Double-Capped Fluorescent lamps operating on non-high frequency ballasts	0.92	0.85	0.80	—
T8 halophosphate fluorescent Double-Capped Fluorescent lamps on high frequency ballast with warm-start	0.95	0.90	0.87	0.80
Tri-Phosphore Double-Capped Fluorescent lamps on non-high frequency ballast	0.99	0.97	0.92	0.90
T8 Tri-Phosphore Double-Capped Fluorescent lamps on high frequency ballast with warm-start	0.96	0.92	0.91	0.90
Circular Single-Capped Fluorescent lamps operating on non-high frequency ballasts, T8 U-shaped double-capped fluorescent lamps and spiral-shaped double capped fluorescent lamps of all diameters equal to or larger than 16 mm (T5)	0.80	0.74	—	—
	0.72 at 5,000 operating hours			
Circular Single-Capped Fluorescent lamps operating on high frequency ballasts	0.85	0.83	0.80	—
	0.75 at 12,000 operating hours			
Other single-capped Fluorescent lamps operating on non-high frequency ballasts	0.85	0.78	0.75	—
Other single-capped Fluorescent lamps on high frequency ballast with warm-start	0.90	0.84	0.81	0.78
T12 halophosphate double-capped fluorescent lamps operation on US non-high frequency ballasts	0.85	0.77	0.66	

The following cumulative deductions shall be applied to the values in Table 7.

Table 8: Lamp lumen maintenance - Deduction percentages for fluorescent lamp lumen maintenance requirements

Lamp parameter	*Deduction from lamp lumen maintenance requirement*
Lamps with 95 ≥ Ra > 90	At operating hours ≤ 8,000 h: – 5 % At operating hours > 8,000 h: – 10 %
Lamps with Ra > 95	At operating hours ≤ 4,000 h: – 10 % At operating hours > 4,000 h: – 15 %
Lamps with a color temperature ≥ 5,000 K	–10 %

Fluorescent lamps without integrated ballast shall have at least the lamp survival factors in Table 9:

Table 9: Lamp survival factors for single and double-capped fluorescent lamps

Lamp types	**Operating hours**			
	2,000h	**4,000h**	**8,000h**	**16,000h**
Double-capped Fluorescent lamps operating on non-high frequency ballasts and T8 halophosphate fluorescent	0.99	0.97	0.90	—
Double-capped Fluorescent lamps on high frequency ballast with warm-start	0.99	0.97	0.92	0.90
Circular single-capped Fluorescent lamps operating on non-high frequency ballasts, T8 U-shaped double-capped fluorescent lamps and spiral-shaped double capped fluorescent lamps of all diameters equal to or larger than 16 mm (T5)	0.98	0.77	—	—
	0.50 at 5,000 operating hours			
Circular single-capped Fluorescent lamps operating on high frequency ballasts	0.99	0.97	0.85	—
	0.50 at 12,000 operating hours			
Other single-capped Fluorescent lamps operating on non-high frequency ballasts	0.98	0.90	0.50	—
Other single-capped Fluorescent lamps on high frequency ballast with warm start	0.99	0.98	0.88	—
T12 double-capped halophosphate Fluorescent lamps operating on US non-high frequency ballasts	0.94	0.88	0.75	

Fluorescent lamps without integrated ballast shall respect the criteria of table 10:

Table 10: Functionality and endurance requirements for non-directional compact fluorescent lamps operated on external control gear (CFLni)

Lumen maintenance and survival factors values at 2000 h are accepted and shall meet the limits in the table 10.

Parameter	Requirements
Lamp survival factor at 6000 h	≥ 0.70
Lumen maintenance	At 2,000 h: ≥ 83 % At 6,000 h: ≥ 70%
Lamp warm-up time to 60% total rated luminous flux (Φ)	< 40 s or < 100 s for lamps containing mercury in amalgam form
Premature failure rate	≤ 5.0 % at 1,000 h
Color rendering (Ra)	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications

C.2 - Functionality and endurance requirements for metal halide lamps and High-pressure sodium

Table 11: Functionality and endurance requirements for High-pressure sodium lamps

High pressure sodium lamp category and burning hours for measurement		Lamp lumen maintenance factor	Lamp survival factor
P ≤ 75 W LLMF and LSF measured at 12,000 burning hours	Ra ≤ 60	> 0.80	> 0.90
	Ra > 60	> 0.75	> 0.75
	all retrofit lamps designed to operate on high pressure mercury vapour lamp ballast	> 0.75	> 0.80
P > 75 W LLMF and LSF measured at 16,000 burning hours	Ra ≤ 60	> 0.85	> 0.90
	Ra > 60	> 0.70	> 0.65
	all retrofit lamps designed to operate on high pressure mercury vapour lamp ballast	> 0.75	> 0.55

Table 12: Functionality and endurance requirements for metal halide lamps

High pressure sodium lamp category and burning hours for measurement		Lamp lumen maintenance factor	Lamp survival factor
Phase 1	P < 1,000 W	≥ 60% at 6,000h	≥ 60% at 6,000h
	P ≥ 1,000 W	≥ 50% at 6,000h	≥ 50% at 6,000h
Phase 2 (1st of January 2020)	All power	> 80% at 12,000h	> 80% at 12,000h

C.3 - Functionality and endurance requirements for non-directional LED lamps and luminaires

Table 13: Functionality and endurance requirements for non-directional LED lamps and luminaires

Lumen maintenance and survival factors values at 6000 h shall meet the limits in table 13 in accordance with IEC 62722 or IES LM 84 and shall be submitted in registration system. In case IEC 62717 or IES LM 80 test report is available then, Lumen maintenance and survival factors values at 2000 h are accepted and shall meet the limits in the table 13 in accordance with IEC 62722 or IES LM 84.

Parameter	Performance required
Lamp survival factor at 6,000 h	≥ 0.90
Lumen Maintenance at 6,000 h	≥ 0.80
Number of switching cycles before failure	≥ 15,000 if rated lamp life ≥ 30,000 h otherwise: ≥ half the rated lamp life expressed in hours
Starting time	< 0.5 s
Lamp warm-up time to 95 % Φ	< 2 s
Premature failure rate	≤ 5.0 % at 1,000 h
Color rendering (Ra)	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications
Color consistency	Variation of chromaticity coordinates within a six-step MacAdam ellipse or less.
Lamp displacement factor (Df) with integrated control gear and integrated luminaires	P ≤ 2 W: no requirement 2 W < P ≤ 5 W: Df ≥ 0.4 5 W < P ≤ 25 W: Df ≥ 0.7(1) P > 25 W: Df ≥ 0.9

	(1) During one year after date of enforcement Df ≥ 0.5 is accepted for lamps with 5 W < P ≤ 25 W

ANNEX D – Energy efficiency requirements for directional lamps

D.1 - Calculation of the energy efficiency index for directional lamps

For the calculation of the energy efficiency index (EEI) of a model, its corrected rated power for any control gear losses is compared with its reference power.

