

ECODESIGN WORKING DOCUMENT
for discussion on 5 July 2011

**Ecodesign requirements for directional lamps, light emitting diode lamps and halogen
lighting converters**

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[blue highlight indicates text or comments highly relevant for further discussion]

[yellow highlight indicates places where formal revision is still needed]

Article 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 lamps;
- c) halogen lighting converters.

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

Article 2
Definitions

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 lamp or a halogen lighting converter not intended for use in general lighting because of its technical parameters,

- (4) "source" means a surface or object emitting radiation produced by a transformation of energy;
- (5) "lamp" means a unit consisting of a source made in order to produce an optical radiation, usually visible. It is designed to be part of a luminaire, but its performance can be assessed independently. It includes any 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) "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°);
- (7) "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;
- (8) "incandescent lamp" means a filament lamp in which the filament operates in an evacuated bulb or is surrounded by inert gas;
- (9) "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;
- (10) "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;
- (11) "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;
- (12) "fluorescent lamp without integrated ballast" means a single or double capped fluorescent lamp without integrated ballast;
- (13) "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;
- (14) "light emitting diode (LED) lamp" or "LED module" means a lamp in which the light is produced by a solid state device embodying a p-n junction, emitting optical radiation when excited by an electric current;
- (15) "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);

- (16) “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;
- (17) "ballast" means lamp control gear which serves to limit the current of the lamp(s) to the required value in case it is connected between the supply and one or more discharge lamps. It may also include means for transforming the supply voltage, dimming the lamp, correcting the power factor and, either alone or in combination with a starting device, providing the necessary conditions for starting the lamp(s);
- (18) "halogen lighting converter" means lamp control gear designed for use with extra low voltage tungsten halogen lamps;
- (19) "compact fluorescent lamp" means a fluorescent lamp that includes all the components necessary for starting and stable operation of the lamp;
- (20) “retrofit LED lamp” means an LED lamp designed to be used in luminaires compatible with non-LED lamps; [referring to such luminaires avoids the need to refer to lamp caps, which could lead to confusion, as in the future unique lamp caps may be developed and included in IEC 60061-1 for LED lamps/modules]
- (21) "luminaire" means an apparatus which distributes, filters or transforms the light transmitted from one or more lamps and includes, except lamps themselves, all the parts necessary for fixing and protecting the lamps, together with the means for connecting them to the electric supply. It may or may not include the control gear necessary for operating the lamps;

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

Article 3 *Ecodesign requirements*

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

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

Stage 1: [one year after entry into force]

Stage 2: [two years after entry into force]

Stage 3: [four years after entry into force]

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 [one year after entry into force]:

Special purpose products using the technologies covered by this Regulation shall comply with the information requirements set out in Annex I.

Article 4
Conformity assessment

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 contain a copy of the product information provided in accordance with **Annex III point 3** of this Regulation, except for halogen lighting converters whose technical documentation file shall describe the product parameters for which limit values are set in **Annex III point 1.3**.

Article 5
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 verification procedure described in **Annex IV** of this Regulation.

Article 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**.

Article 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.

Article 8
Entry into force

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

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

Done at Brussels,

For the Commission
Member of the Commission

ANNEX I

Product information requirements for special purpose products

1. The following special purpose products shall state in the technical documentation file drawn up for the purposes of conformity assessment pursuant to Article 8 of Directive 2009/125/EC which of the technical parameters below make(s) them a special purpose product unsuitable for general lighting:
 - (a) directional lamps having the following chromaticity coordinates x and y :
 - $x < 0.270$ or $x > 0.530$
 - $y < -2.3172 x^2 + 2.3653 x - 0.2199$ or $y > -2.3172 x^2 + 2.3653 x - 0.1595$;
 - (b) directional lamps having a luminous flux below 60 lumens;
 - (c) directional lamps having:
 - 6% or more of total radiation of the range 250-780 nm in the range of 250-400 nm,
 - the peak of the radiation between 315 - 400 nm (UVA) or 280 - 315 nm (UVB).
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, measured after 100 hours of lamp running time;
- (b) "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;
- (c) "chromaticity" means the property of a colour stimulus defined by its chromaticity coordinates, or by its dominant or complementary wavelength and purity taken together;
- (d) "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;
- (e) "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;
- (f) "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;
- (g) "specific effective radiant ultraviolet power" means the effective power of the ultraviolet radiation of a lamp weighted according to the spectral correction factors and related to its luminous flux (unit: mW/klm);
- (h) "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 (100 hour) luminous flux;
- (i) "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;
- (j) "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);
- (k) "lamp start time" means the time needed, after the supply voltage is switched on, for the lamp to start fully and remain alight;

