

Working Document on a Draft

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

[green highlight in the recitals indicates text taken from existing ecodesign implementing measures, only slightly adapted to the directional lamps measure]

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) Under Directive 2009/125/EC ecodesign requirements should be set by the Commission for energy-related products representing significant volumes of sales and trade, having significant environmental impact and presenting significant potential for improvement through design in terms of their environmental impact, without entailing excessive costs.
- (2) Point a) of Article 16(2) 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 shall, 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 EU and third countries, and the results have been made publicly available.

¹ OJ L 285, 31.10.2009, p. 10.

- (4) Mandatory ecodesign requirements apply to products placed on the Community 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).
- (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 within that space. Special purpose 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 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 are identified as significant for the purposes of this Regulation are energy in the use phase as well as mercury content and mercury emissions.
- (8) Mercury emitted in the different life cycle phases of the lamps, including from use-phase electricity generation and from the 80% of directional compact fluorescent lamps containing mercury which are presumed not to be recycled at the end of life, has been estimated to be 0.7 tons in 2007 from the installed stock of lamps. Without taking specific measures, the mercury emissions of the installed lamp stock is predicted to increase to 0.9 tons in 2020 while it has been demonstrated that it 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 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment .
- (10) The setting of energy efficiency requirements for lamps subject to this Regulation will lead to a decrease of the overall mercury emissions.
- (11) Article 10 paragraph 1 point (d) of the Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on Waste Electrical and Electronic Equipment should be fully implemented to ensure minimising the potential risks for the environment and for human health in case of accidental breakage of compact fluorescent lamps or at their end of life.
- (12) Commission Regulation 278/2009 set ecodesign requirements for external power supplies but specifically excluded halogen lamp control gear from the scope, even though the preparatory study had analysed them and found a cost-effective improvement potential. It was understood that halogen lamp control gear would be covered in a later ecodesign implementing measure targeting lighting products.
- (13) Improvements of electricity consumption of products subject to this Regulation should be achieved by applying existing non-proprietary cost effective technologies, which

lead to a reduction of the combined expenses for purchasing and operating the equipment.

- (14) Ecodesign requirements for products subject to this Regulation should be set with a view to improving the environmental performance of the products affected, contributing to the functioning of the internal market and to the Community objective of reducing energy consumption by 20% in 2020 compared with the assumed energy consumption in that year if no measures are implemented.
- (15) The combined effect of ecodesign requirements set out in this Regulation and Commission delegated Regulation supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of general lighting lamps is expected to result in annual electricity savings of 25 TWh by 2020, compared to the situation if no measures are taken.
- (16) 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 over-compensate potential, if any, additional environmental impacts 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 to directional lamps, but also to non-directional LEDs, as they were exempted from functionality requirements in Regulation 244/2009. Product information requirements should allow consumers to make informed choices.
- (17) Integral LED luminaires from which no LED lamp or module can be extracted for independent testing should not constitute a method for LED manufacturers to escape the requirements of this Regulation.
- (18) 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 through 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 the matching lamps and equipment.
- (19) A staged entry into force of the ecodesign requirements should provide a sufficient timeframe for manufacturers to re-design products subject to this Regulation as appropriate. The timing of the stages should be set in such a way that negative impacts related to functionalities of equipment on the market are avoided, and cost impacts for end-users and manufacturers, in particular small and medium enterprises, are taken into account, while ensuring timely achievement of the objectives of this Regulation.
- (20) 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 98/48/EC of the European Parliament and of the Council of 20

July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations².

