

## Annex 2

### **Working document on possible ecodesign requirements for fluorescent lamps without integrated ballast, for ballasts and luminaires used with these lamps, and on the conditions for the indication of suitability of lighting products for office lighting**

Subject matter .....	3
Recitals.....	3
Definitions.....	3
Ecodesign requirements .....	4
Information requirements for components and sub-assemblies.....	5
Conformity Assessment .....	5
Review .....	5
<b>Annex I Ecodesign requirements for fluorescent lamps without integrated ballast, and for ballasts and luminaires used with these lamps.....</b>	<b>6</b>
Exemptions .....	6
<i>I.1. Product information requirements for fluorescent lamps without integrated ballast .....</i>	<i>6</i>
<i>I.2. Requirements on lamp efficacy for fluorescent lamps without integrated ballast .....</i>	<i>7</i>
a.) Starting requirements .....	7
b.) Benchmarks for best products .....	10
<i>I.3. Requirements on the lamp lumen maintenance factor for fluorescent lamps without integrated ballast .....</i>	<i>10</i>
a.) Starting requirements .....	10
b.) Benchmarks for best products .....	10
<i>I.4. Requirement on mercury in fluorescent lamps without integrated ballast.....</i>	<i>11</i>
a.) Starting requirements .....	11
b.) Benchmarks for best products .....	11
<i>I.5. Product information requirements for ballasts used with fluorescent lamps without integrated ballast .....</i>	<i>11</i>
<i>I.6. Requirements on the efficiency of ballasts used with fluorescent lamps without integrated ballast .....</i>	<i>13</i>
a.) Starting requirements .....	13
b.) Staged requirements .....	13
c.) Benchmarks for best products.....	13
<i>I.7. Product information requirements for luminaires for fluorescent lamps without integrated ballast .....</i>	<i>13</i>
<i>I.8. Requirements on the light output ratio (LOR) of luminaires for fluorescent lamps without integrated ballast.....</i>	<i>15</i>
a.) Starting requirements .....	15
b.) Staged requirements .....	17
<i>I.9. Requirements on the energy performance of luminaires for fluorescent lamps without integrated ballast .....</i>	<i>17</i>
a.) Starting requirements .....	17

b.) Staged requirements .....	18
c.) Benchmarks for best products.....	18
<i>I.10. Requirement on waste of fluorescent lamps without integrated ballast, and luminaires and ballasts for such lamps .....</i>	<i>19</i>
<b>Annex II Ecodesign requirements setting the conditions for the indication of suitability of lighting products (of all types) for office lighting .....</b>	<b>20</b>
<i>II.1. Requirement on lamps indicated as "suitable for fixed lighting in office task areas" .....</i>	<i>20</i>
a.) Starting requirements .....	20
b.) Benchmarks for best products .....	20
<i>II.2. Requirements on ballasts indicated as "suitable for fixed lighting in office task areas" .....</i>	<i>20</i>
a.) Starting requirements .....	20
b.) Benchmarks for best products .....	21
<i>II.3. Requirements on luminaires indicated as "suitable for fixed lighting in office task areas" .....</i>	<i>21</i>
a.) Starting requirements .....	21
b.) Staged requirements .....	22
c.) Benchmarks for best products.....	23
<i>II.4. Requirement on waste of lamps, ballasts and luminaires indicated as "suitable for fixed lighting in office task areas" .....</i>	<i>24</i>
<b>Explanatory Notes.....</b>	<b>25</b>
Form of the implementing measure .....	25
Scope and interaction of the requirements.....	25
Dynamic requirements .....	26
Definitions.....	26
Market structure of the products covered by this IM.....	26
New luminaire categorisation systems.....	26
Impact on other legislation.....	26
Voluntary agreements .....	27
List of elements to be added later in the IM .....	27
<b>Detailed explanatory notes on the different parts of the Working Document .....</b>	<b>27</b>
<b>Annex I.....</b>	<b>27</b>
Exemptions: .....	27
<i>I.1. Product information requirements for fluorescent lamps without integrated ballast .....</i>	<i>27</i>
<i>I.2. Requirements on lamp efficacy for fluorescent lamps without integrated ballast .....</i>	<i>28</i>
<i>I.3. Requirements on the lamp lumen maintenance factor for fluorescent lamps without integrated ballast .....</i>	<i>28</i>
<i>I.4. Requirement on mercury in lamps for fluorescent lamps without integrated ballast .....</i>	<i>28</i>
<i>I.5. Product information requirements for ballasts used with fluorescent lamps without integrated ballast .....</i>	<i>29</i>
<i>I.6 Requirements on the efficiency of ballasts used with fluorescent lamps without integrated ballast .....</i>	<i>30</i>
<i>I.8. Requirements on the light output ratio (LOR) of luminaires for fluorescent lamps without integrated ballast.....</i>	<i>30</i>
<i>I.9. Requirements on the energy performance of luminaires for fluorescent lamps without integrated ballast .....</i>	<i>31</i>