- (l) "lamp warm-up time" means the time needed for the lamp after start-up to emit a defined proportion of its stabilized luminous flux;
- (m) "power factor" means the ratio of the absolute value of the active power to the apparent power under periodic conditions;
- (n) "lamp mercury content" means the mercury contained in the lamp;
- (o) "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;
- (p) "nominal value" means the value of a quantity used to designate and identify a product;
- (q) "no-load condition" means the condition in which the input of a halogen lighting converter is connected to the mains power source, but the output is not connected to any primary load;
- (r) "active mode" means a condition in which the input of a halogen lighting converter is connected to the mains power source and the output is connected to a load;
- (s) "active mode efficiency" means the ratio of the power produced by a halogen lighting converter in active mode to the input power required to produce it;
- (t) "average active efficiency" means the average of the active mode efficiencies at 25 %, 50 %, 75 % and 100 % of the nominal output power.
- (u) "ingress protection grading" means a coding system to indicate the degree of protection provided by an enclosure against ingress of dust, solid objects and moisture and to give additional information in connection with such protection.
- (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) "Lamp cap" means that part of a lamp which provides connection to the electrical supply by means of a socket or lamp connector and, in most cases, also serves to retain the lamp in the socket;
- (y) "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.

ANNEX III
Ecodesign requirements

1. ENERGY EFFICIENCY REQUIREMENTS

1.1. Energy efficiency requirements for directional lamps

Directional retrofit LED lamps replacing fluorescent lamps without integrated ballast or high-intensity discharge lamps shall comply with the requirements set out in **point 1.2.**, except if they are at the same time retrofits to filament lamps.

The useful luminous flux of a directional lamp is determined as follows:

Table 1: Definition of the useful luminous flux

Model	Useful luminous flux (Φ_{use})
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 rated power (P_{max}) for a given useful luminous flux (Φ_{use}) is provided **in Table 2.**

The correction factors applicable to the maximum rated power are in **Table 3.** The correction factors are cumulative where appropriate.

Table 2

Application date	Maximum rated power (P_{max}) for a given rated luminous flux (Φ) (W)	
	Filament lamps	Other lamps
Stages 1 to 2	[formula to calculate energy class equivalent to xenon-filled mains voltage halogens]	[formula to calculate energy class equivalent to compact fluorescent lamps, reflector HID]
Stage 3	[formula to calculate energy class equivalent to IRC coated halogens]	[formula to calculate energy class equivalent to top-class LEDs 2012]

Filament lamps with $\Phi_{use} \leq$ [lumen output equivalent to 60W GLS R] shall be exempt from the requirements of Table 2 in Stage 1. [this ensures a two-step phase-out of conventional incandescent and halogens, starting with the high wattages (greater than 60W)]

Table 3

Correction factors	
Scope of the correction	Maximum rated power (W)
filament lamp requiring external lamp control gear	$P_{max} / 1.06$
LED lamp requiring external lamp control gear	$P_{max} / 1.20$
fluorescent lamp requiring external lamp control gear	$P_{max} / \frac{0.24\sqrt{\Phi} + 0.0103\Phi}{0.15\sqrt{\Phi} + 0.0097\Phi}$
high-intensity discharge lamp requiring external lamp control gear	$P_{max} / 1.10$
lamps other than filament lamps with colour rendering index ≥ 90	$P_{max} / 0.85$
LED lamp with $15^\circ \leq$ beam angle $< 20^\circ$	$P_{max} / 0.9$
LED lamp with $10^\circ \leq$ beam angle $< 15^\circ$	$P_{max} / 0.85$
LED lamp with beam angle $< 10^\circ$	$P_{max} / 0.80$

[Comment to the last two rows: spill light has some use in medium to wide beams (contributes to uniformity on the floor and to total room illumination), but is useless in narrow

beams whose only purpose is accent lighting. At such beam angles, technologies emitting no spill light (such as LED) should be allowed to have less total light output.]

1.2. Energy efficiency requirements for retrofit LED lamps replacing fluorescent lamps without integrated ballast or high-intensity discharge lamps

The following requirements apply from Stage 1 to retrofit LED lamps replacing fluorescent lamps without integrated ballast or high-intensity discharge lamps, except for LED lamps that are at the same time retrofits to filament lamps.

The retrofit LED lamp shall be compared to the lamp for which it is claimed to be a replacement lamp in the product information provided according to **point 3.2 of this Annex**.