- (21) In accordance with Article 8 of Directive 2009/125/EC, this Regulation should specify the applicable conformity assessment procedures. .
- (22) In order to facilitate compliance checks, manufacturers should provide information in the technical documentation referred to in Annexes V and VI of Directive 2009/125/EC in so far as this information relates to the requirements laid down in this Regulation.
- (23) In addition to the legally binding requirements laid down in this Regulation, indicative benchmarks for best available technologies should be identified to ensure the wide availability and easy accessibility of information on the life-cycle environmental performance of products subject to this Regulation.
- (24) A review of this measure should take particular note of the evolution of sales of special purpose lamp types so as to verify that they are not used for general lighting purposes, of the development of new technologies such as LEDs, and of the feasibility of establishing energy efficiency requirements at the "A" class level as defined in the Commission delegated Regulation supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of general lighting lamps, or at least at the "B" class level for directional mains voltage halogen lamps.
- (25) 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:

Chapter 1 *Subject matter and scope*

This Regulation establishes ecodesign requirements for the placing on the market of the following general lighting electric products, including when they are marketed for non-general lighting use or when they are integrated into other 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 and luminaires (other than ballasts and luminaires for fluorescent and high-intensity discharge lamps).

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.

² OJ L 217, 05.08.1998, p. 18.

Chapter 2 Definitions

For the purposes of this Regulation, the definitions set out in Directive 2009/125/EC shall apply.

The following definitions shall also apply:

[Text in grey highlight shows definitions that are shared with the draft lamp energy labelling regulation. Any changes should be checked for implementation in the other regulation too.]

- (1) "general lighting" means 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;
- (2) "general lighting product" means a product intended for use in general lighting; it does not include special purpose products;
- (3) "special purpose product" means a lighting product that uses the technologies covered by this Regulation but is not intended for use in general lighting, where the technical characteristics required for the product's special purpose are absent from the general lighting products that comply with the requirements of this Regulation applicable from Stage 3;
- (4) "light source" means a surface or object emitting usually visible optical radiation produced by a transformation of energy;
- (5) "lamp" means a unit consisting of one or several 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 the distribution, filtering or transformation of the optical radiation, in case those components cannot be removed without permanently damaging the unit;
- (6) "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, in most cases, also serves to retain the lamp in the lamp holder;
- (7) "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;
- (8) "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°);
- (9) "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 or may not contain gases influencing the process of incandescence;
- (10) "incandescent lamp" means a filament lamp in which the filament operates in an evacuated bulb or is surrounded by inert gas;

- (11) "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. Tungsten halogen lamps are supplied either with or without integrated power supply;
- (12) "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;
- (13) "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;
- (14) "fluorescent lamp without integrated ballast" means a single or double capped fluorescent lamp without integrated ballast;
- (15) "high intensity discharge lamp" 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 centimetre;
- (16) "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;
- (17) "LED package" means an assembly of one more LED(s), possibly with optical element and thermal, mechanical and electrical interfaces;
- (18) "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;
- (19) "LED lamp" means a lamp incorporating one or more LED modules, which may be equipped with a cap;
- (20) "lamp control gear" means one or more components between the electrical supply and one or more lamps which may serve to transform the supply voltage, limit the current of the lamp(s) to the required value, provide starting voltage and preheating current, prevent cold starting, correct power factor, reduce radio interference, and to provide any other functionality related to the operation of the lamp(s);
- (21) "external lamp control gear" means 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;
- (22) '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;
- (23) "halogen lamp control gear" means lamp control gear that transforms mains voltage to extra low voltage for halogen lamps;

- (24) "compact fluorescent lamp" means a fluorescent lamp that includes all the components necessary for starting and stable operation of the lamp;
- (25) "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.

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

Chapter 3 ***Ecodesign requirements***

- (1) The general lighting products listed in Chapter 1 shall meet the ecodesign requirements set out in Annex II.

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 this is otherwise specified, it 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.

Chapter 4 ***Conformity assessment***

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 of that Directive or the management system set out in Annex V of that Directive.

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 Annex III point 3 of this Regulation;
- (b) describe any additional product parameters for which limit values are set in Annex III;
- (c) provide any other information requested in Annexes I, III and IV to be present in the technical documentation file.