## **Subject matter**

This implementing measure pursuant to Directive 2005/32/EC establishes eco-design requirements related to fluorescent lamps without integrated ballast, as well as for ballasts and luminaires manufactured for use with these lamps. In addition, the implementing measure sets the conditions for the indication of suitability of lighting products (of all types) for fixed lighting in office task areas.

## **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.

3. The implementing measure will be accompanied by a Commission Recommendation for complementary measures to national, regional and local authorities. In their building energy efficiency legislation and public procurement procedures, they will be encouraged to require for office buildings lighting products which have the indication "suitable for fixed lighting in office task areas" in their product documentation, conforming to the second paragraph under "Ecodesign requirements" below.

## **Definitions**

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

"fluorescent lamps without integrated ballast" shall include linear fluorescent lamps (LFL) and compact fluorescent lamps without integrated ballast (CFLni).

"office lighting" shall mean lighting products for fixed installation for office work intended to enable people to perform visual tasks efficiently and accurately, in its short form "fixed lighting for office task areas"

"lamp efficacy" ( $\eta_{\text{lamp}}$ ) shall mean the quotient of the luminous flux emitted by the lamp divided by the power consumed.

"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.

"lamp survival factor" (LSF) shall mean the fraction of the total number of lamps which continue to operate at a given time under defined conditions and switching frequency.

"ballast lumen factor" (BLF) shall mean the ratio of the luminous flux emitted by a reference lamp when operated with a particular production ballast (at the rated voltage of the ballast) to the luminous flux emitted by the same lamp when operated with its reference ballast (EN 12665 & CIE 121/1996)

"ballast efficiency" ( $\eta_{\text{ballast}}$ ) shall mean the ratio between the nominal lamp power and the total input power of the ballast-lamp circuit in standard conditions (EN 50294), corrected with the ballast lumen factor.  $\eta_{\text{ballast}} = \text{Lamp power} \times \text{BLF} / \text{total input power of ballast lamp circuit}$

"light output ratio" (LOR), "upward light output ratio" (ULOR) and "downward light output ratio" (DLOR) shall mean the ratio of respectively the total, upward and downward flux of the luminaire, measured with its own lamps and equipment, to the sum of the individual luminous fluxes of the same lamps when operated outside the luminaire with the same equipment.

"upward flux fraction" (UFF) and "downward flux fraction" (DFF) shall mean the ratios of respectively the upward and downward light output ratios of a luminaire to its light output ratio ( $\text{UFF} = \text{ULOR}/\text{LOR}$ ,  $\text{DFF} = \text{DLOR}/\text{LOR}$ )

"luminaire maintenance factor" (LMF) shall mean the ratio of the light output ratio of a luminaire at a given time to the initial light output ratio.

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

### **Ecodesign requirements**

1. The following products, regardless of the application for which they are intended, shall meet the ecodesign requirements set out in **Annex I**:

- a.) Fluorescent lamps without integrated ballast
- b.) Ballasts and luminaires manufactured for use with the lamps under a.)

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

2. If a lamp, luminaire or ballast of any type (including other than those mentioned under paragraph 1.) conforms to the requirements laid down in **Annex II**, the manufacturer may indicate in the product documentation that the product is "suitable for fixed lighting in office task areas".

