

II

(Non-legislative acts)

REGULATIONS

COMMISSION REGULATION (EU) No 1194/2012

of 12 December 2012

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

(Text with EEA relevance)

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 products⁽¹⁾, 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 starting with those products that offer a high potential for cost-effective reduction of greenhouse gas emissions, such as 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.
- (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 consumption 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

⁽¹⁾ OJ L 285, 31.10.2009, p. 10.

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 of the European Parliament and of the Council ⁽¹⁾. It is appropriate to regulate the ultraviolet light emissions from lamps and other parameters with potential health effects under Directives 2006/95/EC ⁽²⁾ and 2001/95/EC ⁽³⁾ of the European Parliament and of the Council.
- (10) Setting energy efficiency requirements for lamps should lead to a decrease in the overall mercury emissions.
- (11) Article 14(2)(d) of Directive 2012/19/EU of the European Parliament and of the Council ⁽⁴⁾ 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.
- (14) The combined effect of the ecodesign requirements set out in this Regulation and of Commission Delegated Regulation (EU) No 874/2012 ⁽⁵⁾ 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 not covered by the functionality requirements in Commission Regulation (EC) No 244/2009 ⁽⁶⁾. Product information requirements should allow consumers to make informed choices.
- (16) 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 available 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/EC of the European Parliament and of the Council ⁽⁷⁾.

⁽¹⁾ OJ L 174, 1.7.2011, p. 88.

⁽²⁾ OJ L 374, 27.12.2006, p. 10.

⁽³⁾ OJ L 11, 15.1.2002, p. 4.

⁽⁴⁾ OJ L 197, 24.7.2012, p. 38.

⁽⁵⁾ OJ L 258, 26.9.2012, p. 1

⁽⁶⁾ OJ L 76, 24.3.2009, p. 3.

⁽⁷⁾ OJ L 204, 21.7.1998, p. 37.

- (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.
- (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 Regulation should take particular note of the trend in sales of special-purpose lamp types in order to make sure that they are not used outside special applications, and of the development of new technologies such as LED and organic LED. It should assess the feasibility of establishing energy-efficiency requirements at class A level as defined in Regulation (EU) No 874/2012, or at least at class B level for directional mains voltage halogen lamps (taking into account the criteria set out below in Table 2 in point 1.1 of Annex III). It should also assess whether the energy-efficiency requirements for other filament lamps can be significantly tightened. The review should also assess the functionality requirements regarding colour rendering index for LED 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 electrical lighting products:

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

including when they are integrated into other products.

The Regulation also establishes product information requirements for special purpose products.

LED modules shall be exempted from the requirements of this Regulation if they are marketed as part of luminaires that are placed on the market in less than 200 units per year.

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. 'lighting' means the application of light to a scene, objects or their surroundings so that they may be seen by humans;
2. 'accent lighting' means a form of lighting where light is directed so as to highlight an object or a part of an area;
3. 'electrical lighting product' means a product designed for use with electricity and intended for use in lighting;
4. 'special purpose product' means a product that uses the technologies covered by this Regulation but is intended for use in special applications because of its technical parameters as described in the technical documentation. Special applications are those that require technical parameters not necessary for the purposes of lighting average scenes or objects in average circumstances. They are of the following types:
 - (a) applications where the primary purpose of the light is not lighting, such as:
 - (i) emission of light as an agent in chemical or biological processes (such as polymerisation, ultraviolet light used for curing/drying/hardening, photodynamic therapy, horticulture, petcare, anti-insect products);
 - (ii) image capture and image projection (such as camera flashlights, photocopiers, video projectors);
 - (iii) heating (such as infrared lamps);
 - (iv) signalling (such as traffic control or airfield lamps);
 - (b) lighting applications where:
 - (i) the spectral distribution of the light is intended to change the appearance of the scene or object lit, in addition to making it visible (such as food display

