

Annex 3

Possible ecodesign requirements for general lighting equipment Part 1

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Subject matter

This implementing measure pursuant to Directive 2005/32/EC establishes eco-design requirements related to general lighting equipment, specifically lamps, wall-mounted dimmers, and luminaires. Directional light sources (DLS) such as reflector lamps will be treated in a separate implementing measure.

Recitals

1. The following environmental aspects are identified as significant:

- (a) Energy in the use phase
- (b) Mercury content of lamps
- (c) Waste

2. Ecodesign parameters referred to in Annex I, Part 1 of Directive 2005/32/EC which are not considered as significant:

All ecodesign parameters not addressed by the requirements in the measure.

Definitions

For the purposes of the implementing measure the following definitions shall apply:

"general lighting" shall mean substantially uniform lighting of an area without provision for special local requirements. (definition according to EN 12665)

"lamps for general lighting" or in short "lamps" shall mean electric lamps having the characteristics specified in **Annex I**.

"luminaires for general lighting" shall mean luminaires that have sockets compatible with lamps for general lighting.

"Directional Light Source" (DLS) shall mean light sources having at least 80% light output within a solid angle of π sr (corresponding to a cone with angle of 120°). A DLS uses a reflector or an optical component (e.g. lens for LED) to align the luminous flux, 'all reflector lamps' are considered as DLS.

"wall-mounted dimmers" shall mean devices to lower the lamp light output connected to the mains voltage that are designed for wall mounted installation that modify or lower the mains voltage in order to dim the lamp, except devices operated on a data cable.

"lamp efficacy" (η_{lamp}) shall mean the quotient of the luminous flux emitted by the power consumed by the source.

"lamp lumen maintenance factor" (LLMF) shall mean the ratio of the luminous flux emitted by the lamp at a given time in its life to the initial luminous flux.

[to be completed as needed at a later stage]

Other expressions used in the implementing measure shall have the same meaning as in Directive 2005/32/EC.

Ecodesign requirements

1. The following products for general lighting, unless listed among the exemptions in **Annex II**, regardless of the application for which they are intended, shall meet the ecodesign requirements set out in **Annex III**:

- a.) lamps
- b.) wall-mounted dimmers
- c.) luminaires

The benchmarks for best products identified together with the minimum requirements in Annex III are of indicative nature.

2. The provisions of this measure are without prejudice to the requirements set out in the ecodesign implementing measures on fluorescent lighting products without integrated ballast and on lighting with high-intensity discharge lamps.

Information requirements for components and sub-assemblies

No information requirements on manufacturers of components and sub-assemblies of lamps, ballasts and luminaires are envisaged, as the need for this was not demonstrated by the preparatory study, neither mentioned by the stakeholders. Lamps and luminaires are considered as EuPs (not components or sub-assemblies) within the meaning of Article 2.1 of Directive 2005/32/EC.

Location of the CE marking

The CE marking should always be displayed on the lamps, luminaires and dimmers themselves, and also on their packaging if they are sold separately. If they are sold incorporated into other (even non-energy using) products, the CE marking shall be still displayed on the lamps, luminaires and dimmers themselves. In that case the manufacturer/importer placing on the market the product incorporating the lamp, luminaire and dimmer shall be held responsible that they comply with the requirements of this implementing measure and they bear the CE marking.

Conformity Assessment

A conformity assessment shall be carried out according to Article 8(2), and Annex IV (Internal design control, Module A) or Annex V (Management system for assessing conformity) of Directive 2005/32/EC.

Requirements on directional light sources and luminaires

In a forthcoming implementing measure this measure shall be extended to directional light sources including reflector lamps and luminaires with integrated lamp (e.g. LED luminaires). Where appropriate, specific requirements shall be introduced on directional light sources. Further requirements on luminaires (such as efficiency) may also be introduced.

Places in the text of this working document where further provisions on directional light sources should be expected are marked with “+ directional light sources”.

Options for minimum lamp efficacy

The main Working Document discusses different options as to the level of minimum lamp efficacy requirements and to the number and timing of stages. Where the options

would result in diverging requirements in this document, the text is marked with **blue highlight**.

Staged introduction of requirements

The different options for the number of stages and their timing are discussed in the main Working Document. The ecodesign requirements in **Annex III** of this document are based on the assumption of 3 stages in 5 years (1st stage after 1 year, 2nd after 3 years, 3rd after 5 years), but these are only one of the options currently examined by the Commission.

Review

A review of this IM shall be presented to the Consultation Forum depending on technological progress and not later than 5 years after its entry into force.