When the retrofit LED lamp is operated in a luminaire claimed to be compatible in **point 3.2 of this Annex**, the illuminance on a reference surface shall be in no point lower than that provided by the lamp it claims to replace when it is installed in the same luminaire, except where the original illuminance is less than **10%** of the maximum original illuminance. **[exact value to be discussed – the level set should be such that LED retrofit lamps are not required to reproduce useless spill light coming from the more diffuse fluorescent lamps or reflectors, only their useful light]** The luminaire shall not require more power to operate the retrofit LED lamp than to operate the lamp it replaces.

1.3. Energy efficiency requirements for halogen lighting converters

From Stage 1, the average active efficiency of halogen lighting converters shall be at least 0.925.

They shall be able to operate at all power loads ranging from **15%** to 100% of their nominal output power. **[exact value to be discussed - this is supposed to ensure that it can operate also retrofit energy saving lamps]**

The power consumption of halogen lighting converters inserted or designed to be mounted between the switch and the supply shall not exceed 0.5 W at no load condition. **[This means that the ones that are cut off from power when the light is switched off do not have to comply with a no-load requirement meaningless in their case.]**

[This is the proposal copied from the 2007 External Power Supplies study. CELMA have already signalled that they would like to refine it in face of recent evidence.]

2. FUNCTIONALITY REQUIREMENTS

2.1. Functionality requirements for directional lamps other than LED lamps

The lamp functionality requirements are set out in **Table 5** for directional compact fluorescent lamps and in **Table 6** for directional lamps excluding compact fluorescent 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 5 – 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
UVA+UVB radiation	≤ 2.0 mW/klm	≤ 2.0 mW/klm
UVC radiation	≤ 0.01 mW/klm	≤ 0.01 mW/klm
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	≥ 80

[The table is largely based on the CFL functionality requirements in Regulation 244/2009. Views are sought on feasibility, as no information was provided in the studies.]

Table 6 – 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	$\leq 5.0\% @ 100\text{h}$	$\leq 5.0\% @ 200\text{h}$
Lamp power factor	≥ 0.95	≥ 0.95

[The rows highlighted in blue come from the preparatory study. The rest of the table is based on the functionality requirements in Table 5 of Regulation 244/2009, and views are sought on feasibility, as no information was provided in the studies. Why is it not possible to require as number of switching cycles much more than four times the rated lamp life?]

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

The lamp functionality requirements are set out in Table 7 for both non-directional and directional LED lamps, including retrofit 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 7 – Functionality requirements for non-directional and directional LED lamps

Functionality parameter	Requirement from Stage 1
Rated lamp lifetime at 50% lamp survival and 70% lumen maintenance	≥ 15000 h ≥ 10000 h for retrofit LEDs with integrated control gear
Number of switching cycles before failure	≥ 7500 ≥ 5000 for retrofit LEDs with integrated control gear
Starting time	< 0.5 s
Lamp warm-up time to 60% Φ	< 2 s
Premature failure rate at 10% of rated life in hours	$\leq 2.0\%$
Colour rendering (Ra)	≥ 80 ≥ 90 if claimed to be retrofit to halogen or incandescent lamp
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 $>$ 0.7 P $>$ 25W : PF $>$ 0.9

[Apart from colour consistency, all values from Preparatory study or ELC. Preparatory study made recommendation only on lifetime, premature failure rate and colour rendering. Latest ELC recommendation was largely in line with study on these parameters, and proposed others included in the table.]

Directional and non-directional LED lamps that are claimed to be retrofits to halogen or incandescent lamps shall also comply with the following functionality requirements:

- (a) the Correlated Colour Temperature shall be between 2600K and 3200K;
- (b) the lamps shall be fully dimmable using dimmer systems compatible with mains voltage or extra low voltage halogen systems, as applicable;
- (c) extra low voltage LED retrofit lamps shall be able to operate on all types of halogen lighting converters;
- (d) if the lamp is claimed to be a retrofit to a specific halogen or incandescent lamp, its dimensions shall not exceed the maximum standard dimensions of the replaced lamp type.

3. PRODUCT INFORMATION REQUIREMENTS

3.1. Product information requirements for directional lamps

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 following information shall be provided in a legible font on the surface of the lamp.

- (a) Nominal useful luminous flux;
- (b) Colour temperature (expressed as a value in Kelvins);
- (c) Nominal beam angle in degrees.

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.

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, figures or symbols rather than text.

Any equivalence to less efficient lamp types can only be claimed if the conditions listed under paragraphs (l) to (n) below are fulfilled.