### **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. Ballasts, 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 for ballasts incorporated in luminaires**

Where ballasts are placed on the market incorporated in luminaires, the 'CE' marking shall be affixed to the luminaires and their packaging.

### **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.

### **Amendments and repeals**

Directive 2000/55/EC is repealed and replaced by the provisions of the new IM.

### **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**

### **Ecodesign requirements for fluorescent lamps without integrated ballast, and for ballasts and luminaires used with these lamps**

#### **Exemptions**

The requirements in paragraphs I.1, I.2 and I.3 of this Annex shall not apply to the following lamps:

- Coloured lamps and lamps for special applications, i.e. lamps of which the chromaticity coordinates are located outside the tolerance zones for white lamps as defined in standard EN 60081, Annex D, fig. D.1, D.2, D.3, D.4, D.5 and D.6.
- Lamps with more than 90 % light output in a solid angle of  $2\pi$  (reflector lamps)
- Lamps with a diameter less than 0,8 T5 (e.g. T2)
- Lamps with an external ignition strip

The requirements in Annex I shall only apply to luminaires for lamps with an initial lamp lumen output above 1000 lm, or if the luminaire requires the use of more than one lamp, to those luminaires where the sum of the individual lamp lumen outputs is above 1000 lm.

The requirements in paragraphs I.7, I.8 and I.9 of this Annex shall not apply to the following luminaires:

- Medical application (IP 65)
- Vandal proof luminaires
- Adjustable luminaires
- Portable luminaires
- Emergency luminaires
- Hazardous area lighting (Ex-luminaires)

#### **I.1. Product information requirements for fluorescent lamps without integrated ballast**

One year after the implementing measure comes into force:

Product documentation accompanying fluorescent lamps without integrated ballast shall provide the following information:

- Lamp efficacy at 100h
- Lamp Lumen Maintenance Factor at 5000h, 10000h, 15000h and 20000h
- Lamp Survival Factor at 5000h, 10000h, 15000h and 20000h

It is recommended to include new Grades (A+, A++) complementary to the minimum label A under the household lamp energy labelling requirement 98/11/EC for fluorescent lamps without integrated ballasts (or rescale the existing levels). This will put a new benchmark level in terms of lamp efficacy.

Class A and Grade A requirement:  $W \leq 0,15 \sqrt{\Phi} + 0.0097 \Phi$

Class A and Grade A+ requirement:  $W \leq 0,11 \sqrt{\Phi} + 0.01 \Phi$

Class A and Grade A++ requirement:  $W \leq 0,07 \sqrt{\Phi} + 0.009 \Phi$

## **I.2. Requirements on lamp efficacy for fluorescent lamps without integrated ballast**

### **a.) Starting requirements**

One year after the implementing measure comes into force, fluorescent lamps without integrated ballast should have the following minimum efficacies:

*LFL type T8*

<b>LFL T8 Ra&lt;90 Tc &lt; 5000K</b>	<b>Minimum Lamp Efficacy (lm/W) @ optimum temperature (25°C)</b>	
<b>Lamp power (magn. ballast) (W)</b>	<b>Magnetic ballast (50Hz)</b>	<b>Electronic ballast (High Frequency))</b>
<b>≤15</b>	64	
<b>18</b>	75	82
<b>30</b>	80	
<b>36</b>	93	100
<b>≥58</b>	89	100

*LFL type T5, High Efficiency*

LFL T5 High Efficiency Ra<90 Tc < 5000K	Minimum Lamp Efficacy (lm/W) @ optimum temperature (35°C)	Minimum Lamp Efficacy (lm/W) (25°C)
Lamp power (W)		
≤14	95	86
21	99	90
28	102	93
≥35	103	94

*LFL type T5, High Output*

LFL T5 High Output Ra<90 Tc < 5000K	Minimum Lamp Efficacy (lm/W) @ optimum temperature (35°C)	Minimum Lamp Efficacy (lm/W) (25°C)
Lamp power (W)		
≤24	80	73
39	88	79
49	97	88
54	90	82
≥80	85	77

In the three tables above:

Ra is the colour rendering of the lamp

Tc is the colour temperature of the lamp

For lamps with **Tc ≥ 5000K**, the values have to be decreased by multiplying them with 0,92

For lamps with **Ra ≥ 90**, the values have to be decreased by multiplying them with 0,8.