Annex I

Technical specifications of lamps for general lighting

For the purposes of this implementing measure, a lamp for general lighting is defined as a lamp fulfilling the following criteria:

1. It provides white light with CIE 1931 x,y chromaticity coordinates that satisfy the following requirement:
 - $0,27 < x < 0,53$
 - $-2,3172 \cdot x^2 + 2,3653 \cdot x - 0,2199 < y < -2,3172 \cdot x^2 + 2,3653 \cdot x - 0,1595$
2. It has a light output of 150 lumens or more. For directional light sources a minimum threshold will be defined later.
3. It is equipped with one of the caps defined in a harmonised standard the reference of which has been published in the Official Journal. As long as the reference to a harmonised standard laying down cap types used in general lighting is not published, the following list shall be used:
 - E14, E27, B15d, B22d, S14s, S14d, S15s,
 - GX53,
 - G9, GU10, GZ10,
 - G4, GY6.35, G8,5, GU4, GU5,3, G53
 - R7s

Many fluorescent lamps without integrated ballast and high-intensity discharge lamps are also considered as general lighting, however their cap types are not listed here separately as those lamps are treated in other implementing measures.

Lamps that are part of a luminaire with integrated lamp that has no lamp cap for lamp replacement (e.g. LED luminaire) shall also be considered as general lighting lamps if they fulfil the criteria under points 1 and 2.

Annex II

General exemptions

- All lamps not covered by the technical specifications in Annex I.
- Fluorescent lamps without integrated ballast and high-intensity discharge lamps (including low pressure sodium lamps).
- Luminaires not compatible with the lamps covered by the technical specifications in Annex I.

Annex III

Ecodesign requirements

III.1. Product information requirements for lamps for general lighting

Starting from stage 1:

For all lamps, the following information shall be provided on or with each consumer package:

- Lamp wattage in Watt [W] rounded off to 1 W;
- Luminous flux (at 100 h) Φ_{100} in lumen [lm], in at least two times larger font than the lamp wattage indication;
- Nominal lamp lifetime in hours not longer than the rated average lamp lifetime. For new lamp types (e.g. LEDs) with long (>12000 h) life time the term 'projected' should be added if no test data is yet available;
- Energy label as required by 98/11/EC;
- The colour rendering level if not Level '+':
Level '-' = Poor colour rendering: $CRI < 80$
Level '+' = Good colour rendering: $80 \leq CRI < 90$
Level '++' = Excellent colour rendering: $90 \leq CRI$.
where CRI is the colour rendering index of the lamp.
- Colour temperature;
- Starting time (seconds);
- Warm-up time up to 80% of the full light output;
- Lumen maintenance factor at end of life;
- Where to dispose of the lamps;
- A warning if lamps can only be dimmed on dimmers able to dim fluorescent lamps ;
- If designed for optimal use in non-standard conditions (ambient temperature $T_a \neq 25$ °C, e.g. for outdoor application) the consumer should be informed;
- Power Factor if the factor is less than 0,9.¹
- + directional light sources: the light distribution of the lamp (to be elaborated later).

¹ A low power factor can have implications for loading of non public network generation, specifically for users of micro generation through combined heat and power, wind or photovoltaic systems.

Conditional product information requirements on or with each consumer package:

- If equivalence with a GLS-lamp is claimed, the equivalent wattage (rounded off to 1W) of a standard, clear incandescent lamp, form A has to be mentioned.² For this equivalence, average luminous fluxes have to be compared, according to lamp ageing during lifetime. If no test data is available in the technical file (that includes measured luminous flux and switching cycles) the following data should be used:
 - for an incandescent lamp: $\Phi_{av} = \Phi_{100} \times 0,965$ (no test data allowed),
 - for a halogen lamp: $\Phi_{av} = \Phi_{100} \times 0,975$ (no test data allowed),
 - for a CFLi : $\Phi_{av} = \Phi_{100} \times 0,925$
 - for an LED: $\Phi_{av} = \Phi_{100} \times 0,85$
 - for an HID: $\Phi_{av} = \Phi_{100} \times 0,85$ ³
 - for an LFL or CFLni: $\Phi_{av} = \Phi_{100} \times 0,95$ ⁴

The values for the average luminous flux of the standard GLS-C lamp used for comparison have to be taken from the table below.

Average Luminous Flux of a clear GLS standard lamp

Lamp W [W]	Φ_{100} [lm]	Φ_{av} [lm]
15	120	116
25	220	212
40	415	400
60	710	685
75	930	897
100	1340	1293
150	2160	2084
200	3040	2934

The intermediate values have to be calculated by linear interpolation between the two adjacent values;

² The levels of the best available GLS form A has been taken as a reference in order not to disappoint consumers as was experienced in the past (see chapter 3). It is proposed to round off to 1 Watt despite that GLS lamps only exist in 25-40-60-75-100 Watt versions, because the consumers should be able to properly distinguish between energy saving lamps in terms of their performance.

³ Only for discussion here, to be transferred to the HID lighting implementing measure.

⁴ Only for discussion here, to be transferred to the fluorescent lighting implementing measure.