Chapter 5
Verification procedure for market surveillance purposes

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

Chapter 6
Indicative benchmarks

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

Chapter 7
Revision

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

Chapter 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. Directional lamps whose light always falls within the following range of chromaticity coordinates x and y :

- $x < 0.270$ 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 state their chromaticity coordinates in the technical documentation file drawn up for the purposes of conformity assessment pursuant to Article 8 of Directive 2009/125/EC, and 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 general lighting use within the meaning of this Regulation. The technical documentation file drawn up for the purposes of conformity assessment pursuant to Article 8 of Directive 2009/125/EC shall list the technical parameters that make the product design specific for the stated intended purpose.

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.

ANNEX II
Definitions for the purposes of Annexes III to V

- (a) "luminous flux" (Φ) means the quantity derived from radiant flux (radiant power) by evaluating the radiation according to the spectral sensitivity of the human eye;
- (b) "average luminous flux" (Φ_{ave}) means the luminous flux of a lamp averaged over its lifetime taking into account the lamp lumen maintenance factor at the end of the lifetime;
- (c) "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;
- (d) "beam angle" is 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 meter from the light emitting surface;
- (e) "chromaticity" means the property of a colour stimulus defined by its chromaticity coordinates, or by its dominant or complementary wavelength and purity taken together;
- (f) "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;
- (g) "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;
- (h) "colour consistency" means the correlated colour temperature variation allowed in individual copies of a particular lamp model compared to the rated correlated colour temperature, expressed as the size (in steps) of the MacAdam ellipse formed around the rated correlated colour temperature by the individual measured colour temperatures;
- (i) "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;
- (j) "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;
- (k) "lamp lifetime" means the period of operation 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 (L_x, F_x) means the period of operation time during which a given fraction of the total number of lamps (F_x) provide more than a pre-defined percentage of the rated luminous flux (L_x);

- (l) "lamp start time" means the time needed, after the supply voltage is switched on, for the lamp to start fully and remain alight;
- (m) "lamp warm-up time" means the time needed for the lamp after start-up to emit a defined proportion of its stabilized luminous flux;
- (n) "power factor" means the ratio of the absolute value of the active power to the apparent power under periodic conditions;
- (o) "lamp mercury content" means the mercury contained in the lamp;
- (p) "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;
- (q) "nominal value" means the value of a quantity used to designate and identify a product;
- (r) "no-load mode" means the condition in which the input of the lamp control gear is connected to the mains power source, but the output is not connected to any primary load;
- (s) "standby mode" means a mode of the control gear connected to the mains voltage, where the lamp(s) are switched off with the help of a control signal;
- (t) "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;
- (u) "standby power" means the input power of the control gear in the standby mode with sensors and control devices disconnected;
- (v) "switching cycle" means the sequence of switching on and switching off the lamp with defined intervals;
- (w) "premature failure" means when a lamp reaches its end of life after a period in operation which is less than the rated life time stated in the technical documentation;
- (x) "accent lighting" means a form of general lighting where light is directed so as to emphasize an object or a part of an area;
- (y) "anti-glare cap" means a mechanical or optical non-reflective and impervious baffle designed to block direct visible radiation emitted from the light source of a reflector lamp, to avoid temporary partial blindness (disability glare) if viewed directly by an observer.

ANNEX III
Ecodesign requirements

In the case of LED lamps where the chromaticity coordinates of the light can be regulated by the user, the technical documentation file within the meaning of Chapter 4 shall indicate how to program the lamp to the setting in which it complies with the requirements of this Annex.

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 according to 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	$P_{rated} \times 1.20$
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}) according to the following formula:

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

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

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

- Directional lamps with a beam angle $\geq 90^\circ$ and carrying a warning on their packaging according to paragraph (k) of point 3.1.2 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 provided in Table 2.

Table 2

Application date	Maximum Energy Efficiency Index (EEI)		
	Mains voltage filament lamps	Other filament lamps	Lamps other than filament lamps
Stage 1	If $\Phi_{\text{use}} > 450 \text{ lm}$: 1.75	If $\Phi_{\text{use}} \leq 450 \text{ lm}$: 1.2 If $\Phi_{\text{use}} > 450 \text{ lm}$: 0.95	0.5
Stage 2	1.75	0.95	0.5
Stage 3	0.95	0.95	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;
- at least equivalent in functionality parameters to mains voltage filament lamps available at 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

From Stage 2, the no-load mode input power of lamp control gear intended for applications where the switch for turning the lamp load on/off is on the output circuit of the control gear shall not exceed 1 W. From Stage 3, the limit shall be 0.5 W.