- lighting or coloured lamps as defined in point 1 of Annex I), with the exception of variations in correlated colour temperature; or
- (ii) the spectral distribution of the light is adjusted to the specific needs of particular technical equipment, in addition to making the scene or object visible for humans (such as studio lighting, show effect lighting, theatre lighting); or
- (iii) the scene or object lit requires special protection from the negative effects of the light source (such as lighting with dedicated filtering for photosensitive patients or photosensitive museum exhibits); or
- (iv) lighting is required only for emergency situations (such as emergency lighting luminaires or control gears for emergency lighting); or
- (v) the lighting products have to withstand extreme physical conditions (such as vibrations or temperatures below $-20\text{ }^{\circ}\text{C}$ or above $50\text{ }^{\circ}\text{C}$);
- (c) products incorporating lighting products, where the primary purpose is not lighting and the product is dependent on energy input in fulfilling its primary purpose during use (such as refrigerators, sewing machines, endoscopes, blood analysers);
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 a wavelength of 380-780 nm;
 6. 'lamp' means a unit whose performance can be assessed independently and which consists of one or more light sources. It may include additional components necessary for starting, power supply or stable operation of the unit or for distributing, filtering or transforming the optical radiation, in cases where those components cannot be removed without permanently damaging the unit;
 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' or 'socket' means a device which holds the lamp in position, usually by having the cap inserted in it, in which case it also provides the means of connecting the lamp to the electric supply;
 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; it 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 a p-n junction of inorganic material. The junction emits optical radiation when excited by an electric current;
 19. 'LED package' means an assembly having one or more LED(s). The assembly may include 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. The assembly may have electrical, optical, mechanical and thermal components, interfaces and control gear;
 21. 'LED lamp' means a lamp incorporating one or more LED modules. The lamp may be equipped with a cap;
 22. 'lamp control gear' means a device located between the electrical supply and one or more lamps, which provides a functionality related to the operation of the lamp(s), such as transforming the supply voltage, limiting the current of the lamp(s) to the required value, providing starting voltage and preheating current, preventing cold starting, correcting the power factor or reducing radio interference. The device may be designed to connect to other lamp control gear to perform these functions. The term does not include:

- control devices
 - power supplies within the scope of Commission Regulation (EC) No 278/2009 ⁽¹⁾;
23. 'control device' means an electronic or mechanical device controlling or monitoring the luminous flux of the lamp by other means than power conversion, such as timer switches, occupancy sensors, light sensors and daylight regulation devices. In addition, phase cut dimmers shall also be considered as control devices;
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 electric 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 electrical lighting products listed in Article 1 shall meet the ecodesign requirements set out in Annex III, except if they are special purpose products.

⁽¹⁾ OJ L 93, 7.4.2009, p. 3.

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 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) provide any other information required by Annexes I, III and IV to be present in the technical documentation file;
- (c) specify at least one realistic combination of product 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, 12 December 2012.

For the Commission
The President
José Manuel BARROSO

ANNEX I

Product information requirements for special purpose products

1. If the chromaticity coordinates of a lamp always fall within the following range:

$$- x < 0,270 \text{ or } x > 0,530$$

$$- y < -2,3172 x^2 + 2,3653 x - 0,2199 \text{ or } y > -2,3172 x^2 + 2,3653 x - 0,1595;$$

the chromaticity coordinates 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.

2. For all special purpose products, the intended purpose shall be stated in all forms of product information, together with the warning that they are not intended for use in other applications.

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 that make the product design specific for the stated intended purpose. If needed, the parameters may be listed in such a way as to avoid disclosing commercially sensitive information linked to the manufacturer's intellectual property rights.

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

- (a) the intended purpose; and
 - (b) that it is not suitable for household room illumination.
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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 operating period;
- (c) useful luminous flux (Φ_{use}) means the part of the luminous flux of a lamp falling within the cone used for calculating 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 centre beam intensity is the value of luminous intensity measured on the optical beam axis;
- (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 maximum deviation of chromaticity coordinates (x and y) of a single lamp from a chromaticity centre point (c_x and c_y), expressed as the size (in steps) of the MacAdam ellipse formed around the 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 operating time between the start of their use and the moment when only 50 % of the total number of lamps survive or when the average lumen maintenance of the batch falls below 70 %, whichever occurs first;
- (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 stabilised 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 of a lamp control gear where it is connected to the supply voltage and where its output is disconnected in normal operation from all the primary loads by the switch intended for this purpose (a faulty or missing lamp, or a disconnection of the load by a safety switch is not normal operation);

