

COMMISSION REGULATION (EU) No .../..

of

implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products¹, and in particular Article 15(1) thereof,

After consulting the Ecodesign Consultation Forum,

Whereas:

- (1) Directive 2009/125/EC requires the Commission to set ecodesign requirements for energy-related products representing significant volumes of sales and trade, having a significant environmental impact and presenting significant potential for improvement through design in terms of their environmental impact, without entailing excessive costs.
- (2) Article 16(2)(a) of Directive 2009/125/EC provides that in accordance with the procedure referred to in Article 19(3) and the criteria set out in Article 15(2), and after consulting the Ecodesign Consultation Forum, the Commission has to, as appropriate, introduce implementing measures offering a high potential for cost-effective reduction of greenhouse gas emissions, such as for lighting products in both the domestic and tertiary sectors, which include directional lamps, light-emitting diode lamps and related equipment.
- (3) The Commission has carried out a preparatory study to analyse the technical, environmental and economic aspects of directional lamps, light-emitting diode lamps and related equipment. The study has been developed together with stakeholders and interested parties from the Union and third countries, and the results have been made publicly available. A preparatory study on external power supplies provided a similar analysis for halogen lamp control gear.
- (4) Mandatory ecodesign requirements apply to products placed on the Union market wherever they are installed or used; therefore such requirements cannot be made dependent on the application in which the product is used (such as for domestic lighting).

¹ OJ L 285, 31.10.2009, p. 10.

- (5) Products subject to this Regulation are designed essentially for 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. Special purpose lamps designed essentially for other types of application, such as traffic signals, terrarium lighting or household appliances and clearly indicated as such on accompanying product information should not be subject to the ecodesign requirements set out in this Regulation.
- (6) New technologies emerging on the market such as light-emitting diodes should be subject to this Regulation.
- (7) The environmental aspects of the products covered that have been identified as significant for the purposes of this Regulation are energy in the use phase along with mercury content and mercury emissions.
- (8) Mercury emissions in the different phases of the life cycle of the lamps, including from electricity generation in the use phase and from the 80% of directional compact fluorescent lamps containing mercury which are presumed not to be recycled at the end of their life, have been estimated to be 0.7 tonnes in 2007 from the installed stock of lamps. Without taking specific measures, the mercury emissions from the installed lamp stock are predicted to increase to 0.9 tonnes in 2020, although it has been demonstrated that they can be significantly reduced.
- (9) Although the mercury content of compact fluorescent lamps is considered to be a significant environmental aspect, it is appropriate to regulate it under Directive 2011/65/EU.²
- (10) Setting energy efficiency requirements for lamps should lead to a decrease in the overall mercury emissions.
- (11) Article 10(1)(d) of Directive 2002/96/EC³ requires Member States to ensure that users of electrical and electronic equipment in private households are given the necessary information about the potential effects on the environment and human health as a result of the presence of hazardous substances in electrical and electronic equipment. The product information requirements in this Regulation should complement this provision as regards mercury in compact fluorescent lamps.
- (12) The electricity consumption of products subject to this Regulation should be improved by applying existing non-proprietary cost-effective technologies, which lead to a reduction of the combined expenses for purchasing and operating the equipment.
- (13) Ecodesign requirements for products subject to this Regulation should be set with a view to improving the environmental performance of the products concerned and contributing to the functioning of the internal market and to the Union objective of reducing energy consumption by 20% in 2020 compared with the assumed energy consumption in that year if no measures were taken.

² OJ L 174, 1.7.2011, p. 88

³ OJ L 37, 13.2.2003, p. 24

- (14) The combined effect of the ecodesign requirements set out in this Regulation and of Commission Delegated Regulation XXX/2012 [Numbering of the Regulation and OJ reference in footnote to be added before publication in the OJ] is expected to result in annual electricity savings of 25 TWh by 2020 among directional lamps, compared with the situation if no measures were taken.
- (15) The ecodesign requirements should not affect functionality from the user's perspective and should not negatively affect health, safety or the environment. In particular, the benefits of reducing the electricity consumption during the use phase should outweigh any potential additional environmental impact during the production phase of products subject to this Regulation. In order to ensure consumer satisfaction with energy-saving lamps, in particular LEDs, functionality requirements should be set not only for directional lamps, but also to non-directional LEDs, as they were exempted from the functionality requirements in Commission Regulation 244/2009.⁴ Product information requirements should allow consumers to make informed choices.
- (16) Integral LED luminaires from which no LED lamp or module can be extracted for independent testing should not offer a way for LED manufacturers to escape the requirements of this Regulation.
- (17) It is appropriate to set specific requirements at a level that leaves alternative lamps to service the entire installed stock of lighting equipment. In parallel, generic requirements should be set that are implemented by harmonised standards and that make new lighting equipment more compatible with energy-saving lamps, and energy-saving lamps compatible with a wider range of lighting equipment. Product information requirements on lighting equipment can assist users in finding matching lamps and equipment.
- (18) Phasing the ecodesign requirements should provide a sufficient timeframe for manufacturers to re-design products subject to this Regulation. The timing of the stages should be such that any negative impact on functionalities of equipment on the market are avoided and that the cost impact for end-users and manufacturers, in particular small and medium-sized enterprises, is taken into account, while ensuring timely achievement of the objectives of this Regulation.
- (19) Measurements of the relevant product parameters should be performed through reliable, accurate and reproducible measurement methods, which take into account the recognised state-of-the-art measurement methods including, where available, harmonised standards adopted by the European standardisation bodies, as listed in Annex I to Directive 98/34/EC⁵.
- (20) In accordance with Article 8 of Directive 2009/125/EC, this Regulation should specify the conformity assessment procedures applicable.
- (21) In order to facilitate compliance checks, manufacturers should provide information in the technical documentation referred to in Annexes V and VI to Directive 2009/125/EC in so far as that information relates to the requirements laid down in this Regulation.