From Stage 2, the standby power of controllable and dimmable control gear shall not exceed 1 W. From Stage 3, the limit shall be 0.5 W.

From Stage 2, the efficiency 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.

Where the rated lamp lifetime is higher than 2000h, the Stage 1 requirements for the parameters "Rated lamp lifetime", "Lamp Survival Factor" and "Lumen maintenance" in Tables 5 and 6 are only applicable as from Stage 2.

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 3 – Functionality requirements for directional compact fluorescent lamps

Functionality parameter	Stage 1	Stage 3
Lamp Survival Factor at 6000h	≥ 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	$\leq 2.0\%$ at 200h	$\leq 2.0\%$ at 400h
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 paragraph (l) of Annex 3.1.2.	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications according to paragraph (l) of Annex 3.1.2.

If the lamp cap is a standardised type also used with filament lamps, then from Stage 2, the lamp shall be as much as possible compatible 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	Stage 3
Rated lamp lifetime at 50% lamp survival	$\geq 1000\text{h}$ $\geq 2000\text{h}$ for extra low voltage lamps not complying with the Stage 3 filament lamp efficiency requirement in point 1.1	$\geq 2000\text{h}$ $\geq 4000\text{h}$ for extra low voltage lamps
Lumen maintenance	$\geq 85\%$ at 75% of rated average lifetime	$\geq 85\%$ 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	≥ 0.95	≥ 0.95

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.

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

Functionality parameter	Requirement from Stage 1
Lamp Survival Factor at 6000h	≥ 0.90
Lumen Maintenance at 6000h	≥ 0.80
Number of switching cycles before failure	≥ 7500 ≥ 5000 if the lamp cap is a standardised type also used with filament lamps
Starting time	$< 0.5s$
Lamp warm-up time to 95% Φ	$< 2s$
Premature failure rate	$\leq 2.0\%$ at 1000h
Colour rendering (Ra)	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications according to paragraph (l) of Annex 3.1.2.
Colour consistency	Correlated Colour Temperature (CCT) spread within a 6-step MacAdam ellipse or less.
Lamp power factor (PF)	$P \leq 2W$: no requirement $2W < P \leq 5W$: PF > 0.4 $5W < P \leq 25W$: PF > 0.5 $P > 25W$: PF > 0.9

If the lamp cap is a standardised type also used with filament lamps, then from Stage 2, the lamp shall be as much as possible compatible 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

From Stage 2, equipment designed for installation between the mains and the lamps shall be as much as possible compatible with lamps whose Energy Efficiency Index according to part 1.1 of this Annex is at most:

- 0.24 for non-directional lamps (assuming that $\Phi_{use} = \Phi$ in 360°)
- 0.5 for directional lamps.

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

The nominal useful luminous flux and the nominal beam angle shall be provided in a legible font on the surface of the lamp.

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

The following information 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 be specified using the exact wording of the list below. It may be displayed using graphs, drawings or symbols rather than text.

The term "energy saving lamp" or any similar product related promotional statement about lamp efficacy may only be used if the lamp complies with the efficacy requirements applicable to filament lamps in Stage 3 according to Tables 1, 2 and 3.