- (t) 'standby mode' means a mode of lamp control gear where the lamps are switched off with the help of a control signal under normal operating conditions. It applies to lamp control gear with a built-in switching function and permanently connected to the supply voltage when in normal use;
 - (u) 'control signal' means an analogue or digital signal transmitted to the control gear wirelessly or wired either via voltage modulation in separate control cables or via modulated signal in the supply voltage;
 - (v) 'standby power' means the power consumed by the lamp control gear in standby mode;
 - (w) 'no-load power' means the power consumed by the lamp control gear in no-load mode;
 - (x) 'switching cycle' means the sequence of switching the lamp on and off at set intervals;
 - (y) '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;
 - (z) 'anti-glare shield' means a mechanical or optical reflective or non-reflective impervious baffle designed to block direct visible radiation emitted from the light source of a directional lamp, in order to avoid temporary partial blindness (disability glare) if viewed directly by an observer. It does not include surface coating of the light source in the directional lamp;
 - (aa) 'compatibility' means that when a product is intended to be installed in an installation, inserted into another product or connected to it through physical contact or wireless connection,
 - (i) it is possible to perform the installation, insertion or connection; and
 - (ii) shortly after starting to use them together, end-users are not led to believe that any of the products has a defect; and
 - (iii) the safety risk of using the products together is not higher than when the same products taken individually are used in combination with other products.
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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:

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

where:

P_{cor} is the rated power measured at nominal input voltage and corrected where appropriate 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	$P_{\text{rated}} \times 1,06$
Lamps operating on external LED lamp control gear	$P_{\text{rated}} \times 1,10$
Fluorescent lamps of 16 mm diameter (T5 lamps) and 4-pin single capped fluorescent lamps operating on external fluorescent lamp control gear	$P_{\text{rated}} \times 1,10$
Other lamps operating on external fluorescent lamp control gear	$P_{\text{rated}} \times \frac{0,24\sqrt{\Phi_{\text{use}}} + 0,0103\Phi_{\text{use}}}{0,15\sqrt{\Phi_{\text{use}}} + 0,0097\Phi_{\text{use}}}$
Lamps operating on external high-intensity discharge lamp control gear	$P_{\text{rated}} \times 1,10$
Compact fluorescent lamps with colour rendering index ≥ 90	$P_{\text{rated}} \times 0,85$
Lamps with anti-glare shield	$P_{\text{rated}} \times 0,80$

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

For models with $\Phi_{\text{use}} < 1\,300$ lumen: $P_{\text{ref}} = 0,88\sqrt{\Phi_{\text{use}}} + 0,049\Phi_{\text{use}}$

For models with $\Phi_{\text{use}} \geq 1\,300$ lumen: $P_{\text{ref}} = 0,07341\Phi_{\text{use}}$

Φ_{use} is defined as follows:

— directional lamps with a beam angle $\geq 90^\circ$ other than filament lamps 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: 1,20 If $\Phi_{\text{use}} > 450$ lm: 0,95	0,50	0,50

Application date	Maximum energy efficiency index (EEI)			
	Mains-voltage filament lamps	Other filament lamps	High-intensity discharge lamps	Other lamps
Stage 2	1,75	0,95	0,50	0,50
Stage 3	0,95	0,95	0,36	0,20

Stage 3 for mains-voltage filament lamps shall apply only if no later than 30 September 2015, evidence is produced by the Commission through a detailed market assessment and communicated to the Consultation Forum that there are mains-voltage lamps on the market that are:

- compliant with the maximum EEI requirement in stage 3;
- affordable in terms of not entailing excessive costs for the majority of end-users;
- broadly equivalent in terms of consumer-relevant functionality parameters to mains-voltage filament lamps available on the date of entry into force of this Regulation, including in terms of luminous fluxes spanning the full range of reference luminous fluxes listed in Table 6;
- compatible with equipment designed for installation between the mains and filament lamps available on the date of entry into force of this Regulation according to state-of-the-art requirements for compatibility.