⁴ OJ L 76, 24.3.2009, p.3

⁵ OJ L 217, 05.08.1998, p. 18.

- (22) In addition to the legally binding requirements laid down in this Regulation, indicative benchmarks for best available technologies should be identified to make information on the life-cycle environmental performance of products subject to this Regulation widely available and easily accessible..
- (23) A review of this measure should take particular note of the evolution of sales of special purpose lamp types in order to make sure that they are not used for general lighting purposes, and of the development of new technologies such as LED. It should assess the feasibility of establishing energy efficiency requirements at the class A level as defined in the Commission Delegated Regulation XXX/2012 [Numbering of the Regulation and OJ reference in footnote to be added before publication in the OJ], or at least at the class B level for directional mains voltage halogen lamps (taking into account the criteria below Table 2 in point 1.1. of Annex III). It should also assess the feasibility to significantly tighten the energy efficiency requirements for other filaments lamps.
- (24) The measures provided for in this Regulation are in accordance with the opinion of the Committee established by Article 19(1) of Directive 2009/125/EC.

HAS ADOPTED THIS REGULATION:

Article 1
Subject matter and scope

This Regulation establishes ecodesign requirements for placing on the market the following general lighting electrical products:

- (a) directional lamps;
- (b) light-emitting diode (LED) lamps;
- (c) equipment designed for installation between the mains and the lamps, including lamp control gear, control devices and luminaires (other than ballasts and luminaires for fluorescent and high-intensity discharge lamps);

including when they are integrated into other products.

The Regulation also establishes product information requirements for special purpose products that use the technologies covered by this Regulation but are designed for special applications.

Article 2
Definitions

In addition to the definitions set out in Article 2 of Directive 2009/125/EC, the following definitions shall apply for the purposes of this Regulation:

1. 'general lighting' means substantially uniform lighting of an area or part of an area without provision for special local requirements. It includes accent lighting;

2. 'general lighting electrical product' means a product designed for use with electricity and intended for use in general lighting; except special purpose products;
3. 'accent lighting' means a form of general lighting where light is directed so as to emphasize an object or a part of an area;
4. 'special purpose product' means a lighting product that uses the technologies covered by this Regulation but is not intended for use in general lighting because of its technical parameters or because the related product information indicates that it is unsuitable for general lighting;
5. '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 380-780 nm;
6. 'lamp' means a unit consisting of one or more light sources whose performance can be assessed independently; 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;
7. '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;
8. 'lamp holder' 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;
9. 'directional lamp' means a lamp having at least 80% light output within a solid angle of π sr (corresponding to a cone with angle of 120°);
10. 'non-directional lamp' means a lamp that is not a directional lamp;
11. '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;
12. 'incandescent lamp' means a filament lamp in which the filament operates in an evacuated bulb or is surrounded by inert gas;
13. '(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;
14. 'discharge lamp' means a lamp in which the light is produced, directly or indirectly, by an electric discharge through a gas, a metal vapour or a mixture of several gases and vapours;
15. 'fluorescent lamp' means a discharge lamp of the low-pressure mercury type in which most of the light is emitted by one or more layers of phosphors excited by the

ultraviolet radiation from the discharge. Fluorescent lamps may be supplied with an integrated ballast;

16. 'fluorescent lamp without integrated ballast' means a single- or double-capped fluorescent lamp without integrated ballast;
17. 'high intensity discharge lamp' means an electric discharge lamp in which the light-producing arc is stabilised by wall temperature and the arc has a bulb wall loading in excess of 3 watts per square centimetre;
18. 'light emitting diode (LED)' means a light source which consists of a solid state device embodying p-n junctions, emitting optical radiation when excited by an electric current;
19. 'LED package' means an assembly of one or more LED(s), possibly with an optical element and thermal, mechanical and electrical interfaces;
20. 'LED module' means an assembly having no cap and incorporating one or more LED packages on a printed circuit board, which may have electrical, optical, mechanical and thermal components, and control gear;
21. 'LED lamp' means a lamp incorporating one or more LED modules, which may be equipped with a cap;
22. 'lamp control gear' means a device 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 power factor, reducing radio interference. The device may be designed to connect to other lamp control gear to perform these functions. It does not include control devices;
23. '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 phase cut dimmers, timer switches, occupancy sensors, light sensors, daylight regulation;
24. '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;
25. '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;
26. 'halogen lamp control gear' means lamp control gear that transforms mains voltage to extra low voltage for halogen lamps;
27. 'compact fluorescent lamp' means a fluorescent lamp that includes all the components necessary for starting and stable operation of the lamp;

28. '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 supply;
29. 'end-user' means a natural person buying or expected to buy a product for purposes which are outside his trade, business, craft or profession;
30. 'final owner' means the person or entity owning a product during the use phase of its life cycle, or any person or entity acting on behalf of such a person or entity.