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 the nominal lamp power;
- (b) Nominal lamp power;
- (c) Nominal life time of the lamp in hours (not higher than the rated life time);
- (d) Colour temperature, also expressed as a value in Kelvins, and if the value is higher than 3200K, illustrated by a drawing that includes or consists of a snow flake;
- (e) Number of switching cycles before premature lamp failure;
- (f) Warm-up time up to 60% of the full light output (may be indicated as "instant full light" if less than 1 second);
- (g) A warning if the lamp cannot be dimmed or can be dimmed only on specific dimmers;

- (h) If designed for optimal use in non-standard conditions (such as ambient temperature $T_a \neq 25 \text{ }^\circ\text{C}$ or specific thermal management is necessary), information on those conditions;
- (i) Lamp dimensions in millimeters (length and rim diameter);
- (j) Nominal beam angle in degrees;
- (k) If the lamp's beam angle is $\geq 90^\circ$ and its useful luminous flux according to 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;
- (l) If intended for use in outdoor or industrial applications, an indication to this effect;
- (m) If the lamp cap is a standardised type also used with filament lamps, but any of the lamp's dimensions exceed the maximum standard dimensions of a filament lamp, a drawing comparing the lamp's dimensions to the standard dimensions of a filament lamp;
- (n) An indication that the lamp is of a type listed in the first column of Table 6 may be displayed only if the average luminous flux in a 90° cone ($\Phi_{\text{ave}90^\circ}$) of the lamp is not lower than the luminous flux indicated in Table 6 for the smallest wattage among the lamps of the referred type;
- (o) An equivalence claim involving the power of a replaced lamp type may be displayed only if the average luminous flux in a 90° cone ($\Phi_{\text{ave}90^\circ}$) of the lamp is not lower than the corresponding luminous flux in Table 6;

Table 6

Extra Low Voltage Reflector type		
Type reference	Power (W)	$\Phi_{\text{ave}90^\circ}$ (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 reference	Power (W)	Φ_{ave90° (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 reference	Power (W)	Φ_{ave90° (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

For narrow beam LED lamps, the luminous flux requirement in Table 6 shall be multiplied by a factor according to Table 7:

Table 7

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:

- (p) Lamp mercury content as X.X mg;
- (q) Indication 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 how to program the lamp to the setting in which it achieves the performance values claimed in the product information.

If the lamp contains mercury:

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

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

From Stage 1, manufacturers of LED lamps replacing fluorescent lamps without integrated ballast shall warn on publicly available free-access websites and in any other form they deem appropriate that the overall energy efficiency of any installation that use such lamps is determined by the design of the installation.

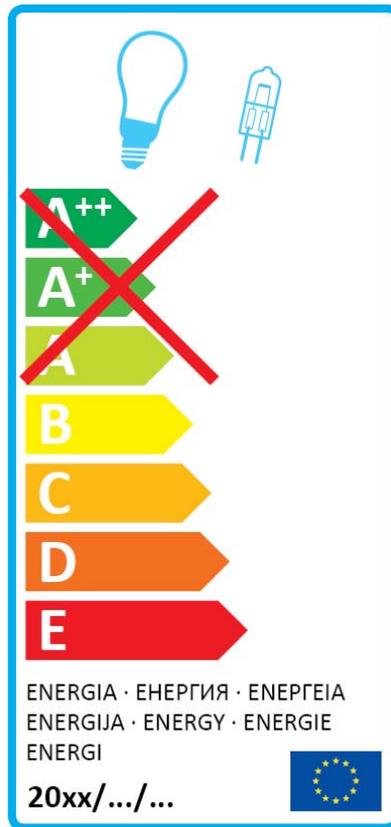
A claim that an LED lamp replaces a fluorescent lamp without integrated ballast of a particular wattage can only be made if:

- the LED lamp emits light in equal distribution in the 360° 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 according to Commission Regulation 245/2009, and
- the wattage of the LED lamp is not higher than the wattage of the fluorescent lamp it claims to replace.