The EEI is calculated as follows and rounded to two decimal places:

$$EEI = \frac{P_{cor}}{P_{ref}}$$

$\boldsymbol{P_{cor}}$ is defined as:
For models *without* external control gear, P_{cor} is the rated power (P_{rated}).

For models *with* external control gear, P_{cor} is the rated power (P_{rated}) corrected in accordance with the correction factors listed below:

Table 14: Power correction if the model requires external control gear

Scope of the correction	Corrected power (P_{cor})
Lamp operating on external LED lamp control gear	P_{rated} x 1.10
Fluorescent lamps of 16mm diameter (T5 lamps) and 4 pin single capped fluorescent lamps operating on external fluorescent lamp control gear	P_{rated} x 1.10
Other lamps operating on external fluorescent lamp control gear	$P_{rated} \times \frac{0.24\sqrt{\Phi_{use}} + 0.0103 \times \Phi_{use}}{0.15\sqrt{\Phi_{use}} + 0.0097 \times \Phi_{use}}$
Lamps operating on external high-intensity discharge lamp control gear	P_{rated} x 1.10
Lamps operating on external low pressure sodium lamp control gear	P_{rated} x 1.15
Lamps with anti-glare shield	P_{rated} x 0.80

The useful luminous flux (Φ_{use}) is defined in accordance with Table 15.

Table 15: Definition of useful luminous flux

Type	Useful luminous flux (Φ_{use})
Directional lamps with a beam angle ≥ 90° other than filament lamps and carrying a textual or graphical warning on their packaging that they are not suitable for accent lighting	Rated luminous flux in a 120° cone (Φ 120°)
Other directional lamps	Rated luminous flux in a 90° cone (Φ 90°)

The rated power P_{rated} of the lamps/luminaires is measured at their nominal input voltage.

$\boldsymbol{P_{ref}}$ is defined as:

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

For models with Φ_{use} < 1300 lumen: $P_{ref} = 0.88\sqrt{\Phi_{use}} + 0.049 \times \Phi_{use}$

For models with Φ_{use} ≥ 1300 lumen: $P_{ref} = 0.07341 \times \Phi_{use}$

D.2 - Maximum allowable EEI for directional lamps

The maximum EEI of directional lamps is indicated in Table 16

Table 16: Maximum energy efficiency index (EEI)

Lamp type	CFLni	LFL	LED	High Intensity Discharge (HID)
Maximum EEI	0.24	0.24	0.24	0.50

Enforcement date: 6 months after publication in the Official Gazette

D.3 - Energy efficiency classes

The energy efficiency rating of lamps/luminaires shall be determined on the basis of their energy efficiency index (EEI) as outlined in Table 17.

Table 17: Energy efficiency classes for directional lamps

Energy efficiency index (EEI)	Equivalent energy efficiency class (English)
EEI ≤ 0.09	6
0.09 < EEI ≤ 0.11	5
0.11 < EEI ≤ 0.13	4
0.13 < EEI ≤ 0.18	3
0.18 < EEI ≤ 0.24	2
0.24 < EEI ≤ 0.50	1

D.4 - Annual energy consumption

The annual energy consumption E_y is calculated on a basis of 1,000h of operation according to the following:

$$E_y = P_{cor} \leftrightarrow \frac{D_{op}}{1000} \qquad \text{[kWh}$$

with

P_{cor}: Corrected power (rated) [W]
D_{op}: Duration of operation [h]
1,000: Conversion factor [-]

ANNEX E – Functionality requirements for directional lamps and integrated luminaires

The lamp functionality requirements are outlined in Table 18 for directional LED lamps and integrated luminaires.

For the purposes of testing the number of times the lamp can be switched on and off before failure, the switching cycle shall consist of periods comprising 1 minute on and 3 minutes off or 5 minutes on and 5 minutes off.

For the purposes of testing lamp lifetime, lamp survival factor, lumen maintenance and premature failure, the standard switching cycle shall be used.

Lumen maintenance and survival factors values at 6000 h shall meet the limits in table 18 in accordance with IEC 62722 or IES LM 84 and shall be submitted in registration system. In case IEC 62717 or IES LM 80 or test report is available then, Lumen maintenance and survival factors values at 2000 h are accepted and shall meet the limits in the table 18 in accordance with IEC 62722 or IES LM 84.

Table 18: Functionality and endurance requirements for directional LED lamps and integrated luminaires

Parameter	Requirements
Lamp survival factor at 6,000 h	≥ 0.90
Lumen Maintenance at 6,000 h	≥ 0.80
Number of switching cycles before failure	≥ 15,000 if rated lamp life ≥ 30,000 h otherwise: ≥ half the rated lamp life expressed in hours
Starting time	< 0.5 s
Premature failure rate	≤ 5.0 % at 1,000 h
Color rendering (Ra)	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications
Color consistency	Variation of chromaticity coordinates within a six-step MacAdam ellipse or less.
Lamp displacement factor (Df) for lamps with integrated control gear and integrated luminaires	P ≤ 2 W: no requirement 2 W < P ≤ 5 W: Df > 0.4 5 W < P ≤ 25 W: Df > 0.7(1)

	P > 25 W: Df > 0.9 (1) during one year after date of enforcement Df ≥ 0.5 is accepted for lamps with 5 W < P ≤ 25 W

ANNEX F – Marking requirements for non-directional and directional lamps and luminaire.

F.1 - Information to be displayed on the lamp itself

For lamps other than high-intensity discharge lamps, the following shall be printed on the bulb with non-removable ink:

- Brand name
- Input voltage *
- Rated power (Watt)
- Country of origin

* Not applicable for fluorescent lamps

F.2 - Information to be visibly displayed to end-users, prior to their purchase and on the packaging.