For the purposes of Annexes III to V, the definitions set out in Annex II shall also apply.

Article 3 ***Ecodesign requirements***

1. The general lighting products listed in Article 1 shall meet the ecodesign requirements set out in Annex III.

Each ecodesign requirement shall apply in accordance with the following stages:

Stage 1: 1 September 2013

Stage 2: 1 September 2014

Stage 3: 1 September 2016

Unless a requirement is superseded or unless otherwise specified, each requirement shall continue to apply together with the other requirements introduced at later stages.

2. Starting from 1 September 2013, special purpose products using the technologies covered by this Regulation shall comply with the information requirements set out in Annex I.

Article 4 ***Conformity assessment***

1. The conformity assessment procedure referred to in Article 8 of Directive 2009/125/EC shall be the internal design control set out in Annex IV to that Directive or the management system set out in Annex V to the same Directive.
2. For the purposes of conformity assessment pursuant to Article 8 of Directive 2009/125/EC, the technical documentation file shall:
 - (a) contain a copy of the product information provided in accordance with part 3 of Annex III to this Regulation;
 - (b) describe any additional product parameters for which limit values are set in Annex III;

- (c) provide any other information required by Annexes I, III and IV in the technical documentation file;
- (d) specify at least one realistic combination of settings and conditions in which the product complies with this Regulation.

Article 5

Verification procedure for market surveillance purposes

Member States shall apply the verification procedure described in Annex IV to this Regulation when performing the market surveillance checks referred to in Article 3(2) of Directive 2009/125/EC.

Article 6

Indicative benchmarks

The indicative benchmarks for the best-performing products and technologies available on the market at the time of adopting this Regulation are set out in Annex V.

Article 7

Revision

The Commission shall review this Regulation in the light of technological progress no later than three years after its entry into force and shall present the results of that review to the Consultation Forum.

Article 8

Entry into force

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

For the Commission

Member of the Commission

ANNEX I

Product information requirements for special purpose products

1. The chromaticity coordinates of directional lamps whose light always falls within the following range of chromaticity coordinates:

- $x < 0.270$ or $x > 0.530$

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

shall be stated in the technical documentation file drawn up for the purposes of conformity assessment in accordance with Article 8 of Directive 2009/125/EC, which shall indicate that these coordinates make them a special purpose product unsuitable for general lighting.

2. For special purpose products other than those listed in point 1, the intended purpose shall be stated in all forms of product information, together with the fact that they are not intended for use as general lighting within the meaning of this Regulation.

If the product is placed on the market in a packaging containing information to be visibly displayed prior to purchase to the end-user, the following information shall be clearly and prominently indicated on the packaging:

- (a) the intended purpose; and
- (b) that it is not suitable for household room illumination.

The technical documentation file drawn up for the purposes of conformity assessment in accordance with Article 8 of Directive 2009/125/EC shall list the technical parameters (if any) that make the product design specific for the stated intended purpose. If needed, the parameters may be listed in a way to avoid disclosing commercially sensitive information linked to the intellectual property rights of the manufacturer.

ANNEX II
Definitions for the purposes of Annexes III to V

For the purposes of Annexes III to V, the following definitions shall apply:

- (a) '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;
- (b) 'initial luminous flux' means the luminous flux of a lamp after a short ageing period;
- (c) useful luminous flux (Φ_{use}) means the part of the luminous flux of a lamp falling in the beam angle considered for the calculation of the lamp's energy efficiency in point 1.1. of Annex III;
- (d) '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;
- (e) 'beam angle' means the angle between two imaginary lines in a plane through the optical beam axis, such that these lines pass through the centre of the front face of the lamp and through points at which the luminous intensity is 50% of the centre beam intensity, where the beam intensity is the value of luminous intensity measured on the optical beam axis 1 metre from the light-emitting surface;
- (f) 'chromaticity' means the property of a colour stimulus defined by its chromaticity coordinates, or by its dominant or complementary wavelength and purity taken together;
- (g) 'correlated colour temperature' (T_c [K]) means the temperature of a Planckian (black body) radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions;
- (h) 'colour rendering' (R_a) means the effect of an illuminant on the colour appearance of objects by conscious or subconscious comparison with their colour appearance under a reference illuminant;
- (i) 'colour consistency' means the correlated colour temperature variation allowed in individual specimens of a particular lamp model compared with the rated correlated colour temperature, expressed as the size (in steps) of the MacAdam ellipse formed around a chromaticity centre point (c_x and c_y);
- (j) '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;
- (k) '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;