For lamps that have an **external protective sleeve**, a derating factor of 0.95 shall be applied.

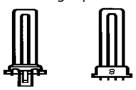
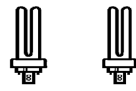
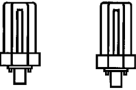

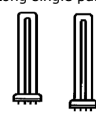


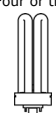
For **circular T5 lamps**, optimum temperature of 35°C is not achieved in luminaires and efficacy of circular lamps is lower; a derating factor of 0,85 shall be applied on the efficacy values @ 25°C.

All linear fluorescent lamps with other diameters, other lengths or other wattages (except those listed under the exemptions) should match at least the efficacy values for T8 lamps if they are under 60 W, and for high output T5 lamps if they are above 60 W. In case the lamp power is different, the efficacy should be interpolated between two adjacent power levels.



For CFL-ni @ optimum temperature (25°C)

Based on 100h Minimum Value IEC 60901 (90% of 100h initial)

Type	Small single parallel tube, lamp cap G23 (2 pin) or 2G7 (4pin)				Cap G23 (2pin) or 2G7 (4pin)				
Wattage	5	7	9	11					
nominal light output (lm) for Tc < 5000K (e.g. 827, 830, 835, 840)	250	400	600	900	Small single parallel tube				
nominal light output (lm) for Tc ≥ 5000K (e.g. 850, 865)	225	360	540	810					
minimum efficacy (lm/W) for Tc < 5000K (e.g. 827, 830, 835, 840)	45	51	60	74					
minimum efficacy (lm/W) for Tc ≥ 5000K (e.g. 850, 865)	41	46	54	66					
Type	Double parallel tubes, lamp cap G24d (2 pin) or G24q (4 pin)				Cap G24d (2pin) or G24q (4pin)				
Wattage	10	13	18	26					
nominal light output (lm) for Tc < 5000K (e.g. 827, 830, 835, 840)	600	900	1200	1710	Double parallel tubes				
nominal light output (lm) for Tc ≥ 5000K (e.g. 850, 865)	540	810	1080	1540					
minimum efficacy (lm/W) for Tc < 5000K (e.g. 827, 830, 835, 840)	54	62	60	59					
minimum efficacy (lm/W) for Tc ≥ 5000K (e.g. 850, 865)	49	56	54	53					
Type	Triple parallel tubes, lamp cap GX24d (2 pin) or GX24q (4 pin)							Cap GX24d (2pin) or GX24q (4pin)	
Wattage	13	18	26	32	42	57	70		
nominal light output (lm) for Tc < 5000K (e.g. 827, 830, 835, 840)	900	1200	1710	2400	3200	4300	5200	Triple parallel tubes	
nominal light output (lm) for Tc ≥ 5000K (e.g. 850, 865)	810	1080	1540	2160	2880	3870	4680		
minimum efficacy (lm/W) for Tc < 5000K (e.g. 827, 830, 835, 840)	62	60	59	68	69	68	67		
minimum efficacy (lm/W) for Tc ≥ 5000K (e.g. 850, 865)	56	54	53	61	62	61	60		
Type	Four parallel tubes, lamp cap GX24q (4 pin)							Cap GX24q (4pin)	
Wattage	57	70							
nominal light output (lm) for Tc < 5000K (e.g. 827, 830, 835, 840)	4300	5200						Four parallel tubes	
nominal light output (lm) for Tc ≥ 5000K (e.g. 850, 865)	3870	4680							
minimum efficacy (lm/W) for Tc < 5000K (e.g. 827, 830, 835, 840)	68	67							
minimum efficacy (lm/W) for Tc ≥ 5000K (e.g. 850, 865)	61	60							
Type	Long single parallel tube, lamp cap 2G11 (4 pin)							Cap 2G11 (4pin)	
Wattage	18	24	36	40	55	80			
nominal light output (lm) for Tc < 5000K (e.g. 827, 830, 835, 840)	1200	1800	2900	3300	4500	6000	Long single parallel tube		
nominal light output (lm) for Tc ≥ 5000K (e.g. 850, 865)	1080	1620	2610	2970	4050	5400			
minimum efficacy (lm/W) for Tc < 5000K (e.g. 827, 830, 835, 840)	60	68	73	74	74	68			
minimum efficacy (lm/W) for Tc ≥ 5000K (e.g. 850, 865)	54	61	65	67	66	61			
Type	4 legs in one plane, lamp cap 2G10 (4 pin)							Cap 2G10 (4pin)	
Wattage	18	24	36						
nominal light output (lm) for Tc < 5000K (e.g. 827, 830, 835, 840)	1100	1700	2800				4 legs in one plane		
nominal light output (lm) for Tc ≥ 5000K (e.g. 850, 865)	990	1540	2520						
minimum efficacy (lm/W) for Tc < 5000K (e.g. 827, 830, 835, 840)	55	64	70						
minimum efficacy (lm/W) for Tc ≥ 5000K (e.g. 850, 865)	50	58	63						
Type	Single flat plane tube, lamp cap GR8 (2 pin), GR10q (4 pin) or GRY10q3 (4 pin)							Cap GR8 (2 pin), GR10q (4pin) or GRY10q3 (4 pin)	
Wattage	10	16	21	28	38	55			
nominal light output (lm) for Tc < 5000K (e.g. 827, 830, 835, 840)	650	1050	1350	2050	2700	3200	Single flat bent tube		
nominal light output (lm) for Tc ≥ 5000K (e.g. 850, 865)	585	945	1215	1845	2430	2880			
minimum efficacy (lm/W) for Tc < 5000K (e.g. 827, 830, 835, 840)	59	59	58	66	64	52			
minimum efficacy (lm/W) for Tc ≥ 5000K (e.g. 850, 865)	53	53	52	59	58	47			
Type	Four or three parallel T5 tubes, lamp cap 2G8 (4 pin)							Cap 2G8 (4pin)	
Wattage	60	82	85	120					
nominal light output (lm) for Tc < 5000K (e.g. 827, 830, 835, 840)	4000	6150	6000	9000				Four or three parallel T5 tubes	
nominal light output (lm) for Tc ≥ 5000K (e.g. 850, 865)	3600	5535	5400	8100					
minimum efficacy (lm/W) for Tc < 5000K (e.g. 827, 830, 835, 840)	60	68	64	68					
minimum efficacy (lm/W) for Tc ≥ 5000K (e.g. 850, 865)	54	61	57	61					