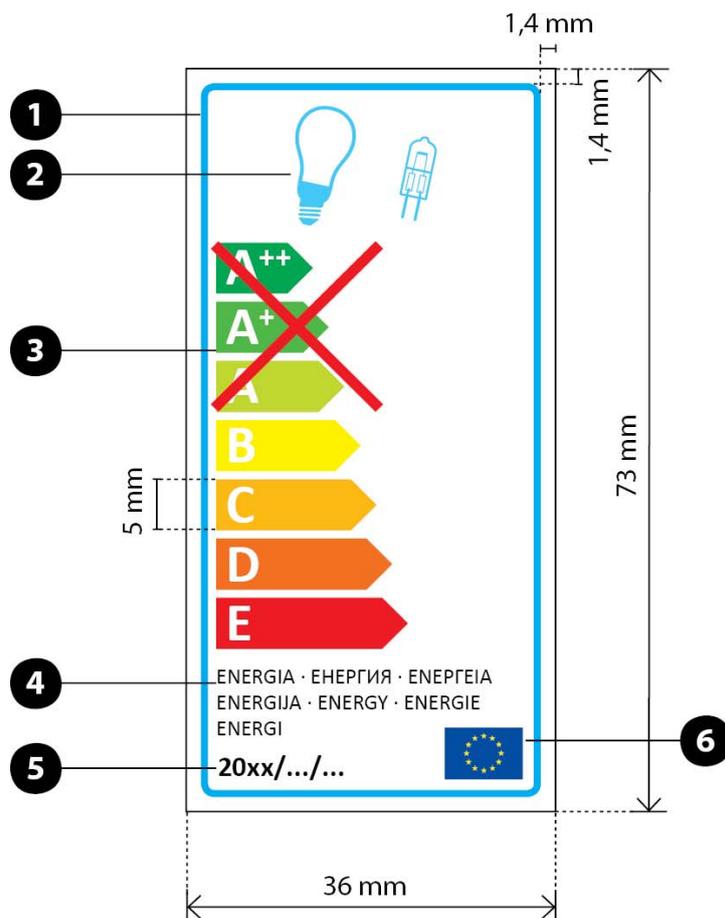
3.3. Product information requirements for equipment designed for installation between the mains and the lamps

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 may not be compatible with energy saving lamps shall be published on publicly available free-access websites and in other forms the manufacturer deems appropriate.

In addition to this warning, if the equipment is intended for display prior to purchase to the end-user, the following drawing shall be included on a fiche that is physically attached to a part of the equipment itself where it would be likely to be visible if the equipment was placed on display in a shop without its packaging:



The fiche shall be attached in a non-permanent way which ensures that the user putting the equipment into service is likely to remove it. The drawing shall be displayed also on the packaging of the equipment, in which case the following black and white version may be used if the packaging has no colour print otherwise.



Whereby:

- (a) The minimum dimensions of the icon shall be 73 mm x 36 mm;
- (b) The background shall be white for the colour version of the label. If the ‘black on white’ version of the label is used, the printing and background may be in any colours that preserve the legibility of the label;
- (c) For the colour version of the label, colours shall be CMYK — cyan, magenta, yellow and black, following this example: 00-70-X-00: 0% cyan, 70% magenta, 100% yellow, 0% black;
- (d) The label shall fulfil all of the following requirements (numbers refer to the figure above, colour specifications apply only to the colour version of the label):
 - ❶ **EU logo** – colours: X-80-00-00 and 00-00-X-00.

② **Bulbs :**

- **Pictograms as depicted.**

③ **A-G scale**

- **Arrow:** height: 5 mm, gap: 0.8 mm – colours:

Highest class: X-00-X-00,

Second class: 70-00-X-00,

Third class: 30-00-X-00,

Fourth class: 00-00-X-00,

Fifth class: 00-30-X-00,

Sixth class: 00-70-X-00,

Last class: 00-X-X-00.

- **Text:** Calibri bold 15 pt, capitals and white; '+' symbols: Calibri bold 15 pt, Superscript, white, aligned on a single row.

- **Red cross :** 00-X-X-00, border: 3 pt

④ **Energy:**

- **Text:** Calibri regular 8 pt, capitals, 100% black.

⑤ **Numbering of the Regulation:** Calibri bold 8 pt, 100% black.

⑥ **EU logo** – colours: X-80-00-00 and 00-00-X-00.

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 authorities of the Member States shall apply the following verification procedures.