- (l) 'lamp lifetime' means the period of operating time after which the fraction of the total number of lamps which continue to operate corresponds to the lamp survival factor of the lamp under defined conditions and switching frequency. For LED lamps, lamp lifetime means the period of operating time during which more than 50% of the total number of lamps provide more than 70% of the rated initial luminous flux (L_x);
- (m) 'lamp start time' means the time needed, after the supply voltage is switched on, for the lamp to start fully and remain alight;
- (n) 'lamp warm-up time' means the time needed after start-up, for the lamp to emit a defined proportion of its stabilized luminous flux;
- (o) 'power factor' means the ratio of the absolute value of the active power to the apparent power under periodic conditions;
- (p) 'lamp mercury content' means the mercury contained in the lamp;
- (q) '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;
- (r) 'nominal value' means the value of a quantity used to designate and identify a product;
- (s) 'no-load mode' means the condition in which the input of the lamp control gear is connected to the mains voltage, but the output is not connected to any primary load;
- (t) 'standby mode' means a mode of lamp control gear where the lamps are switched off with the help of a control signal in normal operating conditions. It applies to lamp control gear with incorporated switching function and permanently connected to the supply voltage in normal use;
- (u) 'control signal' means an analogue or digital signal transmitted to the control gear wirelessly or via voltage modulation in separate control cables, except when the mains voltage is changed using the phase-cut technology;
- (v) 'standby power' means the input power of the control gear in the standby mode with sensors and control devices disconnected. If disconnection is not possible, then the power consumed by control devices is subtracted from the measured input power in standby mode;
- (w) 'switching cycle' means the sequence of switching the lamp on and off at set intervals;
- (x) '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;
- (y) "'anti-glare cap' means a mechanical or optical reflective or non-reflective impervious baffle designed to block direct visible radiation emitted from the

light source of a directional lamp, in order to avoid temporary partial blindness (disability glare) if viewed directly by an observer. It does not include surface coating of the light source in the directional lamp.

ANNEX III Ecodesign requirements

1. ENERGY EFFICIENCY REQUIREMENTS

1.1. Energy efficiency requirements for directional lamps

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

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

where:

P_{cor} is the rated power measured at nominal input voltage and corrected in accordance with Table 1. The correction factors are cumulative where appropriate.

Table 1: Correction factors

Scope of the correction	Corrected power (P_{cor})
Lamps operating on external halogen lamp control gear	$P_{rated} \times 1.06$
Lamps operating on external LED lamp control gear	$P_{rated} \times 1.10$
Fluorescent lamps of 16 mm diameter (T5 lamps) and 4-pin single capped fluorescent lamps operating on external fluorescent lamp control gear	$P_{rated} \times 1.10$
Other lamps operating on external fluorescent lamp control gear	$P_{rated} \times \frac{0.24\sqrt{\Phi_{use}} + 0.0103\Phi_{use}}{0.15\sqrt{\Phi_{use}} + 0.0097\Phi_{use}}$
Lamps operating on external high-intensity discharge lamp control gear	$P_{rated} \times 1.10$
Compact fluorescent lamps with colour rendering index ≥ 90	$P_{rated} \times 0.85$
Lamps with anti-glare cap	$P_{rated} \times 0.80$

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

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

For models with $\Phi_{\text{use}} \geq 1300$ lumen : $P_{\text{ref}} = 0.07341\Phi_{\text{use}}$

The useful luminous flux (Φ_{use}) is defined as follows:

- Directional lamps other than filament lamps with a beam angle $\geq 90^\circ$ and carrying a warning on their packaging in accordance with point 3.1.2(j) of this Annex : rated luminous flux in a 120° cone (Φ_{120°)
- Other directional lamps : rated luminous flux in a 90° cone (Φ_{90°)

The maximum EEI of directional lamps is indicated in Table 2.

Table 2

Application date	Maximum energy efficiency index (EEI)			
	Mains-voltage filament lamps	Other filament lamps	High-intensity discharge lamps	Other lamps
Stage 1	If $\Phi_{\text{use}} > 450$ lm : 1.75	If $\Phi_{\text{use}} \leq 450$ lm : 1.2 If $\Phi_{\text{use}} > 450$ lm : 0.95	0.5	0.5
Stage 2	1.75	0.95	0.5	0.5
Stage 3	0.95	0.95	0.36	0.2

Stage 3 for mains-voltage filament lamps shall be applicable only if evidence is produced by the time of the revision of this Regulation that there are mains-voltage lamps on the market that are

- compliant with the maximum EEI requirement in stage 3;
- affordable;
- sufficiently equivalent in terms of consumer-relevant functionality parameters to mains-voltage filament lamps available on the date of entry into force of this Regulation;
- sufficiently compatible with equipment designed for installation between the mains and filament lamps.

1.2. Energy efficiency requirements for lamp control gear

As from stage 2, the no-load mode input power of a piece of lamp control gear intended for use between the mains and the switch for turning the lamp load on/off shall not exceed 1.0 W. As from stage 3, the limit shall be 0.50 W. For pieces of lamp control gear with output power (P) over 250W, the no-load mode input power limits shall be multiplied by P/250.

As from stage 3, the standby power of a piece of lamp control gear shall not exceed 0.50 W.

As from stage 2, the efficiency of a piece of halogen lamp control gear that transforms mains voltage to extra-low voltage for halogen lamps shall be at least 0.91 at 100% load.

2. FUNCTIONALITY REQUIREMENTS

2.1. Functionality requirements for directional lamps other than LED lamps

The lamp functionality requirements are set out in Table 3 for directional compact fluorescent lamps and in Table 4 for directional lamps excluding compact fluorescent lamps, LED lamps and high-intensity discharge lamps.