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);
- (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 $T_a \neq 25 \text{ }^\circ\text{C}$), information on those conditions;
- (i) Lamp dimensions in millimeters (length and rim diameter);
- (j) Nominal beam angle in degrees;
- (k) A warning that the lamp is not suitable for accent lighting, if the lamp's useful luminous flux according to point 1.1 of this Annex is to be measured in a 120° cone;
- (l) The lamp type reference as given in the Table 8, if the lamp dimensions make the lamp a retrofit to one of the lamp types listed in Table 8;
- (m) The statement or icon "halogen retrofit" and the power of the replaced lamp type as in Table 8 may be displayed, if the lamp dimensions make the lamp a retrofit to one of the lamp types listed in Table 8, and the rated luminous flux in a 90° cone (Φ_{90°) of the lamp is not lower than the luminous flux provided in the cell located in Table 8 in the row of the claimed equivalent lamp type and power and in the column of the corresponding retrofit technology;

Table 8

Extra Low Voltage Reflector type				
Type reference	Power (W)	Φ_{90° (lumen) Halogen lamps	Φ_{90° (lumen) Compact fluorescent lamps	Φ_{90° (lumen) Other lamps
MR11 GU4	20	205	216	235
	35	410	432	470
MR16 GU 5.3	20	205	216	235
	35	395	416	452
	50	615	648	705
AR111	35	359	378	411
	50	564	594	646
	75	820	864	940
	100	1076	1134	1234

Mains Voltage Blown Glass Reflector type				
Type reference	Power (W)	Φ_{90° (lumen) Halogen lamps	Φ_{90° (lumen) Compact fluorescent lamps	Φ_{90° (lumen) Other lamps
R50/NR50	25	92	97	106
	40	174	184	200
R63/NR63	40	185	194	212
	60	308	324	353
R80/NR80	60	308	324	353
	75	359	378	411
	100	595	626	682
R95/NR95	75	359	378	411
	100	554	583	635
R125	100	595	626	682
	150	1025	1080	1175
Mains Voltage Pressed Glass Reflector type				
Type reference	Power (W)	Φ_{90° (lumen) Halogen lamps	Φ_{90° (lumen) Compact fluorescent lamps	Φ_{90° (lumen) Other lamps
PAR16	20	92	97	106
	25	128	135	147
	35	205	216	235
	50	308	324	353
PAR20	35	205	216	235
	50	308	324	353
	75	513	540	588
PAR25	50	359	378	411
	75	564	594	646
PAR30S	50	359	378	411
	75	564	594	646
	100	769	810	881
PAR36	50	359	378	411
	75	564	594	646
	100	738	778	846
PAR38	60	410	432	470
	75	569	599	652
	80	615	648	705
	100	779	821	893
	120	923	972	1058

[Initial luminous fluxes were recommended by ELC. They were understood as luminous fluxes of conventional halogen and incandescent technologies. As all alternative technologies have longer life and loose light with age (even improved halogen bulbs), it was necessary to introduce a correction based on lumen maintenance for each replacement technology in order to avoid consumer disappointment. This means that lamps that lose light when aging will have to give more light at the beginning of their life than equivalent shorter life lamps, to counterbalance loss of light with aging. The table already shows luminous fluxes corrected by 1.025 for halogens, 1.08 for CFLs and 1.175 for other lamps, exactly as in Regulation 244/2009.]

For narrow beam retrofit LED lamps, the luminous flux requirement in **Table 8** shall be multiplied by a factor according to **Table 9**:

Table 9

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

[Same rationale as for Table 3]

- (n) 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**.

If the lamp contains mercury:

- (o) Lamp mercury content as X.X mg;
- (p) 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

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.

If the lamp contains mercury:

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

3.2. Product information requirements for retrofit LED lamps replacing fluorescent lamps without integrated ballast or high-intensity discharge lamps

From Stage 1, manufacturers of retrofit LED lamps replacing fluorescent lamps without integrated ballast or high-intensity discharge lamps shall make the following information publicly available on free-access websites and in other forms they deem appropriate.

These requirements do not apply to LED lamps that are at the same time retrofits to filament lamps.