- The term "energy saving lamp" or any similar product related promotional statement about lamp efficacy can only be provided if the following efficacy levels according to Annex III.2. are met:

	CRI '-'	CRI '+'	CRI '++'
Stage 1	A++	A	B
Stage 2	A++	A+	B+

III.2. Efficacy requirements on lamps for general lighting

The efficacy levels referred to in this Annex are set out in the following table:

Level	Maximum input lamp power (W) related to lamp lumen (Φ)
G	$> 1,30 \times (0,88\sqrt{\Phi} + 0,049\Phi)$
F	$1,30 \times (0,88\sqrt{\Phi} + 0,049\Phi)$
E	$1,10 \times (0,88\sqrt{\Phi} + 0,049\Phi)$
D	$0,95 \times (0,88\sqrt{\Phi} + 0,049\Phi)$
C	$0,80 \times (0,88\sqrt{\Phi} + 0,049\Phi)$
B	$0,60 \times (0,88\sqrt{\Phi} + 0,049\Phi)$
B+	$0,40 \times (0,88\sqrt{\Phi} + 0,049\Phi)$
A	$0,24\sqrt{\Phi} + 0,0103\Phi$
A+	$0,18\sqrt{\Phi} + 0,0103\Phi$
A++	$0,13\sqrt{\Phi} + 0,0091\Phi$
A+++	$0,08\sqrt{\Phi} + 0,006\Phi$

The parameters should be measured according to applicable EN standards (at 100 h operation) with the following additional corrections:

- For lamps that have an optimum working temperature above 25 °C, lumen output may be corrected for the optimum working temperature up to 60 °C.⁵
- For calculating the grade of low voltage lamps, the wattage must be corrected for the transformer losses, i.e. the lamp wattage has to be multiplied by the correction factor of 1,11.
- For fluorescent lamps without integrated ballast the wattage has to be corrected for the ballast losses by the correction factor $1/\eta_{\text{ballast}}$ equivalent to $\text{EEI} = \text{A2}$;⁶
- For HID lamps without integrated ballast the wattage has to be corrected for the ballast losses by the correction factor 1.1.⁷

⁵ These lamps are typically designed for indoor luminaires that optimise the lamp working temperature above the ambient temperature. E.g. most T5 lamps have their optimum working temperature at 35 °C, where they have an efficacy about 10 % higher than at 25 °C.

⁶ Only for discussion here, to be transferred to the fluorescent lighting implementing measure. Please note that in the working document on fluorescent lighting, another formula was incorporated that did not take into account ballast losses, nevertheless A++ and A+ are equivalent levels in the two cases.

⁷ Only for discussion here, to be transferred to the HID lighting implementing measure


- For LED lamps that cannot be operated on the mains voltage the wattage has to be corrected for the power supply losses by the correction factor 1.1.

The minimum efficacy requirements will be set by referring to these levels, using correction factors for different lamp parameters if necessary. Several policy options are still under discussions, please refer to **the main Working Document** for their description.

As regards the form, the requirements would be set out as in the illustrative example provided below (detailing levels and stages for option 2 of the main Working Document).

The detailed efficacy values and also the impact on lamp types can be studied in the annexed Excel workbook (see sheets "Option 2 – values" and "Option 2 – types").

	Stage 1	Stage 2	Stage 3
Proposed Timing	Year 1	Year 3	Year 5
Lamp Luminous Flux Φ_{100} [lm]	Minimum lamp efficacy level	Minimum lamp efficacy level	Minimum lamp efficacy level
$150 \leq \Phi \leq 450$	E	D	B+
$450 < \Phi \leq 1000$	C	B+	A
$1000 < \Phi < 2000$	B+	A	A
$2000 \leq \Phi$	A	A	A

Maximum Wattage GLS			
	40	None	None

Correction factors	
Reason for correction	Correction factor
Colour rendering index > 90	Minimum efficacy at level B if $\Phi \leq 1000$ or at level B+ if $1000 < \Phi$
Colour rendering index < 80	+1 minimum efficacy level, unless bright point light source
Second lamp envelope (only for mercury containing lamps)	Minimum efficacy at level B+ if $\Phi \leq 2000$ or at level A if $2000 < \Phi$
Lamp which is a bright point light source	Minimum efficacy at level B if $\Phi \leq 1000$ or at level B+ if $1000 < \Phi$
+ directional light sources	to be elaborated in part 2 of the preparatory study

The second lamp envelope is defined as a second outer lamp envelope that is not required for the production of light (e.g. decorative).

The bright point source is defined as the light produced by a lamp that has only clear glass covers.