Table 3 – Functionality requirements for directional compact fluorescent lamps

Functionality parameter	Stage 1 except where indicated otherwise	Stage 3
Lamp survival factor at 6000h	From stage 2: ≥ 0.50	≥ 0.70
Lumen maintenance	At 2000h : $\geq 80\%$	At 2000h: $\geq 83\%$ At 6000h: $\geq 70\%$
Number of switching cycles before failure	\geq half the lamp lifetime expressed in hours ≥ 10000 if lamp starting time $> 0.3s$	\geq lamp lifetime expressed in hours ≥ 30000 if lamp starting time $> 0.3s$
Starting time	$< 2.0s$	$< 1.5s$ if $P < 10W$ $< 1.0s$ if $P \geq 10W$
Lamp warm-up time to 60% Φ	$< 40s$ or $< 100s$ for lamps containing mercury in amalgam form	$< 40s$ or $< 100s$ for lamps containing mercury in amalgam form
Premature failure rate	$\leq 5.0\%$ at 500 h	$\leq 5.0\%$ at 1000 h
Lamp power factor	≥ 0.50 if $P < 25W$ ≥ 0.90 if $P \geq 25W$	≥ 0.55 if $P < 25W$ ≥ 0.90 if $P \geq 25W$
Colour rendering (Ra)	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications according to point 3.1.3(m) of this Annex	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications according to point 3.1.3(m) of this Annex

If the lamp cap is a standardised type also used with filament lamps, then as from stage 2, the lamp shall comply with state-of-the-art requirements for compatibility with equipment designed for installation between the mains and filament lamps.

Table 4 – Functionality requirements for directional lamps excluding LED lamps, compact fluorescent lamps and high-intensity discharge lamps

Functionality parameter	Stage 1 and 2	Stage 3
Rated lamp lifetime at 50% lamp survival	$\geq 1000\text{h}$ ($\geq 2000\text{h}$ in stage 2) $\geq 2000\text{h}$ for extra low voltage lamps not complying with the stage 3 filament lamp efficiency requirement in point 1.1 of this Annex	$\geq 2000\text{h}$ $\geq 4000\text{h}$ for extra low voltage lamps
Lumen maintenance	$\geq 80\%$ at 75% of rated average lifetime	$\geq 80\%$ at 75% of rated average lifetime
Number of switching cycles	\geq four times the rated lamp life expressed in hours	\geq four times the rated lamp life expressed in hours
Starting time	$< 0.2\text{s}$	$< 0.2\text{s}$
Lamp warm-up time to 60% Φ	$\leq 1.0\text{s}$	$\leq 1.0\text{s}$
Premature failure rate	$\leq 5.0\%$ at 100h	$\leq 5.0\%$ at 200h
Lamp power factor	Power $> 25\text{W}$: ≥ 0.9 Power $\leq 25\text{ W}$: ≥ 0.5	Power $> 25\text{W}$: ≥ 0.9 Power $\leq 25\text{ W}$: ≥ 0.5

2.2. Functionality requirements for non-directional and directional LED lamps

The lamp functionality requirements are set out in Table 5 for both non-directional and directional LED lamps.

Table 5 – Functionality requirements for non-directional and directional LED lamps

Functionality parameter	Requirement as from stage 1, except where indicated otherwise
Lamp survival factor at 6000h	From stage 2: ≥ 0.90
Lumen Maintenance at 6000h	From stage 2: ≥ 0.80
Number of switching cycles before failure	≥ 15000 if rated lamp life $\geq 30000\text{h}$ otherwise: \geq half the rated lamp life expressed in hours
Starting time	$< 0.5\text{s}$
Lamp warm-up time to 95% Φ	$< 2\text{s}$
Premature failure rate	$\leq 5.0\%$ at 1000h
Colour rendering (Ra)	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications in accordance with point 3.1.3(m) of this Annex
Colour consistency	Correlated colour temperature (CCT) spread within a six-step MacAdam ellipse or less.
Lamp power factor (PF)	$P \leq 2\text{W}$: no requirement $2\text{W} < P \leq 5\text{W}$: PF > 0.4 $5\text{W} < P \leq 25\text{W}$: PF > 0.5 $P > 25\text{W}$: PF > 0.9

If the lamp cap is a standardised type also used with filament lamps, then as from stage 2 the lamp shall comply with state-of-the-art requirements for compatibility with equipment designed for installation between the mains and filament lamps.

2.3. Functionality requirement for equipment designed for installation between the mains and the lamps

As from stage 2, equipment designed for installation between the mains and the lamps shall comply with state-of-the-art requirements for compatibility with lamps whose energy efficiency index (calculated for both directional and non-directional lamps in accordance with the method set out in point 1.1 of this Annex) is at most:

- 0.24 for non-directional lamps (assuming that $\Phi_{\text{use}} =$ total rated luminous flux)
- 0.5 for directional lamps.

The positions of a control device where the operated filament lamps do not emit visible light must correspond to positions of the control device where the operated filament lamps do not consume any power.