The information does not need to use the exact wording on the list below. It may be displayed in the form of graphs, drawings or symbols rather than text

The information in paragraphs (a) to (p) below shall be visibly displayed on the packaging if the product is intended to be displayed to the end-users

a. Brand name;

b. Model number;

c. Country of origin;

d. Rated voltage and rated frequency;

e. Rated luminous flux (Lumen);

f. Rated Efficacy (Lumen/Watt);

g. Rated power (Watt);

h. Rated beam angle in degrees (only for directional lamps);

i. Lamp displacement factor (only for LED lamps with integrated control gear);

j. Rated life time of the lamp in hours;

k. Rated Color temperature, as a value in Kelvins, expressed graphically or in words;

l. Number of switching cycles before premature failure (only for LED lamps or if claimed by the manufacturer for other type of lamps);

m. Rated Color rendering index (Ra);

n. Stating all hazardous material contained in the lamp/luminaire, as relevant;

o. A warning if the lamp cannot be dimmed or can be dimmed only on specific dimmers; in the latter case, a list of compatible dimmers shall be also provided on the manufacturer's website or any other form the manufacturer deems appropriate

p. Following information are optional:

- Lamp type: directional or non-directional
- Color consistency (only for LED lamps);
- Lumen maintenance factor at the end of the nominal life;
- Warm-up time up to 60 % of the full light output (may be indicated as 'instant full light' if less than 1 second), when relevant;
- If designed for optimum use in non-standard conditions (such as ambient temperature Ta ≠ 25 °C or specific thermal management is necessary), provide information on those conditions;
- Rated peak intensity in candela (cd), when available;
- An equivalence claim involving the power of a replaced lamp type may be displayed only if the lamp type is listed in Part 1 - Table 13 and if the luminous flux of the lamp in a 90° cone ($\Phi_{90°}$) is not lower than the corresponding reference luminous flux in Part 1 - Table 13 The reference luminous flux shall be multiplied by the correction factor in Part 1 - Table 14. For LED lamps, it shall be in addition multiplied by the correction factor in Part 1 - Table 15. The intermediate values of both the luminous flux and the claimed equivalent lamp.
- For LED lamps, if intended for use in outdoor or industrial applications, an indication to this effect;
- Lamp dimensions in millimeters (length and largest diameter);
- Actual values of all hazardous material contained in the lamp/luminaire

q. Following information shall be displayed on free-access websites or in any other form the manufacturer deems appropriate:

- how to clean lamp debris in case of accidental lamp breakage and disposal of lamp at the end of life, when relevant;
- About actual values of the hazardous content, when relevant

F.3 - Information on control gear and ballast

For control gear and ballast, the following shall be printed on the product and packaging:

- Brand name;
- Model number;
- Country of origin;
- Rated voltage and rated frequency;
- Rated efficiency %
- Rated input power (Watt);
- Rated power factor

- Rated ambient temperature (Ta) and Rated case temperature (Tc)

ANNEX G – Requirement on ballast for fluorescent lamps without integrated ballast and ballast/driver for high intensity discharge, halogen and LED lamps

G.1 - Ballast energy performance requirements

G1.1 - Ballast for all types of lamps

The no-load power of a lamp control gear intended for use between the mains and the switch for turning the lamp load on/off shall not exceed 1.00W.

For lamp control gear with output power (P) over 250 W, the no-load power limits shall be multiplied by P/250 W.

The standby power of a lamp control gear shall not exceed 1.00 W.

G1.2 - Additional requirement for control gear for halogen and LED lamps

- The minimum efficiency of Halogen control gear shall be 0.91 at 100 % load.
- The minimum efficiency of LED control gear for all wattage shall be calculated in accordance with equation:

$$\textbf{Minimum Efficiency } (\eta)\ \% = \frac{P^{0.81}}{(1.09 \times P^{0.81} + 2.10)}$$

G1.3 - Additional requirement for ballasts for high intensity discharge lamps

Ballasts for high intensity discharge lamps shall have the efficiency described in Table 19.

Table 19: Minimum efficiency for ballasts for high intensity discharge lamps

Nominal lamp power (P) W	Minimum ballast efficiency ($\eta_{ballast}$) %
P ≤ 30	65
30 < P ≤ 75	75
75 < P ≤ 105	80
105 < P ≤ 405	85
P > 405	90

G1.4 - Additional requirement for ballasts for fluorescent lamps

Multi-wattage ballasts shall comply with the requirements below according to each nominal power on which they operate.
The minimum energy efficiency index class shall be B2 for ballasts covered by table 20, A3 for the ballasts covered by table 21, and A1 for dimmable ballasts covered by table 22.

At the dimming position corresponding to 25 % of the lumen output of the operated lamp, the input power (P_{in}) of the lamp-ballast circuit shall not exceed:

$$P_{in} < 50\ \% * P_{Lrated}/\eta_{ballast}$$

Where P_{Lrated} is the rated lamp power and $\eta_{ballast}$ is the minimum energy efficiency limit of the respective EEI class.

The power consumption of the fluorescent lamp ballasts shall not exceed 100 W when operated lamps do not emit any light in normal operating conditions and when other possible connected components (network connections, sensors etc.) are disconnected. If they cannot be disconnected, their power shall be measured and deducted from the result.

Table 20 contains the EEI classes for ballasts which are designed to operate the lamps mentioned in the table or other lamps which are designed to be operated by the same ballasts as the lamps mentioned in the table (meaning that the data of the reference ballast is equal).

Table 20: Energy efficiency index requirements for non-dimmable ballasts for fluorescent lamps

LAMP DATA					BALLAST EFFICIENCY (P_{lamp}/P_{input}) Non-dimmable				
Lamp type	Nominal Power	ILCOS CODE	Rated/typical Power		Class A2 BAT	Class A2	Class A3	Class B1	Class B2
			60 Hz	HF					
	W		W	W					
T8	15	FD-15-E-G13-26/450	15	13.5	87.8%	84.4%	75.0%	67.9%	62.0 %
T8	18	FD-18-E-G13-26/600	18	16	87.7%	84.2%	76.2%	71.3%	65.8 %
T8	30	FD-30-E-G13-26/900	30	24	82.1%	77.4%	72.7%	79.2%	75.0 %
T8	36	FD-36-E-G13-26/1200	36	32	91.4%	88.9%	84.2%	83.4%	79.5 %
T8	38	FD-38-E-G13-26/1050	38.5	32	87.7%	84.2%	80.0%	84.1%	80.4 %
T8	58	FD-58-E-G13-26/1500	58	50	93.0%	90.9%	84.7%	86.1%	82.2 %
T8	70	FD-70-E-G13-26/1800	69.5	60	90.9%	88.2%	83.3%	86.3%	83.1 %
TC-L	18	FSD-18-E-2G11	18	16	87.7%	84.2%	76.2%	71.3%	65.8 %