In case the lamp power is different, the efficacy should be interpolated between two adjacent power levels.

All compact fluorescent lamps with non integrated ballast with other forms, other diameters, other lengths or other wattages should match at least the efficacy values as mentioned in the table below:

For other CFLni-types @ optimum temperature (25°C)

CFLni Ra<90 Tc < 5000K	Minimum Lamp Efficacy (lm/W) (25°C)
Lamp power (W)	
≤5	45
7	51
9	60
11	74
55	74
≥120	68

In case the lamp power is different, the efficacy should be linear interpolated between two adjacent power levels or have level of 5W when the lamp power is ≤5 W or of 120 W when it is ≥120 W.

#### b.) Benchmarks for best products

Grade A++ according to the formula in I.1.

### **I.3. Requirements on the lamp lumen maintenance factor for fluorescent lamps without integrated ballast**

#### a.) Starting requirements

One year after the implementing measure comes into force:

Fluorescent lamps without integrated ballast should have the following lamp lumen maintenance factors:

Burning hours	5000	10000	15000	20000
Lamp types				
Linear Fluorescent lamps	0.92	0.90	0.90	0.90
Compact Fluorescent lamps, non integrated	0.91	0.87	0.85	

#### b.) Benchmarks for best products

There are no better fluorescent lamps currently available on the market compared to the starting requirements, therefore those requirements are also the benchmarks.