When a luminaire is placed on the market intended to be marketed to the end-users, and lamps that are replaceable by the end-user are included with the luminaire, the lamps shall be of the highest energy class according to Commission Delegated Regulation XXX/2012 [Numbering of the Regulation and OJ reference in footnote to be added before publication in the OJ] with which the luminaire is compatible.

3. PRODUCT INFORMATION REQUIREMENTS

3.1. Product information requirements for directional lamps

The following information shall be provided as from stage 1, except where otherwise stipulated.

3.1.1. Information to be displayed on the lamp itself

For lamps other than high-intensity discharge lamps, the value and unit ("lm", "K" and "°") of the nominal useful luminous flux, of the colour temperature and of the nominal beam angle shall be displayed in a legible font on the surface of the lamp if, after the inclusion of safety-related information such as power and voltage, there is sufficient space available for it on the lamp without unduly obstructing the light coming from the lamp.

In case there is room for only one of the three values, the nominal useful luminous flux shall be provided; if for two values, the nominal useful luminous flux and the colour temperature.

3.1.2. Information to be visibly displayed prior to purchase to end-users on the packaging and on free access websites

The information in paragraphs (a) to (o) below shall be displayed on free access websites and in any other form the manufacturer deems appropriate.

If the product is placed on the market in a packaging containing information to be visibly displayed prior to purchase to the end-user, the information shall also be clearly and prominently indicated 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 term 'energy-saving lamp' or any similar product related promotional statement about lamp efficacy may be used only if the energy efficiency index of the lamp (calculated in accordance with the method set out in point 1.1 of this Annex) is at least 0.5.

These information requirements do not apply to filament lamps not fulfilling the efficacy requirements of stage 2.

- (a) Nominal useful luminous flux displayed in a font at least twice as large as any display of the nominal lamp power;

- (b) Nominal life time of the lamp in hours (not longer than the rated life time);
- (c) Colour temperature, as a value in Kelvins and also as the light colour expressed graphically or in words;
- (d) Number of switching cycles before premature lamp failure;
- (e) Warm-up time up to 60% of the full light output (may be indicated as 'instant full light' if less than 1 second);
- (f) 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 included;
- (g) If designed for optimum use in non-standard conditions (such as ambient temperature $T_a \neq 25^\circ\text{C}$ or specific thermal management is necessary), information on those conditions;
- (h) Lamp dimensions in millimeters (length and rim diameter);
- (i) Nominal beam angle in degrees;
- (j) If the lamp's beam angle is $\geq 90^\circ$ and its useful luminous flux as defined in point 1.1 of this Annex is to be measured in a 120° cone, a warning that the lamp is not suitable for accent lighting;
- (k) If the lamp cap is a standardised 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, a drawing comparing the lamp's dimensions to the dimensions of the filament lamp(s) it replaces;
- (l) An indication that the lamp is of a type listed in the first column of Table 6 may be displayed only if the luminous flux of the lamp in a 90° cone (Φ_{90°) is not lower than the reference luminous flux indicated in Table 6 for the smallest wattage among the lamps of the type concerned, multiplied by the maintenance correction factor in Table 7 for all lamps and by the beam correction factor in Table 8 for LED lamps;
- (m) An equivalence claim involving the power of a replaced lamp type may be displayed only if the lamp type is listed in Table 6 and if the luminous flux of the lamp in a 90° cone (Φ_{90°) is not lower than the corresponding reference luminous flux in Table 6 multiplied by the maintenance correction factor in Table 7 for all lamps and by the beam correction factor in Table 8 for LED lamps. The intermediate values of both the luminous flux and the claimed lamp power (rounded to 1 W) shall be calculated by linear interpolation between the two adjacent values;

Table 6 – Reference luminous flux for equivalence claims

Extra-low voltage reflector type		
Type	Power (W)	Reference Φ_{90° (lm)
MR11 GU4	20	200
	35	400
MR16 GU 5.3	20	200
	35	385
	50	600
AR111	35	350
	50	550
	75	800
	100	1050

Mains-voltage blown glass reflector type		
Type	Power (W)	Reference Φ_{90° (lm)
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	1000

Mains-voltage pressed glass reflector type		
Type	Power (W)	Reference Φ_{90° (lm)
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 7 – Multiplication factors for lumen maintenance

Lamp type	Luminous flux multiplication factor
Halogen lamps	1
Compact fluorescent lamps	1.08
LED lamps	$1 + \frac{0.5 \times (100 - LLMF)}{100}$ where LLMF is the lumen maintenance factor at the end of the nominal life

Table 8 – Multiplication factors for LED lamps

LED lamp beam angle	Luminous flux multiplication factor
$15^\circ \leq \text{beam angle} < 20^\circ$	0.9
$10^\circ \leq \text{beam angle} < 15^\circ$	0.85
beam angle $< 10^\circ$	0.80

If the lamp contains mercury:

- (n) Lamp mercury content as X.X mg;
- (o) Indication of which website to consult in case of accidental lamp breakage to find instructions on how to clean up the lamp debris.

3.1.3. Information to be made publicly available on free-access websites and in any other form the manufacturer deems appropriate

As a minimum, the following information shall be expressed at least as values.