TC-L	24	FSD-24-E-2G11	24	22	90.7%	88.0%	81.5%	76.0%	71.3 %
TC-L	36	FSD-36-E-2G11	36	32	91.4%	88.9%	84.2%	83.4%	79.5 %
TCF	18	FSS-18-E-2G10	18	16	87.7%	84.2%	76.2%	71.3%	65.8 %
TCF	24	FSS-24-E-2G10	24	22	90.7%	88.0%	81.5%	76.0%	71.3 %
TCF	36	FSS-36-E-2G10	36	32	91.4%	88.9%	84.2%	83.4%	79.5 %
TC-D / DE	10	FSQ-10-E-G24q=1 FSQ-10-I-G24d=1	10	9.5	89.4%	86.4%	73.1%	67.9%	59.4 %
TC-D / DE	13	FSQ-13-E-G24q=1 FSQ-13-I-G24d=1	13	12.5	91.7%	89.3%	78.1%	72.6%	65.0 %
TC-D / DE	18	FSQ-18-E-G24q=2 FSQ-18-I-G24d=2	18	16.5	89.8%	86.8%	78.6%	71.3%	65.8 %
TC-D / DE	26	FSQ-26-E-G24q=3 FSQ-26-I-G24d=3	26	24	91.4%	88.9%	82.8%	77.2%	72.6 %
TC-T / TE	13	FSM-13-E-GX24q=1 FSM-13-I-GX24d=1	13	12.5	91.7%	89.3%	78.1%	72.6%	65.0 %
TC-T / TE	18	FSM-18-E-GX24q=2 FSM-18-I-GX24d=2	18	16.5	89.8%	86.8%	78.6%	71.3%	65.8 %
TC-T / TC TE	26	FSM-26-E-GX24q=3 FSM-26-I-GX24d=3	26.5	24	91.4%	88.9%	82.8%	77.5%	73.0 %
TC-DD / DDE	10	FSS-10-E-GR10q FSS-10-L/P/H-GR10q	10.5	9.5	86.4%	82.6%	70.4%	68.8%	60.5 %
TC-DD / DDE	16	FSS-16-E-GR10q FSS-16-I-GR8 FSS-16-L/P/H-GR10q	16	15	87.0%	83.3%	75.0%	72.4%	66.1 %
TC-DD / DDE	21	FSS-21-E-GR10q FSS-21-L/P/H-GR10q	21	19.5	89.7%	86.7%	78.0%	73.9%	68.8 %
TC-DD / DDE	28	FSS-28-E-GR10q FSS-28-I-GR8 FSS-28-L/P/H-GR10q	28	24.5	89.1%	86.0%	80.3%	78.2%	73.9 %
TC-DD / DDE	38	FSS-38-E-GR10q FSS-38-L/P/H-GR10q	38.5	34.5	92.0%	89.6%	85.2%	84.1%	80.4 %

TC	5	FSD-5-I-G23 FSD-5-E-2G7	5.4	5	72.7%	66.7%	58.8%	49.3%	41.4 %
TC	7	FSD-7-I-G23 FSD-7-E-2G7	7.1	6.5	77.6%	72.2%	65.0%	55.7%	47.8 %
TC	9	FSD-9-I-G23 FSD-9-E-2G7	8.7	8	78.0%	72.7%	66.7%	60.3%	52.6 %
TC	11	FSD-11-I-G23 FSD-11-E-2G7	11.8	11	83.0%	78.6%	73.3%	66.7%	59.6 %
T5	4	FD-4-E-G5-16/150	4.5	3.6	64.9%	58.1%	50.0%	45.0%	37.2 %
T5	6	FD-6-E-G5-16/225	6	5.4	71.3%	65.1%	58.1%	51.8%	43.8 %
T5	8	FD-8-E-G5-16/300	7.1	7.5	69.9%	63.6%	58.6%	48.9%	42.7 %
T5	13	FD-13-E-G5-16/525	13	12.8	84.2%	80.0%	75.3%	72.6%	65.0 %
T9-C	22	FSC-22-E-G10q-29/200	22	19	89.4%	86.4%	79.2%	74.6%	69.7 %
T9-C	32	FSC-32-E-G10q-29/300	32	30	88.9%	85.7%	81.1%	80.0%	76.0 %
T9-C	40	FSC-40-E-G10q-29/400	40	32	89.5%	86.5%	82.1%	82.6%	79.2 %
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%		
T2	21	FDH-21-L/P-W4,3x8,5d-7/		21	88.9%	85.7%	79.2%		
T2	23	FDH-23-L/P-W4,3x8,5d-7/		23	89.8%	86.8%	80.7%		
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%		
T5-E	95	FDH-95-G5-L/P-16/1150		95	92.7%	90.5%	84.1%		
T5-E	120	FDH-120-G5-L/P-16/1450		120	92.5%	90.2%	84.5%		
T5-C	22	FSCH-22-L/P-2GX13-16/ 225		22.3	88.1%	84.8%	78.8%		
T5-C	40	FSCH-40-L/P-2GX13-16/ 300		39.9	91.4%	88.9%	83.3%		
T5-C	55	FSCH-55-L/P-2GX13-16/ 300		55	92.4%	90.2%	84.6%		
T5-C	60	FSCH-60-L/P-2GX13-16/ 375		60	93.0%	90.9%	85.7%		
TC-LE	40	FSDH-40-L/P-2G11		40	91.4%	88.9%	83.3%		
TC-LE	55	FSDH-55-L/P-2G11		55	92.4%	90.2%	84.6%		
TC-LE	80	FSDH-80-L/P-2G11		80	93.0%	90.9%	87.0%		
TC-TE	32	FSMH-32-L/P-2GX24q=3		32	91.4%	88.9%	82.1%		
TC-TE	42	FSMH-42-L/P-2GX24q=4		43	93.5%	91.5%	86.0%		
TC-TE	57	FSM6H-57-L/P-2GX24q=5		56	91.4%	88.9%	83.6%		

		FSM8H-57-L/P-2GX24q=5							
TC-TE	70	FSM6H-70-L/P-2GX24q=6 FSM8H-70-L/P-2GX24q=6		70	93.0%	90.9%	85.4%		
TC-TE	60	FSM6H-60-L/P-2G8=1		63	92.3%	90.0%	84.0%		
TC-TE	62	FSM8H-62-L/P-2G8=2		62	92.2%	89.9%	83.8%		
TC-TE	82	FSM8H-82-L/P-2G8=2		82	92.4%	90.1%	83.7%		
TC-TE	85	FSM6H-85-L/P-2G8=1		87	92.8%	90.6%	84.5%		
TC-TE	120	FSM6H-120-L/P-2G8=1 FSM8H-120-L/P-2G8=1		122	92.6%	90.4%	84.7%		
TC-DD	55	FSSH-55-L/P-GRY10q3		55	92.4%	90.2%	84.6%		

In addition, non-dimmable ballasts not included in table 20 shall be assigned an EEI depending on their efficiency as described in Table 21.