#### **I.4. Requirement on mercury in fluorescent lamps without integrated ballast**

##### **a.) Starting requirements**

One year after the implementing measure comes into force:

Fluorescent lamps without integrated ballast should have a maximum concentration level of 0.2 milligrams of leachable mercury per liter of extract fluid, measured with a method equivalent to the measurement method "Toxicity Characteristic Leaching Procedure" (US Environmental Protection Agency). [method to be copied into an Annex of the IM, for more information: <http://www.epa.gov/sw-846/pdfs/1311.pdf>]

Recommendation for the next RoHS exemptions review: maximum lamp mercury in fluorescent lamps without integrated ballast shall be 2 mg.

##### **b.) Benchmarks for best products**

There is no evidence available on the best levels achievable in respect to leachable mercury.

The lowest mercury content in currently available fluorescent lamps without integrated ballast is 1,4 mg.

#### **I.5. Product information requirements for ballasts used with fluorescent lamps without integrated ballast**

One year after the implementing measure comes into force:

An energy efficiency index (EEI) class dependent on the ratio of the nominal lamp power to the total input power of the ballast-lamp circuit shall be affixed in a non-detachable form to ballasts for fluorescent lamps without integrated ballast, and indicated on their packaging, as well as in the product documentation. The EEI class shall be determined according to the table below.

Where ballasts are placed on the market incorporated in luminaires, the EEI class shall be affixed to the luminaires and indicated on their packaging, as well as in the product documentation.

For ballasts operating multiple lamps, the corresponding efficiency requirement will be the one applicable to the total power of the operated lamps.

Multi-wattage ballasts shall be classified according to their efficiency under the highest wattage with which they are compatible.

Note that the equivalence of former CELMA EEI categories B2 and B1 with the new categories D and C is not total, as for lamps below 13 W and for the 15 W lamp category, more ambitious values are proposed than currently. Otherwise, the values for other lamp wattages under B2 / D and B1 / C still correspond.