- (a) The information specified in point 3.1.2;
- (b) Rated wattage (0.1 W precision);
- (c) Rated luminous flux;
- (d) Rated lamp life time;
- (e) Lamp power factor;
- (f) Lumen maintenance factor at the end of the nominal life;
- (g) Starting time (as X.X seconds);
- (h) Colour rendering;
- (i) Colour consistency;

- (j) Rated peak intensity in candela (cd);
- (k) Rated beam angle;
- (l) In the case of LED lamps where the chromaticity coordinates of the light can be regulated by the user, an indication of how to program the lamp to the colour setting at which it achieves the performance values claimed in the product information.
- (m) If intended for use in outdoor or industrial applications, an indication to this effect;

If the lamp contains mercury:

- (n) Instructions on how to clean up the lamp debris in case of accidental lamp breakage;
- (o) Recommendations on how to dispose of the lamp at the end of its life.

3.2. Additional product information requirements for LED lamps replacing fluorescent lamps without integrated ballast

In addition to the product information requirements according to point 3.1 of this Annex or point 3.1 of Annex II to Regulation 244/2009, as from stage 1, manufacturers of LED lamps replacing fluorescent lamps without integrated ballast shall publish a warning on publicly available free-access websites and in any other form they deem appropriate that the overall energy efficiency and light distribution of any installation that uses such lamps is determined by the design of the installation.

Claims that an LED lamp replaces a fluorescent lamp without integrated ballast of a particular wattage may be made only if:

- the luminous intensity in any direction around the tube axis does not deviate by more than 25% from the average luminous intensity around the tube, and
- the luminous flux of the LED lamp is not lower than the luminous flux of the fluorescent lamps of the claimed wattage obtained by multiplying the claimed wattage with the minimum luminous efficacy values corresponding to the fluorescent lamp in Commission Regulation 245/2009, and
- the wattage of the LED lamp is not higher than the wattage of the fluorescent lamp it is claimed to replace.

3.3. Product information requirements for equipment other than luminaires designed for installation between the mains and the lamps

As from stage 2, if the equipment provides no compatibility with any of the energy-saving lamps according to part 2.3 of this Annex, a warning that the equipment is not compatible with energy-saving lamps shall be published on publicly available free-access websites and in other forms the manufacturer deems appropriate.

ANNEX IV

Verification procedure for market surveillance purposes

When performing the market surveillance checks referred to in Article 3(2) of Directive 2009/125/EC, the Member States' authorities shall apply the verification procedures listed in this Annex. The market surveillance authorities shall provide the information of the testing results to other Member States and to the Commission.

Member State authorities shall use reliable, accurate and reproducible measurement procedures, which take into account the generally recognised state-of-the-art measurement methods, including methods set out in documents whose reference numbers have been published for that purpose in the Official Journal of the European Union.

1. VERIFICATION PROCEDURE FOR LAMPS OTHER THAN LED LAMPS AND FOR LED LAMPS THAT ARE MEANT TO BE REPLACED IN THE LUMINAIRE BY THE END-USER

Member States' authorities shall test a sample 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 9.

The model shall be considered to comply with the requirements laid down in this Regulation if:

- (a) the lamps in the batch are accompanied by the required and correct product information, and
- (b) the lamps in the batch are found to comply with the compatibility provisions of points 2.1 and 2.2 of Annex III, applying state-of-the-art methods and criteria for assessing compatibility, including those set out in documents whose reference numbers have been published for that purpose in the Official Journal of the European Union, and
- (c) testing of the parameters of the lamps in the batch listed in Table 9 shows no non-compliance for any of the parameters.

Table 9

Parameter	Procedure
Lamp survival after 6000h (for LED lamps only)	<p>The test ends</p> <ul style="list-style-type: none">• when the required number of hours is met, or• when more than two lamps fail, <p>whichever occurs first.</p> <p>In order to comply, only two out of every 20 lamps in the test batch may fail before the required number of hours.</p>

Parameter	Procedure
Number of switching cycles before failure	<p>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.</p> <p>If, after the required number of switching cycles is reached, at least 19 of every 20 lamps in the batch have no failure, the model shall be considered to comply. Otherwise it shall be considered not to comply.</p>
Starting time	The average starting time of the batch is allowed to vary 10% from the required starting time. No lamp in the sample batch is allowed to have a starting time longer than two times the required starting time.
Lamp warm-up time to 60 % Φ	The average warm-up time of the batch is allowed to vary 10% from the required warm-up time. No lamp in the sample batch is allowed to have a warm-up time that exceeds the required warm-up time multiplied by 1.5.
Premature failure rate	<p>The test ends</p> <ul style="list-style-type: none"> • when the required number of hours is met, or • when more than one lamp fails, <p>whichever occurs first.</p> <p>In order to comply, only one out of every 20 lamps in the test batch (i.e. 5%) may fail before the required number of hours.</p>
Colour rendering (Ra)	The average Ra of the lamps in the test batch is allowed to be three points below the required value. For no single lamp may the Ra be more than 3.9 points below the required value.
Lumen maintenance at end of life and rated lifetime (for LED lamps only)	The batch shall be considered to comply if the lumen maintenance at end of life and the lifetime values obtained by extrapolation from the lamp survival factor and average lumen maintenance of the batch at 6000h do not vary by more than 10% from the lumen maintenance and rated lifetime declared in the product information. 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.
Equivalence claims for retrofit lamps according to points 3.1.2(l) and (m) of Annex III	If only the equivalence claim is verified for compliance, it is sufficient to test 10 lamps, where possible obtained in equal proportion from four randomly selected sources.
Beam angle	The model is considered to comply if the average results of the batch do not vary from the declared beam angle by more than 25%. For LED lamps, the beam angle value of each individual LED lamp in the measured sample shall not deviate by more than 25% of the rated value.