Table 21: Energy efficiency index requirements for non-dimmable ballasts for fluorescent lamps not included in Table 20

η ballast	**Energy Efficiency Index**
≥ 0.94 * EBb_{FL}	A3
≥ EBb_{FL}	A2
≥ 1-0.75*(1-EBb_{FL})	A2 BAT

Furthermore, dimmable fluorescent lamp ballasts receive EEI classes according to the class into which the ballast would fall when it is operated at the 100 % lumen output, as described in Table 22.

Table 22: Energy efficiency index requirements for dimmable ballasts for fluorescent lamps

Complied class at 100 % lumen output	Energy Efficiency Index of dimmable ballast
A3	A1
A2	A1 BAT

Multi-wattage ballasts shall either be classified according to their efficiency under the lowest (worst) efficiency, or a relevant class shall be indicated for each operated lamp.

G.2 - Product information requirements on ballasts

Manufacturers of ballasts shall provide at least the following information on free-access websites and in other forms they deem appropriate for each of their ballast models. That information shall also be affixed in a distinct and durable form to the ballast. It shall also be contained in the technical documentation file drawn up for the purposes of conformity assessment.
For ballasts for fluorescents lamps, an energy efficiency index (EEI) class shall be provided as defined below.

'Energy efficiency index' (EEI) means a classification system of ballasts for fluorescent lamps without integrated ballasts in classes according to efficiency limit values. The classes for non-dimmable ballasts are (in descending order of efficiency) A2 BAT, A2, A3, B1, B2 and for dimmable ballasts A1 BAT and A1.

ANNEX H – Energy label for lamps and integrated luminaires

H.1 - Determining the energy efficiency class

The energy efficiency class for each product shall be determined as outlined in Table 6 in Annex B (non-directional lamps), as outlined in Table 17 in Annex D (directional lamps) or in Table 37 in Annex L for integrated luminaires.

H.2 placement of the label

The label shall be printed on the most prominent part of the individual product packaging to be easily visible to the end-user.
H.3 Design of the label

ANNEX I – Hazardous chemicals: Substance restrictions for lamps & control gears

The following limits for hazardous substances apply.

Table 23: Maximum content limits of hazardous substances

Descriptions	Tolerated mcv of substance by weight in homogeneous materials
Lead(Pb)	0.1%
Cadmium (Cd)	0.01%
Hexavalent chromium (Cr6+)	0.1%
Polybrominated biphenyls (PBB)	0.1%
Polybrominated diphenyl ether (PBDE)	0.1%

Table 25 outlines exemptions to the hazardous substance limits set in this annex. Eligible products or components have no limit on the levels of the relevant hazardous substance.

Table 24: Lamps exempted from limits listed in Table 24

Description	Requirements
Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound	No limit
Lead in dielectric ceramic in capacitors for a rated voltage of 125V AC or 250V DC or higher	No limit
Lead in glass of fluorescent tubes not exceeding 0.2% by weight	No limit
Cadmium and its compounds in electrical contacts	No limit
Lead as an alloying element in aluminum containing up to 0.4 % lead by weight	No limit
Copper alloy containing up to 4 % lead by weight	No limit
Lead in high melting temperature type solders (i.e. lead- based alloys containing 85 % by weight or more lead)	No limit
Lead and cadmium in printing inks for the application of enamels on glasses, such as borosilicate and soda lime glasses	No limit
Lead in glass of fluorescent tube not exceeding 0.2% by weight	No limit

Table 26 outlines the limit on mercury content per lamp applicable to single and double capped fluorescent lamps (without integrated ballast) and high intensity discharge lamps for general lighting purposes. All other lamp types in this Standard shall not have mercury limits.

Table 25: Maximum mercury content

Lamp type	Limit
Mercury in single capped (compact) fluorescent lamps	
≥30 W and <150 W	5.0 mg
<30 W	2.5 mg
<30 W with long lifetime (> 15,000 h)	3.5 mg

With circular or square structural shape or other non-linear with tube diameter ≤ 17 mm	7.0 mg
Mercury in double-capped linear fluorescent lamps	
Tri-band phosphor with normal lifetime and a tube diameter < 9 mm (e.g. T2)	5.0 mg
Tri-band phosphor with normal lifetime and a tube diameter ≥ 9 mm and ≤ 17 mm (e.g. T5)	5.0 mg
Tri-band phosphor with normal lifetime and a tube diameter > 17 mm and ≤ 28 mm (e.g. T8)	8.0 mg
Tri-band phosphor with normal lifetime and a tube diameter > 28 mm (e.g. T12)	5.0 mg
Tri-band phosphor with long lifetime (≥ 25,000 h) and T8 halophosphate	8.0 mg
Mercury in other fluorescent lamps	
Non-linear halophosphate lamps (all diameters)	15 mg
Non-linear tri-band phosphor lamps with tube diameter > 17 mm (e.g. T9)	15 mg
Lamps for other general lighting and special purposes (e.g. induction lamps)	15 mg
T12 linear halophosphate lamps	10 mg
Mercury in other low pressure discharge lamps	15 mg
Mercury in High Pressure Sodium (vapour) lamps for general lighting purposes with improved color rendering index Ra > 60	
P ≤ 155 W	30 mg
155 W < P ≤ 405 W	40 mg
P > 405 W	40 mg
Mercury in other High Pressure Sodium (vapour) lamps for general lighting purposes	
P ≤ 155 W	25 mg
155 W < P ≤ 405 W	30 mg
P > 405 W	40 mg
Mercury in metal halide lamps (MH)	no limit
Mercury in High Pressure Mercury (vapour) lamps	no limit
Mercury in other discharge lamps for special purposes not specifically mentioned in this Annex	no limit
Note: Maximum mercury content limits for lamps (per burner) in the scope of this Standard (only applies to single capped fluorescent lamps without integrated ballast and high intensity discharge lamps for general lighting purposes)	