1.2. Energy efficiency requirements for lamp control gear

As from stage 2, the no-load power of a lamp control gear intended for use between the mains and the switch for turning the lamp load on/off shall not exceed 1,0 W. As from stage 3, the limit shall be 0,50 W. For lamp control gear with output power (P) over 250 W, the no-load power limits shall be multiplied by P/250 W.

As from stage 3, the standby power of a lamp control gear shall not exceed 0,50 W.

As from stage 2, the efficiency of a halogen lamp control gear 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 6 000 h	From 1 March 2014: $\geq 0,50$	$\geq 0,70$
Lumen maintenance	At 2 000 h: $\geq 80 \%$	At 2 000 h: $\geq 83 \%$ At 6 000 h: $\geq 70 \%$
Number of switching cycles before failure	\geq half the lamp lifetime expressed in hours $\geq 10\,000$ if lamp starting time $> 0,3$ s	\geq lamp lifetime expressed in hours $\geq 30\,000$ if lamp starting time $> 0,3$ s
Starting time	$< 2,0$ s	$< 1,5$ s if $P < 10$ W $< 1,0$ s if $P \geq 10$ W
Lamp warm-up time to 60 % Φ	< 40 s or < 100 s for lamps containing mercury in amalgam form	< 40 s or < 100 s for lamps containing mercury in amalgam form
Premature failure rate	$\leq 5,0 \%$ at 500 h	$\leq 5,0 \%$ at 1 000 h

Functionality parameter	Stage 1 except where indicated otherwise	Stage 3
Lamp power factor for lamps with integrated control gear	$\geq 0,50$ if $P < 25$ W $\geq 0,90$ if $P \geq 25$ W	$\geq 0,55$ if $P < 25$ W $\geq 0,90$ if $P \geq 25$ W
Colour rendering (Ra)	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications according to point 3.1.3(l) of this Annex	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications according to point 3.1.3(l) 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 other 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	$\geq 1\,000$ h ($\geq 2\,000$ h in stage 2) $\geq 2\,000$ h for extra low voltage lamps not complying with the stage 3 filament lamp efficiency requirement in point 1.1 of this Annex	$\geq 2\,000$ h $\geq 4\,000$ h for extra low voltage lamps
Lumen maintenance	≥ 80 % at 75 % of rated average lifetime	≥ 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	$< 0,2$ s	$< 0,2$ s
Lamp warm-up time to 60 % Φ	$\leq 1,0$ s	$\leq 1,0$ s
Premature failure rate	$\leq 5,0$ % at 100 h	$\leq 5,0$ % at 200 h
Lamp power factor for lamps with integrated control gear	Power > 25 W: $\geq 0,9$ Power ≤ 25 W: $\geq 0,5$	Power > 25 W: $\geq 0,9$ Power ≤ 25 W: $\geq 0,5$

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 6 000 h	From 1 March 2014: $\geq 0,90$
Lumen Maintenance at 6 000 h	From 1 March 2014: $\geq 0,80$
Number of switching cycles before failure	$\geq 15\,000$ if rated lamp life $\geq 30\,000$ h otherwise: \geq half the rated lamp life expressed in hours
Starting time	$< 0,5$ s
Lamp warm-up time to 95 % Φ	< 2 s
Premature failure rate	$\leq 5,0$ % at 1 000 h

Functionality parameter	Requirement as from stage 1, except where indicated otherwise
Colour rendering (Ra)	≥ 80 ≥ 65 if the lamp is intended for outdoor or industrial applications in accordance with point 3.1.3(l) of this Annex
Colour consistency	Variation of chromaticity coordinates within a six-step MacAdam ellipse or less.
Lamp power factor (PF) for lamps with integrated control gear	$P \leq 2$ W: no requirement 2 W < $P \leq 5$ W: PF > 0,4 5 W < $P \leq 25$ W: PF > 0,5 $P > 25$ 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 Φ_{use} = total rated luminous flux),
- 0,40 for directional lamps.