Parameter	Procedure
Peak intensity	For LED lamps, the model is considered to comply if the peak intensity of each individual LED lamp in the measured sample is not less than 75% of the rated intensity.
Other parameters	The model is considered to comply if the average results of the batch do not vary from the limit, threshold or declared values by more than 10%.

Otherwise, the model shall be considered not to comply.

2. VERIFICATION PROCEDURE FOR LED LAMPS OR LED MODULES THAT ARE NOT MEANT TO BE REPLACED IN THE LUMINAIRE BY THE END-USER

Member States' authorities shall apply the following procedure in the order given below, until they are able to test or they conclude that testing is impossible ("luminaire" refers to the luminaire containing the LED modules or LED lamps, and "testing" refers to the procedure described in part 1 of this Annex):

- (1) If the technical documentation file of the luminaire provides for testing the whole luminaire as a lamp, the authorities shall test 20 luminaires as lamps.
- (2) If the technical documentation file of the luminaire allows for the removal of the LED module(s) for testing, the authorities shall follow the instructions of the technical documentation file to dismantle enough luminaires to obtain 20 copies of each incorporated LED lamp or LED module model, and test them.
- (3) The authorities shall determine the identity of the manufacturer or importer of the LED modules or LED lamps contained in the luminaire.
 - If the luminaire manufacturer obtained the incorporated LED lamps or LED modules as individual CE marked products from the Union market, the authorities shall obtain 20 copies of each model from the Union market for testing. If the models are not available any more on the Union market, market surveillance cannot be performed.
 - If the luminaire manufacturer produced the incorporated LED lamps or LED modules himself or imported them to the Union, the authorities shall request the luminaire manufacturer to provide 20 copies of each incorporated model for testing. The deadline for fulfilling the request shall provide sufficient time for the luminaire manufacturer to import the copies if applicable. However, the authorities cannot oblige the manufacturer to fulfil the request beyond 1 year after the first making available on the market of the examined luminaire to final owners, or if the manufacturer fulfilled at least two other such requests in the past for the same LED lamp or LED module model.

- (4) If the LED light sources cannot be all distinguished as LED lamps or LED modules in the luminaire, or if the identity of their manufacturer cannot be determined, or if they were never available as individual CE marked products on the Union market and the luminaire manufacturer does not provide 20 copies each model, the authorities shall test 20 luminaires as lamps.

3. VERIFICATION PROCEDURE FOR EQUIPMENT DESIGNED FOR INSTALLATION BETWEEN THE MAINS AND THE LAMPS

Member State authorities shall test one single unit.

The equipment shall be considered to comply with the requirements laid down in this Regulation if it is found to comply with the compatibility provisions of point 2.3 of Annex III, applying state-of-the-art methods and criteria for assessing compatibility, including those set out in documents whose reference numbers have been published for that purpose in the Official Journal of the European Union. If non-compatibility is concluded, the model shall still be considered to comply if it fulfils the product information requirements in point 3.3 of Annex III.

In addition to the compatibility requirements, lamp control gear shall also be tested for the efficiency requirements in point 1.2 of Annex III. The test shall be carried out on a single piece of lamp control gear, not on a combination of several pieces of lamp control gear, even if the model is designed to rely on other pieces of lamp control gear to operate the lamp(s) in a given installation. The model shall be considered to comply with the requirements if the results do not vary from the limit values by more than 2.5%. If the results vary from the limit values by more than 2.5%, three more units shall be tested. The model shall be considered to comply with the requirements if the average of the results of the subsequent three tests does not vary from the limit values by more than 2.5%.

In addition to the compatibility requirements, luminaires intended to be marketed to end-users shall also be checked for the presence of lamps in their packaging. The model shall be considered to comply if no lamps are present or if the lamps that are present are of the energy classes required in point 2.3 of Annex III.

In addition to the compatibility requirements, control devices designed to operate filament lamps shall be tested to determine the power consumed by the filament lamps they operate when the control device is in positions where the lamps do not emit any light. The model shall be considered to comply if the filament lamps do not consume any power in the examined positions of the model.

If the model does not fulfil the applicable compliance criteria referred to above, it shall be considered not to comply.

ANNEX V

Indicative benchmarks referred to in Article 6

The best available technology on the market, at the time of entry into force of this Regulation, for the environmental aspects that were considered significant and are quantifiable is indicated below. Features required in certain applications (such as high colour rendering) could prevent products offering those features from achieving these benchmarks.

4. DIRECTIONAL LAMP EFFICIENCY

The most efficient lamp had an energy efficiency index of 0.16.

5. LAMP MERCURY CONTENT

There are lamp types that contain no mercury, but are among the most energy efficient.

6. HALOGEN LAMP CONTROL GEAR EFFICIENCY

The most efficient halogen lamp control gear had an efficiency of 0.93.