ANNEX J – Tests methods for lamps and control gears

Table 26: Standards applicable to all lamps covered by part 2

Organization	Reference	Title	Measured parameters
IEC	EN 60061-1:1993 All amendments up to A41:2009	Lamp caps and holders together with gauges for the control of interchangeability and safety -- Part 1: Lamp caps	• Lamp caps' geometry

	EN 62471:2008	Photo biological safety of lamps and lamp systems	• Radiation (spectrum evaluation related to Annex I.1.d)
International Commission on Illumination	CIE 18.2:1983	The Basis of Physical Photometry	• Light beam angle
IEC	62321:2015 series	Measurements of certain substances in electro technical products	Part 1: Introduction and overview Part 2: Disassembly, disjunction and mechanical sample preparation Part 3.1 Lead, mercury, cadmium, total chromium and total bromine using X-ray fluorescence spectrometry Part 4: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS Part 5: Cadmium, lead and chromium in polymers and electronics and cadmium and lead in metals by AAS, AFS, ICP-OES and ICP-MS Part 6: Polybrominated biphenyls and polybrominated diphenyl ethers in polymers by gas chromatograhy - mass spectrometry (GC-MS)
IEC	IEC 62321-4 by CV-AAS, CV-AFS, ICP-OES and ICP-MS	Determination of certain substances in electrotechnical products – Part 4: Mercury in polymers, metals and electronics	Mercury content
IEC	62554:2011	Sample preparation for measurement of mercury level in fluorescent lamps	Methodology for preparation of the sampling for measurement of mercury content
IEC	IEC 62321-4 by CV-AAS, CV-AFS, ICP-OES and ICP-MS	Determination of certain substances in electro-technical products – Part 4: Mercury in polymers, metals and electronics	Mercury content

Table 27: Standards applicable to fluorescent lamps

Organization	Reference	Title	Measured parameters
IEC	IEC 60081:1998 Amendments: A1:2002 A2:2003	Double-capped fluorescent lamps - Performance specifications	• Lamp luminous flux • Power consumed by the lamp (excluding the power dissipated by auxiliary equipment such as ballasts)

	A3:2005 A4:2010		• Lamp Lumen Maintenance Factor (LLMF) **Note:** in the standard LLMF is called “lumen maintenance”. • Lamp Survival Factor (LSF) **Note:** LSF is not explicitly mentioned, only the method for life testing. LSF is deduced from the lumen maintenance curve according to Annex C of the standard. For the purposes of Table 6 in Annex III, the Lamp Survival Factor shall be measured in high frequency operating mode with a switching cycle of 11h on / 1h off. In other cases the switching cycle shall be the one set out in the standard. • Chromaticity • Correlated Colour Temperature (CCT) • Colour rendering
IEC	IEC 60901:1996 Amendments: A1:1997 A2:2000 A3:2004 A4:2008 Draft A5 (34A/1358/CDV)	Single-capped fluorescent lamps - Performance specifications	• Lamp luminous flux • Power consumed by the lamp (excluding the power dissipated by auxiliary equipment such as ballasts) • Lamp Lumen Maintenance Factor (LLMF) **Note:** in the standard LLMF is called “lumen maintenance”. • Lamp Survival Factor (LSF) **Note:** LSF is not explicitly mentioned, only the method for life testing. LSF is deduced from the lumen maintenance curve according to Annex C of EN 60081 (the version referred to in the row on double-capped fluorescent lamps). • Chromaticity • Correlated Colour Temperature (CCT) • Colour rendering
IES	LM9	Electric and photometric measurements of fluorescent lamps	•
IES	LM 66	Electrical and photometric measurements of Single-ended	•

		compacts fluorescent lamps	

Table 28: Standards applicable to high-pressure mercury vapour lamps

Organization	Reference	Title	Measured parameters
IEC	EN 62035:2000 Amendment: A1:2003	Discharge lamps (excluding fluorescent lamps) safety specifications	• Specific effective radiant UV power
IEC	EN 60188:2001	High-pressure mercury vapour lamps - Performance specifications	• Lamp luminous flux • Power consumed by the lamp (excluding the power dissipated by auxiliary equipment such as ballasts)
International Commission on Illumination	CIE 97-2005	Maintenance of Indoor Electric Lighting Systems	• Lamp Lumen Maintenance Factor (LLMF) • Lamp Survival Factor (LSF)
	CIE 154-2003	Maintenance of Outdoor Electric Lighting Systems	
	CIE 15-2004	Colourimetry	• Chromaticity • Correlated colour temperature
	CIE 13.3-1995	Method of Measuring and Specifying Colour Rendering Properties of Light Sources	• Colour rendering

Table 29: Standards applicable to high-pressure vapour lamps

Organisation	Reference	Title	Measured parameters
IEC	EN 62035:2014 Amendment: A1:2014	Discharge lamps (excluding fluorescent lamps) safety specifications	• Specific effective radiant UV power
IEC	IEC 60662:2012	High-pressure sodium vapour lamps - Performance specifications	• Power consumed by the lamp (excluding the power dissipated by auxiliary equipment such as ballasts) • Lamp Lumen Maintenance Factor (LLMF) **Note:** in the standard LLMF is called “lumen maintenance”. • Lamp Survival Factor (LSF) **Note:** LSF is not explicitly mentioned, only the method for life testing. LSF is deduced from the lumen maintenance curve according to Annex C of EN

			60081 (the version referred to in the row on double-capped fluorescent lamps).
International Commission on Illumination IEC	CIE 84-1989	Measurement of luminous flux	• Lamp luminous flux •
	CIE 15-2004	Colourimetry	• Chromaticity • Correlated colour temperature
	CIE 13.3-1995	Method of Measuring and Specifying Colour Rendering Properties of Light Sources	• Colour rendering