When a dimming control device is switched on at its lowest control setting for which the operated lamps consume power, the operated lamps shall emit at least 1 % of their luminous flux at full load.

When a luminaire is placed on the market and intended to be marketed to the end-users, and lamps that the end-user can replace are included with the luminaire, these lamps shall be of one of the two highest energy classes, according to Commission Delegated Regulation (EU) No 874/2012, with which the luminaire is labelled to be 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.

These information requirements do not apply to:

- filament lamps not fulfilling the efficacy requirements of Stage 2,
- LED modules when marketed as part of a luminaire from which they are not intended to be removed by the end-user.

In all forms of product information, 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 0,40 or below.

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.

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

3.1.2. Information to be visibly displayed to end-users, prior to their purchase, 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 to the end-users, prior to their purchase, 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.

- (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 expressed graphically or in words;
- (d) Number of switching cycles before premature 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 provided on the manufacturer's website;
- (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 millimetres (length and largest 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. The reference luminous flux shall be multiplied by the correction factor in Table 7. For LED lamps, it shall be in addition multiplied by the correction factor in Table 8;
- (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. The reference luminous flux shall be multiplied by the correction factor in Table 7. For LED lamps, it shall be in addition multiplied by the correction factor in Table 8. The intermediate values of both the luminous flux and the claimed equivalent lamp power (rounded to the nearest 1 W) shall be calculated by linear interpolation between the two adjacent values.

Table 6

Reference luminous flux for equivalence claims

Extra-low voltage reflector type		
Type	Power (W)	Reference Φ_{90° (lm)
MR11 GU4	20	160
	35	300
MR16 GU 5.3	20	180
	35	300
	50	540
AR111	35	250
	50	390
	75	640
	100	785

Mains-voltage blown glass reflector type		
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	1 000
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	$1 + 0,5 \times (1 - LLMF)$ 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
$20^\circ \leq \text{beam angle}$	1
$15^\circ \leq \text{beam angle} < 20^\circ$	0,9
$10^\circ \leq \text{beam angle} < 15^\circ$	0,85
$\text{beam angle} < 10^\circ$	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 power (0,1 W precision);
- (c) Rated useful luminous flux;
- (d) Rated lamp life time;
- (e) Lamp power factor;
- (f) Lumen maintenance factor at the end of the nominal life (except for filament lamps);
- (g) Starting time (as X,X seconds);
- (h) Colour rendering;
- (i) Colour consistency (only for LEDs);
- (j) Rated peak intensity in candela (cd);
- (k) Rated beam angle;
- (l) If intended for use in outdoor or industrial applications, an indication to this effect;
- (m) Spectral power distribution in the range 180-800 nm;

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 for recycling in line with Directive 2012/19/EU of the European Parliament and of the Council ⁽¹⁾.

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 (EC) No 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 are determined by the design of the installation.

⁽¹⁾ OJ L 197, 24.7.2012, p. 38.

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 lamp of the claimed wattage. The luminous flux of the fluorescent lamp shall be obtained by multiplying the claimed wattage with the minimum luminous efficacy value corresponding to the fluorescent lamp in Commission Regulation (EC) No 245/2009 ⁽¹⁾, and
- the wattage of the LED lamp is not higher than the wattage of the fluorescent lamp it is claimed to replace.

The technical documentation file shall provide the data to support such claims.

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.

3.4. Product information requirements for lamp control gears

As from stage 2, the following information shall be published on publicly available free access websites and in other forms the manufacturer deems appropriate:

- Indication that the product is intended to be used as a lamp control gear,
- If applicable, the information that the product may be operated in no-load mode.

⁽¹⁾ OJ L 76, 24.3.2009, p. 17.