			Directive 2000/55/EC		Old CELMA EEI categories										
			class	B2		B1		A2		(BAT)		A1		(BAT)	
power			New EC minimum requirements (D) and EEI categories												
50Hz lamp	HF lamp	W input	class	D	$\eta_D$	C	$\eta_C$	B-n	$\eta_{B-n}$	A-n	$\eta_{A-n}$	B-d	$\eta_{B-d}$	A-d	$\eta_{A-d}$
0,95	1		BLF	50Hz 0,95		50Hz 0,95		HF 1		HF 1		HF 1		HF 1	
4	3,4			5,8	0,65	5,6	0,68	5,2	0,65	5,0	0,68	5,2	0,65	5,0	0,68
5	4,5			7,3	0,65	7,0	0,68	6,9	0,65	6,6	0,68	6,9	0,65	6,6	0,68
6	5,1			8,8	0,65	8,4	0,68	7,8	0,65	7,5	0,68	7,8	0,65	7,5	0,68
7	6,5			10,2	0,65	9,8	0,68	9	0,72	8,6	0,75	10	0,65	9,6	0,68
8	6,7			11,7	0,65	11,2	0,68	11	0,65	10,6	0,68	10	0,65	9,9	0,68
9	8			13,2	0,65	12,6	0,68	11	0,73	10,6	0,76	12	0,67	11,5	0,69
10	9	16		14,6	0,65	14,0	0,68	11	0,82	10,6	0,85	14	0,69	13,4	0,72
10	9,5	16		14,6	0,65	14,0	0,68	11	0,86	10,6	0,90	14	0,73	13,4	0,76
11	11			16,1	0,65	16,0	0,65	14	0,79	13,4	0,82	16	0,73	15,4	0,76
13	11,8			19,0	0,65	17,0	0,73	15	0,79	14,4	0,82	17	0,74	16,3	0,77
13	12,5	19		19,0	0,65	17,0	0,73	14	0,89	13,4	0,93	17	0,78	16,3	0,81
15	13,5	23		21,9	0,65	21,0	0,68	16	0,84	15,4	0,88	21	0,75	20,2	0,78
16	14	23		23,0	0,66	21,0	0,72	17	0,82	16,3	0,86	21	0,74	20,2	0,77
	14							17	0,82	16,3	0,86	0	0,74	0,0	0,77
18	16	26		26,0	0,66	24,0	0,71	19	0,84	18,2	0,88	24	0,76	23,0	0,79
18	16,5	26		26,0	0,66	24,0	0,71	19	0,87	18,2	0,90	24	0,79	23,0	0,82
21	19	29		29,0	0,69	27,0	0,74	22	0,86	21,1	0,90	27	0,79	25,9	0,82
	21							24	0,88	23,0	0,91	26	0,81	25,0	0,84
22	19			30	0,70	28,0	0,75	22	0,86	21,1	0,90	28	0,79	26,9	0,82
	22							26	0,85	25,0	0,88	28	0,79	26,9	0,82
24	22	32		32	0,71	30	0,76	25	0,88	24,0	0,92	30	0,81	28,8	0,85
26	24	34		34	0,73	32	0,77	27	0,89	25,9	0,93	32	0,83	30,7	0,86
	24							26	0,92	25,0	0,96	28	0,86	26,9	0,89
28	25	36		36	0,74	34	0,78	29	0,86	27,8	0,90	34	0,81	32,6	0,84
30	24	38		38	0,75	36	0,79	31	0,77	29,8	0,81	36	0,73	34,6	0,76
	28							32	0,88	30,7	0,91	34	0,82	32,6	0,86
32	30			40	0,76	38	0,80	35	0,86	33,6	0,89	38	0,81	36,5	0,84
36	32	43		43	0,80	41	0,83	36	0,89	34,6	0,93	41	0,84	39,4	0,88
38	32	45		45	0,80	43	0,84	38	0,84	36,5	0,88	43	0,80	41,3	0,83
	32							36	0,89	34,6	0,93	39	0,82	37,4	0,85
38	34	45		45	0,80	43	0,84	38	0,89	36,5	0,93	43	0,85	41,3	0,89
	35							39	0,90	37,4	0,93	42	0,83	40,3	0,87
	39							43	0,91	41,3	0,93	46	0,85	44,2	0,88
	40							45	0,89	43,2	0,93	48	0,83	46,1	0,87
	49							55	0,89	52,8	0,93	58	0,84	55,7	0,88
40	32			48	0,79	46	0,83	37	0,86	35,5	0,90	46	0,82	44,2	0,85
	40							45	0,89	43,2	0,93	48	0,83	46,1	0,87
	42							47	0,89	45,1	0,93	50	0,84	48,0	0,88
58	50	67		67	0,82	64	0,86	55	0,91	52,8	0,93	64	0,85	61,4	0,88
	54							60	0,90	57,6	0,93	63	0,86	60,5	0,89
	55							61	0,90	58,6	0,93	65	0,85	62,4	0,88
	55							61	0,90	58,6	0,93	65	0,85	62,4	0,88
	57							63	0,90	60,5	0,93	67	0,85	64,3	0,89
	60							66	0,91	63,4	0,93	70	0,86	67,2	0,89
70	60	80		80	0,83	77	0,86	68	0,88	65,3	0,92	77	0,83	73,9	0,87
	63							70	0,90	67,2	0,93	75	0,84	72,0	0,88
	70							77	0,91	73,9	0,93	82	0,85	78,7	0,89
	80							88	0,91	84,5	0,93	92	0,87	88,3	0,91
	80							88	0,91	84,5	0,93	92	0,87	88,3	0,91
	87							96	0,91	92,2	0,93	103	0,84	98,9	0,88
	95							105	0,90	100,8	0,93	113	0,84	108,5	0,88
	120							133	0,90	127,7	0,93	142	0,85	136,3	0,88
	122							135	0,90	129,6	0,93	144	0,85	138,2	0,88

## **I.6. Requirements on the efficiency of ballasts used with fluorescent lamps without integrated ballast**

### **a.) Starting requirements**

One year after the implementing measure comes into force:

Ballasts for fluorescent lamps without integrated ballast shall have an Energy Efficiency Index Class of at least D according to Annex I.5.

In addition, the power consumption of ballasts for fluorescent lamps without integrated ballast shall not exceed 1.0 W when the lamps they are operating do not emit any light (<1 %).