Table 30: Standards applicable to metal halide lamps

Organization	Reference	Title	Measured parameters
IEC	EN 62035:2014	Discharge lamps (excluding fluorescent lamps) safety specifications	• Specific effective radiant UV power
IEC	IEC 61167 (34A/1326/CDV)	Metal halide lamps - Performance specifications	• Power consumed by the lamp (excluding the power dissipated by auxiliary equipment such as ballasts) • Lamp Lumen Maintenance Factor (LLMF) **Note:** in the standard LLMF is called “lumen maintenance”. • Lamp Survival Factor (LSF) **Note:** LSF is not explicitly mentioned, only the method for life testing. LSF is deduced from the lumen maintenance curve according to Annex C of EN 60081 (the version referred to in the row on double-capped fluorescent lamps).
International Commission on Illumination	CIE 84-1989	Measurement of luminous flux	• Lamp luminous flux
	CIE 15-2004	Colourimetry	• Chromaticity • Correlated colour temperature
	CIE 13.3-1995	Method of Measuring and Specifying Colour Rendering Properties of Light Sources	• Colour rendering

Table 31: Standards applicable to ballasts

Organization	Reference	Title	Measured parameters
Ballasts for fluorescent lamps (both high	CENELEC	EN 50294:1998 Amendments: A1:2001	• Measurement method of total input power of ballast-lamp circuits

frequency and non-high frequency)		A2:2003	

Table 32: Standards applicable to Luminaires and LED lamps not listed in SASO 2870

Organization	Reference	Title	Measured parameters
IES	LM 80-08	Measurement lumen maintenance of LED Light sources	• lumen maintenance • Lamps survival factor
IES	TM 28-14	Projecting Long term Luminous flux maintenance of LED lamps and luminaires	• lumen maintenance • Lamps survival factor
IEC	IEC 62717	LED modules for general lighting – Performance requirements	• Power • Luminous flux • Displacement factor • CRI, CCT • Beam angle • Lumen maintenance • Endurance
IEC	IEC 62722-1	Luminaire performance – General requirements	• Power • Luminous flux • CRI, CCT, chromaticity coordinates • Beam angle • Lumen maintenance • Endurance
IEC	IEC 62722-2-1	Luminaire performance – Particular requirements for LED luminaires	• Power • Luminous flux • CRI, CCT, chromaticity coordinates • Beam angle • Lumen maintenance • Endurance
NEMA	ANSI C78.377	Electric Lamps — Specifications for the Chromaticity of Solid-state Lighting Products	• Chromaticity

ANNEX K – Measurement of the mercury content for fluorescent lamps

K.1 – Default method for measurement

Lamp samples shall be prepared for measurement according to IEC62554 “Sample preparation for measurement of mercury level in fluorescent lamps”

The average mercury content has to be measured in accordance with the CV AAS method as described in EN 62321-4 “Determination of certain substances in electro technical products – Part 4: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS"

K.2 - Alternative method for measurement of the mercury content

The following method is accepted as an alternative to IEC 62554 and IEC 62321-4 for the measurement of the mercury content

The applicant shall provide a test report stating that the mercury content has been measured using the method described below. The report shall state the average mercury content, calculated by analyzing ten lamps, and then deleting the highest and lowest values before calculating the arithmetic mean of the remaining eight values.

The test method for the mercury content is as follows. The arc tube is first separated from its plastic surrounds and associated electronics. The associated lead wires are cut as close to the glass seal as possible. The arc tube is taken to a fume cupboard and is cut into segments. The segments are placed in a suitably sized robust screw-capped plastic bottle to which is added a 1 inch diameter porcelain ball and 25 ml of high purity concentrated nitric acid (70 %). The bottle is sealed and shaken for a few minutes to reduce the arc tube to fine particle size, the stopper is periodically loosened to eliminate any possibility of pressure build-up. The contents of the bottle are allowed to react for 30 minutes during which time the contents are periodically agitated. The contents of the bottle are then filtered through an acid resistant filter paper and collected in a 100 ml graduated volumetric flask. Potassium dichromate is then added to the flask so that the final concentration is 1000 ppm with respect to chromium. The flask is then made up to volume with pure water. Matched standards are made up on a concentration range up to 200 ppm mercury. The solutions are analyzed using flame atomic absorption at a wavelength of 253.7 nm with background correction on. From the results obtained and knowledge of the solution volume, the original mercury content of the light bulb can be computed. The competent body may agree adaptations to the details of this test method if they are necessary for technical reasons, and these shall be applied in a consistent manner.

ANNEX L – Energy efficiency for (integrated) luminaires

L.1 - Types of luminaires

Definitions for the different types of luminaires are presented in Clause 3
Luminaires within the scope of this regulation (integrated luminaires) are characterized as direct or indirect lighting sources depending of the beam angle of the light emission.

For information only, luminaires can be identified per type of use as expressed in Table 34

Table 33: Use types for luminaires (informative)

Terms	Description	Content
LT_1	General (artificial) lighting	Lighting designed to provide an uniform level of illumination
LT_2	Local lighting	Lighting designed to provide designed level of illumination over a specific area surrounding with lower illumination from spilled light source(s)
LT_3	Accent lighting	Lighting that calls attention or adds interest to a particular object or unusual feature or interest of a room. Highlights, emphasizes illumination with a strong light from behind in order to embrace depth or to separate the object from the background, sidelights is highlights coming from the side.
LT_4	Task lighting	Lighting designed to provide a strong illumination for visually demanding activities. It needs to be glare-free. Effective task lighting enhances visual clarity and keeps the eyes from getting tired.
LT_5	Ambient lighting	An ambient source of light that washes the room with a glow. It flattens an interior and creates very little shadow.
LT_6	Aesthetic lighting	Lighting as a piece of art. A neon sculpture would be purely decorative and illustrates aesthetic lighting.
LT_7	Natural lighting	Lighting provided without any artificial lighting sources

L.2 - Minimum Efficacy for luminaires

The minimum energy efficacy for luminaires are reported in Table 35, depending on the total power of the luminaires.

Table 34: Minimum energy efficacy for (MEPS) Luminaires

Power of the luminaire	Minimum value for efficacy
P_{rated} < 15 W	≥ 65 Lumen/Watt
P_{rated} ≥ 15 W	≥ 70 Lumen/Watt

L.3 - Energy Efficiency Index for luminaires (EEI)

The energy efficiency for luminaires is calculated as for the EEI for lamps of the same category (directional or non-directional) according respectively to Annex C for non-directional luminaires and E for directional luminaires, based on illuminance (Lumen) and Power deducted from the Energy Efficacy.

For the calculation of the energy efficiency index (EEI) of a model, its corrected (electric) power P_{cor} for any control gear losses is compared with its reference power P_{ref} (based on the luminous flux emitted).