- (a) The brand name and model number of at least one discharge lamp available in the EU at the moment of placing on the market to which the LED lamp is a retrofit;
- (b) If the retrofit LED lamp works with LED control gear, the brand name and model number of the discharge lamp ballast (available in the EU at the moment of placing on the market) with which the discharge lamp referred to in paragraph (a) was tested;
- (c) The brand name and model number of at least one luminaire available in the EU at the moment of placing on the market with which the retrofit LED lamp, and if applicable, its control gear is compatible;
- (d) The information listed in paragraphs (a) to (i) of point 3.1.2. and (b) to (i) of point 3.1.3.;
- (e) If the retrofit LED lamp is directional, the information listed in paragraph (j) of point 3.1.2 and in paragraphs (j) and (k) of point 3.1.3.

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 procedure.

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 RETROFIT LED LAMPS REPLACING FLUORESCENT LAMPS WITHOUT INTEGRATED BALLAST OR HIGH-INTENSITY DISCHARGE LAMPS

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 the average results of the batch do not vary from the limit, threshold or declared values by more than 10%, and if the lamps are accompanied by the required and correct product information.

Otherwise, the model shall be considered not to comply.

2. VERIFICATION PROCEDURE FOR RETROFIT LED LAMPS REPLACING FLUORESCENT LAMPS WITHOUT INTEGRATED BALLAST OR HIGH-INTENSITY DISCHARGE LAMPS

Member State authorities shall test a randomly selected sample batch of:

- (a) minimum twenty retrofit LED lamps of the same model from the same manufacturer;
- (b) minimum twenty lamps of a discharge lamp model for which the LED lamp model is claimed to be a retrofit according to **Annex III point 3.2 paragraph (a)**;
- (c) if the retrofit LED lamp model operates on LED control gear, minimum one LED control gear and one ballast with which the discharge lamp referred to in **paragraph (b)** was tested according to **Annex III point 3.2 paragraph (b)**;
- (d) minimum one luminaire with which the retrofit LED lamp model is claimed to be compatible according to **Annex III point 3.2 paragraph (c)**.

If the discharge lamp model, ballast model or luminaire model to which the manufacturer refers to according to **Annex III point 3.2** is not anymore available in the EU, then models whose relevant parameters are equivalent can be used instead for verification.

The illuminance provided by the retrofit LED lamps and by the discharge lamps installed in the luminaire shall be measured on a reference surface in points selected as representative of

functional illuminance levels according to the purpose of the luminaire and in the context of lighting design rules or best practice applied in the Member State. However, the representative points shall not comprise points in which with the discharge lamps, illuminance levels are lower than 10% of the maximum illuminance. The average illuminance in the selected representative points and the average power required by the luminaire shall be calculated for both batches.

The batch of retrofit LED lamps shall also be tested for compliance with functionality and product information requirements.

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

- (a) the average illuminance level in all of the selected representative points of the reference surface is at least 95% of the average illuminance level measured with the discharge lamps, and
- (b) the average power required by the luminaire when operating the retrofit LED lamps is at most 105% of the average power required by the luminaire when operating the discharge lamps, and
- (c) the other average results of the batch do not vary from the limit, threshold or declared values by more than 10%,
- (d) the lamps are accompanied by the required and correct product information.

Otherwise, the model shall be considered not to comply.

3. VERIFICATION PROCEDURE FOR HALOGEN LIGHTING CONVERTERS

Member State authorities shall test one single unit.

The model shall be considered to comply with the requirements laid down in this Regulation if the results do not vary from the limit values by more than 10%.

If the results vary from the limit values by more than 10%, three more units shall be tested. The model shall be considered to comply with the requirements laid down in this Regulation if the average of the results of the latter three tests does not vary from the limit values by more than 10%.

Otherwise, the model shall be considered not to comply.

ANNEX V

Indicative benchmarks referred to in Article 6

At the time of adoption of this Regulation, the best available technology on the market for the parameters covered by the Regulation was as indicated below. There was no product that achieved all of these benchmark values at the same time. Features required in certain applications (e.g. high colour rendering) could prevent products offering those features from achieving some of these benchmarks.

[taking into account the rapid development of the LED market, the values should be filled in at a later stage of the adoption procedure, which will take at least 10 months counting from the Consultation Forum meeting]

1. DIRECTIONAL LAMP EFFICIENCY

The most efficient lamp required X W power for Y useful lumens (Y/X lm/W).

2. LAMP FUNCTIONALITY

Table 10

Functionality parameter	Benchmark value
Rated lamp lifetime	
Lumen maintenance	
Number of switching cycles	
Starting time	
Lamp warm-up time to 80% Φ	
Lamp power factor	
Colour rendering	
Colour consistency	

3. HALOGEN LIGHTING CONVERTER EFFICIENCY

[views sought on what can be considered BAT today – the external power supplies preparatory study finished in 2007]