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 the reference numbers of which 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 State authorities shall test a sample batch of minimum twenty lamps of the same model from the same manufacturer, randomly selected.

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

- (a) the lamps are accompanied by the required and correct product information, and
- (b) they comply with the compatibility provisions of documents that provide compliance with the compatibility requirements of Annex III.2.1 and 2.2 and the reference numbers of which have been published for that purpose in the Official Journal of the European Union, and
- (c) testing the parameters listed in Table 8 does not show non-compliance.

Table 8

Parameter	Procedure and maximum measurement tolerance
90 % lamp survival after 6000h	<p>The test ends</p> <ul style="list-style-type: none">• when the required number of hours is met, or• when more than 2 lamps fail, <p>whichever occurs first.</p> <p>In order to comply, only 2 out of every 20 lamps in the test batch may fail before the required number of hours.</p>

Parameter	Procedure and maximum measurement tolerance
Number of switching cycles before failure	<p>The test shall end when the required number of switching cycles is reached, or when more than 2 out of every 20 lamps in the test batch have reached their end of 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 higher than 2 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 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 1 lamp fails, <p>whichever occurs first.</p> <p>In order to comply, only 1 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 3 points below the required value. For no single lamp the Ra is allowed to be more than 3.9 points below the required value.
Lumen Maintenance at end of life and rated lifetime	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%.
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 MODULES THAT ARE NOT MEANT TO BE REPLACED IN THE LUMINAIRE BY THE END-USER

Member State authorities shall request from the manufacturer of the luminaire containing the lamp(s) or module(s) the identity of the manufacturer(s) who placed on the EU market the

LED lamp(s) or module(s) integrated into the luminaire. They shall then obtain 20 copies of each LED lamp or module for testing according to part 1 above.

If not all the LED light sources integrated into the luminaire can be obtained separately as testable lamps or modules, then the whole luminaire shall be tested. In that case, Member State authorities shall test one single luminaire as a lamp.

The model shall be considered to comply if the unit(s) fulfil(s) the criteria of part 1 of this Annex, with the following changes:

- no compliance needs to be checked under paragraph (b) of part 1 of this Annex;
- the lifetime-related tests shall stop at the failure of the tested single sample.

Otherwise, three more luminaires shall be tested.

The model shall be considered to comply if the units fulfil the criteria of part 1 of this Annex, with the following changes:

- no compliance needs to be checked under paragraph (b) of part 1 of this Annex;
- the lifetime-related tests shall stop at the failure of the first tested sample;
- the averages are established on the basis of the performance of the three units.

Otherwise, the model shall be considered not to comply.

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 complies with the compatibility provisions of documents that provide compliance with the compatibility requirements of Annex III.2.3 and the reference numbers of which have been published for that purpose in the Official Journal of the European Union. Further units shall be tested in case the referenced documents require it after finding non-compliance of the first tested unit. In case non-compatibility is concluded, the model shall be still considered to comply if it is accompanied by the product information required in Annex III.3.3.

In addition to the compatibility requirements, halogen lamp control gear shall be tested also for the efficiency requirements of Annex III.1.2. 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 latter three tests does not vary from the limit values by more than 2.5%.

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

4. VERIFICATION PROCEDURE FOR SPECIAL PURPOSE PRODUCTS

Member State authorities shall test one single unit.

The product shall be considered to comply with the requirements laid down in this Regulation if it is accompanied by the required and correct product information, and if it has at least one of the technical characteristics defined in Chapter 2 (3) and listed in documents the reference numbers of which have been published for that purpose in the Official Journal of the European Union.

ANNEX V

Indicative benchmarks referred to in Chapter 6

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

5. DIRECTIONAL LAMP EFFICIENCY

The most efficient lamp had an Energy Efficiency Index of 0.16.

6. LAMP MERCURY CONTENT

There are lamp types that contain no mercury, while being among the most energy efficient ones.

7. HALOGEN LAMP CONTROL GEAR EFFICIENCY

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