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 factor at 6 000 h (for LED lamps only)	The test shall end <ul style="list-style-type: none"> — when the required number of hours is met, or — when more than two lamps fail, whichever occurs first. Compliance: a maximum of two out of every 20 lamps in the test batch may fail before the required number of hours. Non-compliance: otherwise.
Number of switching cycles before failure	The test shall end when the required number of switching cycles is reached, or when more than one out of every 20 lamps in the test batch have reached the end of their life, whichever occurs first. Compliance: at least 19 of every 20 lamps in the batch have no failure after the required number of switching cycles is reached. Non-compliance: otherwise.
Starting time	Compliance: the average starting time of the lamps in the test batch is not higher than the required starting time plus 10 %, and no lamp in the sample batch has a starting time longer than two times the required starting time. Non-compliance: otherwise.
Lamp warm-up time to 60 % Φ	Compliance: the average warm-up time of the lamps in the test batch is not higher than the required warm-up time plus 10 %, and no lamp in the sample batch has a warm-up time that exceeds the required warm-up time multiplied by 1,5. Non-compliance: otherwise.

Parameter	Procedure
Premature failure rate	<p>The test shall end</p> <ul style="list-style-type: none"> — when the required number of hours is met, or — when more than one lamp fails, whichever occurs first. <p>Compliance: a maximum of one out of every 20 lamps in the test batch fails before the required number of hours.</p> <p>Non-compliance: otherwise.</p>
Colour rendering (Ra)	<p>Compliance: the average Ra of the lamps in the test batch is not lower than three points below the required value, and no lamp in the test batch has a Ra value that is more than 3,9 points below the required value.</p> <p>Non-compliance: otherwise.</p>
Lumen maintenance at end of life and rated lifetime (for LED lamps only)	<p>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.</p> <p>Compliance: the lumen maintenance at end of life and the lifetime values obtained by extrapolation from the lamp survival factor and from the average lumen maintenance of the lamps in the test batch at 6 000 h are not lower than respectively the lumen maintenance and the rated lifetime values declared in the product information minus 10 %.</p> <p>Non-compliance: otherwise.</p>
Equivalence claims for retrofit lamps according to points 3.1.2(l) and (m) of Annex III	<p>If only the equivalence claim is verified for compliance, it is sufficient to test 10 lamps, where possible obtained approximately in equal proportion from four randomly selected sources.</p> <p>Compliance: the average results of the lamps in the test batch do not vary from the limit, threshold or declared values by more than 10 %.</p> <p>Non-compliance: otherwise.</p>
Beam angle	<p>Compliance: the average results of the lamps in the test batch do not vary from the declared beam angle by more than 25 % and the beam angle value of each individual lamp in the test batch does not deviate by more than 25 % of the rated value.</p> <p>Non-compliance: otherwise.</p>
Peak intensity	<p>Compliance: the peak intensity of each individual lamp in the test batch is not less than 75 % of the rated intensity of the model.</p> <p>Non-compliance: otherwise.</p>
Other parameters (including the energy efficiency index)	<p>Compliance: the average results of the lamps in the test batch do not vary from the limit, threshold or declared values by more than 10 %.</p> <p>Non-compliance: otherwise.</p>

Otherwise, the model shall be considered not to comply.

2. VERIFICATION PROCEDURE FOR LED MODULES NOT INTENDED TO BE REMOVED FROM THE LUMINAIRE BY THE END-USER

For the purposes of the tests described below, Member States' authorities shall obtain test units of the same model from the same manufacturer (of LED modules or luminaires, as applicable), where possible in equal proportion from randomly selected sources. For points (1), (3) and (5) below, the number of sources shall be at least four where possible. For point (2), the number of sources shall be at least four where possible, unless the number of luminaires necessary to obtain by extraction 20 LED modules of the same model is less than four, in which case the number of sources is equal to the number of luminaires needed. For point (4), if the test on the first two luminaires fails, the next three to be tested shall come from three other sources where possible.

Member States' authorities shall apply the following procedure in the order given below, until a conclusion regarding the compliance of model(s) of the LED module(s) is reached, or they conclude that testing cannot be performed. 'Luminaire' refers to the luminaire containing the LED modules, and 'test' refers to the procedure described in part 1 of this Annex, except in point (4). If testing according to both points (1) and (2) is allowed in the technical documentation file, the authorities may choose the most appropriate method.