The EEI is calculated as follows and rounded to two decimal places.

$$EEI = \frac{P_{cor}}{P_{ref}}$$

P_{cor} is defined as:
For models *without* external control gear, P_{cor} is the rated power (P_{rated}).

For models *with* external control gear P_{cor} is the rated power (P_{rated}) corrected in accordance with the corrections factors listed below:

The rated power P_{rated} of the lamps/luminaires is measured at their nominal input voltage.

Correction factors presented in Table 36 apply to moderated the electric power of the luminaires

Correction factor cumulative with those expressed in annex B for indirect lamps and Annex D for direct lamps.

Table 35: Correction factors applicable to Power of the Luminaires

Rated Power of the Luminaire	Correction factor
$P_{rated} \leq 6W$	$P_{cor} = P_{rated} \times 1.17$
$6\ W < P_{rated} \leq 15\ W$	$P_{cor} = P_{rated} \times 1.03$
$15\ W < P_{rated}$	$P_{cor} = P_{rated} \times 0.98$

$\boldsymbol{P_{ref}}$ is defined as:

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

For models with Φ_{use} < 1300 lumen: $P_{ref} = 0.88\sqrt{\Phi_{use}} + 0.049 \times \Phi_{use}$

For models with Φ_{use} ≥ 1300 lumen: $P_{ref} = 0.07341 \times \Phi_{use}$

For non-directional lamps, the useful luminous flux (Φ_{use}) is the total rated luminous flux (Φ).

L.4 - Classification of Energy Efficiency Index for (integrated) luminaires (EEI)

The energy efficiency rating of luminaires shall be determined on the basis of their energy efficiency index (EEI) as outlined in Table 37.

Table 36: Energy efficiency classes for luminaires

Energy efficiency index (EEI)	Equivalent energy efficiency class (Stars)
EEI ≤ 0.09	7
0.09 < EEI ≤ 0.11	6
0.11 < EEI ≤ 0.13	5
0.13 < EEI ≤ 0.18	4
0.18 < EEI ≤ 0.24	3
0.24 < **EEI** ≤ 0.5	2

ANNEX M – Criteria for market surveillance

For purposes of market surveillance, it might be drawn a sample of batch (based on each parameter listed in table 38) of the same model from the same manufacturer, where possible obtained in equal proportion from four randomly selected sources.

- The lamps in the batch are accompanied by the required and correct product information,
- All parameters listed in Table 38 are met

Table 37: Criteria applying for market surveillance

Parameter	Procedure
Energy efficiency index[1]	Compliance: The Energy Efficiency Index (EEI) value for lamps in the scope of this Standard shall be less than or equal to the specified values in Tables 2 and 8, when calculated at both rated and average tested power and luminous flux. Furthermore, the average EEI of the sample tested should be not higher than 10% of the rated EEI, and each lamp in the sample should have an EEI value within 10% of the sample's average EEI. For Luminaires the MEPS for Energy Efficacy shall be respected for each product; furthermore, the average efficacy of the sample tested should not be lower 10% of the rated efficacy (in Lumen/W), and each luminaire in the sample should have an efficacy value within 10% of the sample's average efficacy. Non-compliance: otherwise
Lamp survival factor at 6000 h	The test shall end • when the required number of hours is met, or

[1] The tolerances for variation indicated above relate only to the verification of the measured parameters by the authorities and shall not be used by the supplier as an allowed tolerance on the values in the technical documentation to achieve a more efficient energy class. The declared values shall not be more favorable for the supplier than the values reported in the technical documentation.

(for LED lamps only)	• when more than two lamps fail, whichever occurs first Compliance: a maximum of two out of every 20 lamps in the test batch may fail before the required number of hours Non-compliance: otherwise
Number of switching cycles before failure	The test shall end when the required number of switching cycles is reached, or when more than one out of every 20 lamps in the test batch have reached the end of their life, whichever occurs first Compliance: at least 19 of every 20 lamps in the batch have no failure after the required number of switching cycles is reached Non-compliance: otherwise
Starting time	Compliance: the average starting time of the lamps in the test batch is not higher than the required starting time plus 10 %, and no lamp in the sample batch has a starting time longer than two times the required starting time Non-compliance: otherwise
Lamp warm-up time to 60 % Φ	Compliance: the average warm-up time of the lamps in the test batch is not higher than the required warm-up time plus 10%, and no lamp in the sample batch has a warm-up time that exceeds the required warm-up time multiplied by 1.5 Non-compliance: otherwise
Premature failure rate	The test shall end • when the required number of hours is met, or • when more than one lamp fails, whichever occurs first. Compliance: a maximum of one out of every 20 lamps in the test batch fails before the required number of hours Non-compliance: otherwise
Color rendering (Ra)	Compliance: the average Ra of the lamps in the test batch is not lower than three points below the required value, and no lamp in the test batch has a Ra value that is more than 3,9 points below the required value Non-compliance: otherwise
Lumen maintenance at end of life and rated lifetime (for LED lamps only)	For these purposes, 'end of life' shall mean the point in time when only 50 % of the lamps are projected to survive or when the average lumen maintenance of the batch is projected to fall below 70 %, whichever is projected to occur first Compliance: the lumen maintenance at end of life and the lifetime values obtained by extrapolation from the lamp survival factor and from the average lumen maintenance of the lamps in the test batch at 6000 h are not lower than respectively the lumen maintenance and the rated lifetime values declared in the product information minus 10 % Non-compliance: otherwise
Equivalence claims for retrofit lamps according to Annex G	If only the equivalence claim is verified for compliance, it is sufficient to test 10 lamps, where possible obtained approximately in equal proportion from four randomly selected sources Compliance: the average results of the lamps in the test batch do not vary from the limit, threshold or declared values by more than 10 % Non-compliance: otherwise

Beam angle	Compliance: the average results of the lamps in the test batch do not vary from the declared beam angle by more than 25 % and the beam angle value of each individual lamp in the test batch does not deviate by more than 25 % of the rated value Non-compliance: otherwise
Peak intensity	Compliance: the peak intensity of each individual lamp in the test batch is not less than 75 % of the rated intensity of the model Non-compliance: otherwise
Other parameters	Compliance: the average results of the lamps in the test batch do not vary from the limit, threshold or declared values by more than 10 %. Non-compliance: otherwise

If a model within the registered family of product fails, the registration of all models under the same family of product will be automatically canceled.