Exception on the following lamps:

Lamp type	Lamp cap	Lamp power [W]	Minimum lamp efficacy level
Halogen main voltage	R7s	$50 \leq W \leq 300$	C
Halogen main voltage	G9	all wattages	C

Reason:

- Halogen main voltage lamps with R7s cap are often applied in luminaires with presence detection and they have to give instant light, what other lamp types cannot for the moment. Lamps above 300 W are mainly used for general lighting where warm-up time is no problem; as a consequence lamps can be replaced by HID-lamps in appropriate luminaires.
- No level B energy efficient solutions exist nowadays with G9 socket (currently used by level C halogen main voltage lamps)

In subsequent revisions of the implementing measure, these exceptions may be withdrawn, as the requirements on luminaires (see Annex III.5 of the Working Document) are likely to phase out most of the luminaires that use these lamps (except the ones with incorporated presence detector).

More information on the background to this option is provided in Chapter 8 of the preparatory study.⁸

III.3. Performance requirements for lamps for general lighting

Lamps for general lighting shall meet the performance requirements set out in the table below. The values in parenthesis indicate the requirements for mercury-containing lamps if they are different from the requirements on all lamps. The number of stages is indicative and depends on the outcome of discussions on the policy options as explained in the main Working Document.

Performance parameter	Stage 1	Stage 2	Stage 3	Benchmark
Minimum rated lamp life	1000h (6000h)	1000h (6000h)	2000h (10000h)	4000 h (15000 h)
Lumen maintenance	85 % at 1000 h (85 % at 2000 h or 80 % at 2000 h for lamps with second lamp	85 % at 1000 h (85 % at 2000 h or 80 % at 2000 h for lamps with second lamp	85 % at 1000 h (88 % at 2000h and 70 % at 10000 h)	90 % at the minimum lamp life time

⁸ Available on www.eup4light.net

	envelope)	envelope)		
Number of switching cycles	as defined in EN lamp life test standards (e.g. for CFLi tests are with 2h45 on and 0h15 off cycle)	as defined in EN lamp life test standards (12000 if lamp starting time > 0.3 s)	as defined in EN life lamp test standards (20000 if lamp starting time > 0.3 s)	Unlimited with versions that have a start delay
Starting time	< 2,0 s	<2,0 s	< 1,0 s	< 0.2 s
Lamp warmup time to 60% Φ	1,0 s (120 s)	1,0s (60 s or <120 s if the diameter is less than 65 mm and length below 108 mm and has minimum 400 lm)	1,0s (60 s or <120 s if the diameter is less than 65 mm and length below 108 mm and has minimum 400 lm)	(15 s or 4 s for special mixed CFLi+HL lamps)
Lamp power factor	0.50	0.55	0.60	0.95 (0.65)
Maximum premature lamp failure rate	5,0%@100 h (2,0%@200 h)	2,0 % @ 100 h (1,0 %@ 200 h)	2,0 % @ 100 h (1,0 %@ 200 h)	
Maximum UVA+UVB⁹	2mW/kLm	2mW/kLm	2mW/kLm	

III.4. Benchmark on mercury content in lamps for general lighting

No particular provision is set here on the mercury content of lamps, as the provisions of the RoHS Directive (2002/95/EC) apply, where a maximum of 5 mg of mercury is allowed in compact fluorescent lamps.

For information, according to the domestic lighting preparatory study, the current benchmark value for mercury content of compact fluorescent lamps is 1 mg or less.

⁹ In line with the International Commission on Non-Ionizing Radiation Protection (<http://www.icnirp.de/>)

III.5. Requirements on luminaires for general lighting

Luminaires for general lighting shall be compatible only with the lamp caps referred to in Annex I.3 unless they are luminaires with integrated lamp (e.g. LED luminaires).

If options 1 or 2 of the **main Working Document** are selected, further luminaire requirements will be set:

Luminaires for general lighting shall not be manufactured with the following sockets:

- G9
- R7s, (unless the luminaire has a built-in presence detector and minimum ingress protection IP54)
- RX7s (unless the luminaire has an integrated HID lamp ballast)

Further requirements on luminaires (on e.g. luminaire efficiency) may be introduced in a later measure complementing this implementing measure, as explained above.

III.6. Requirements on wall-mounted lamp dimmers for general lighting

From Stage 1, wall-mounted lamp dimmers for general lighting shall be able to dim fluorescent lamps with integrated ballast

III.7. Requirement on waste of lamps, luminaires and wall-mounted lamp dimmers for general lighting

From Stage 1:

Lamps, luminaires and wall-mounted lamp dimmers for general lighting, without prejudice to good engineering practice and unless inappropriate for the intended use, be manufactured in such a way that the impact of their waste on the environment (in terms of points (j), (l), (m) in Annex I Part 1.3 of the Ecodesign Directive 2005/32/EC) is minimised, taking account of technical progress and the specific legislation on waste such as 2002/96/EC.

Improvements aiming to reduce the impact of their waste should not have a negative effect on their energy efficiency.