- (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. If the model of the luminaire is considered to comply, the model(s) of the LED module(s) shall be considered to comply with the requirements laid down in this Regulation. If the model of the luminaire is considered not to comply, the model(s) of the LED module(s) shall be considered not to comply either.
- (2) Otherwise, if the technical documentation file of the luminaire allows for the removal of the LED module(s) for testing, the authorities shall obtain enough luminaires to obtain 20 copies of each incorporated LED module model. They shall follow the instructions of the technical documentation file to dismantle the luminaires and test each LED module model separately. The conclusion regarding the compliance of the model(s) of the LED module(s) shall follow from the test(s).
- (3) Otherwise, if according to the technical documentation file of the luminaire, the luminaire manufacturer obtained the incorporated LED module(s) as individual CE marked product(s) from the Union market, the authorities shall obtain 20 copies of each LED module model from the Union market for testing and test each LED module model separately. The conclusion regarding the compliance of the model(s) of the LED module(s) shall follow from the test(s). If the model(s) are not available any more on the Union market, market surveillance cannot be performed.
- (4) Otherwise, if the luminaire manufacturer did not obtain the incorporated LED module(s) as individual CE marked products from the Union market, the authorities shall request the luminaire manufacturer to deliver a copy of the original test data of the LED module(s) showing that the LED module(s) comply with the requirements applicable to:

- all LED modules in Table 5 of this Regulation,
- if they are directional LED modules, in Tables 1 and 2 of this Regulation,
- if they are non-directional LED modules, in Tables 1, 2 and 3 of Regulation (EC) No 244/2009.

If according to the test data, any of the LED module model(s) in the luminaire do not comply with the requirements, the model(s) of the LED module(s) shall be considered not to comply.

Otherwise, the authorities shall dismantle a single luminaire to check that the LED module(s) in the luminaire are the same type as described in the test data. If any of them is different or cannot be identified, the model(s) of the LED module(s) shall be considered not to comply.

Otherwise, the switching cycles, premature failure, starting time and warm-up time requirements of Table 5 shall be tested on another luminaire operated at its rating. During operation of the luminaire at its rated values, the temperature of the LED module(s) shall be also tested against the defined limits. If the results of the tests (other than on premature failure) vary from the limit values by more than 10 %, or the luminaire failed prematurely, three more luminaires shall be tested. If the averages of the results of the subsequent three tests (other than those relating to premature failure and to operating temperature) do not vary from the limit values by more than 10 %, none of the luminaires failed prematurely, and the operating temperature (in °C) is within 10 % of the defined limits in all three of them, the model(s) of the LED module(s) shall be considered to comply with the requirements. Otherwise, they shall be considered not to comply.

- (5) If testing according to points (1) to (4) is not possible because no independently testable LED modules can be distinguished in the luminaire, the authorities shall test the switching cycles, premature failure, starting time and warm-up time requirements of Table 5 on a single luminaire. If the results of the tests vary from the limit values by more than 10 %, or the luminaire failed prematurely, three more luminaires shall be tested. If the averages of the results of the subsequent three tests (other than those relating to premature failure) do not vary from the limit values by more than 10 %, and none of the luminaires failed prematurely, the model(s) of the LED module(s) incorporated into the luminaire shall be considered to comply with the requirements laid down in this Regulation. Otherwise, they 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 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 or in Article 3.2 of Delegated Regulation (EU) No 874/2012.

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, dimming control devices shall be tested with filament lamps when the control device is in the minimum dimming position. The model shall be considered to comply if, when installed according to the manufacturer's instructions, the lamps provide at least 1 % of their luminous flux at full load.

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.

1. DIRECTIONAL LAMP EFFICIENCY

The most efficient lamp had an energy efficiency index of 0,16.

2. LAMP MERCURY CONTENT

There are lamps that contain no mercury and are among the most energy-efficient.

3. HALOGEN LAMP CONTROL GEAR EFFICIENCY

The most efficient halogen lamp control gear had an efficiency of 0,93.