### **b.) Staged requirements**

Three years after the implementing measure comes into force, the power consumption of ballasts used with fluorescent lamps without integrated ballast shall not exceed 0.5 W when the lamps they are operating do not emit any light (<1 %).

### **c.) Benchmarks for best products**

Ballasts belonging to EEI class A-n and A-d in the EEI table in Annex I.5, and having a power consumption not exceeding 0.5 W when the lamps they are operating do not emit any light (<1 %).

## **I.7. Product information requirements for luminaires for fluorescent lamps without integrated ballast**

One year after the implementing measure comes into force:

The following information shall be supplied for all luminaires for fluorescent lamps without integrated ballast:

In the product documentation:

- Ballast efficiency (ratio between the nominal lamp power and the total input power of ballast lamp-circuit according to standard EN 50294) and ballast energy efficiency class according to Annex I.5.
- Lamp efficacy (lm/W) of the recommended lamp
- Other information as appropriate on the recommended lamp and ballast
- CEN flux code as defined in EN 13032-2.
- Luminaire Efficacy Rating  
 $LER = LOR \times \eta_{ballast} \times \eta_{lamp}$   
*where*  
LOR is the luminaire light output ratio (CEN Flux code N5) in standard working

conditions (25 °C).

$\eta_{ballast}$  is the ballast efficiency of the recommended ballast

$\eta_{lamp}$  is the lamp efficacy in standard working conditions (25 °C) of the recommended lamp

- Luminaire Efficacy Rating corrected:

$$LER_c = LOR_x(DFF+0.5UFF) \times \eta_{ballast} \times \eta_{lamp}$$

where

DFF is the downward light flux fraction (CEN Flux code N4)

UFF is the upward light flux fraction (CEN Flux code N9)

the other parameters are those under the Luminaire Efficacy Rating

- If applicable, a warning message that no dimming ballast or light output control is incorporated into the luminaire.
- For luminaires operated with T5 lamps, influence of the air flows on ambient temperature should be given. If the luminaire is suitable to be built-in in ceilings where ventilation and air-conditioning are combined, this should be indicated.
- For all luminaires excluding the so-called 'bare batten' or 'strip' luminaires that belong to the proposed lighting distribution class DI-W, applicable luminaire maintenance factor (LMF) value data shall be provided with cleaning instructions if needed up to 4 years. If this data is not available it should be indicated that the luminaires are not suitable for applications where maintained illuminance is specified, in accordance to EN 12464-1(2004). The LMF specification shall be done according to CIE 97 (2007) on 'The maintenance of indoor lighting systems', using a similar table:

LMF values	cleaning intervals						
Environment	(year)						
	1,0	1,5	2,0	2,5	3,0	3,5	4,0
Very Clean							
Clean							
Normal (optional)							
Dirty (optional)							

- Lamp and ballast replacement instructions.
- Disassembly instructions

On the product itself (in a non-detachable form) and on its packaging:

- Luminaire type according to the table in I.7: LTxx;
- Model and product number to find all technical data in the manufacturers catalogue (printed or electronic on internet) without password or manufacturer interference.

- Luminaire light distribution class indicator according to the following table, in the format "LDC = D-W";

class code indicator	LVK class example	Name	beam	CEN flux code								
				N1	N2	N3	N4	N5	N6	N7	N8	N9
D-W	A10-A32	Direct lighting	wide	NA	≤0.9	>0.9	>0.9	NA	NA	NA	NA	NA
D-M	A40-A44	direct lighting	medium	≤0.9	>0.9	NA	>0.9	NA	NA	NA	NA	NA
D-N	A50-A80	direct lighting	narrow	>0.9	NA	NA	>0.9	NA	NA	NA	NA	NA
DI-W	B21-B22	direct with indirect lighting.	wide	NA	≤0.9	>0.9	≥0.5 <0.9	NA	NA	NA	NA	NA
DI-M	B31-B33	direct with indirect lighting	medium	≤0.9	>0.9	NA	≥0.5 <0.9	NA	NA	NA	NA	NA
DI-N	B41-B63	direct with indirect lighting	narrow	>0.9	NA	NA	≥0.5 <0.9	NA	NA	NA	NA	NA
ID-W	C11-C33	indirect with direct lighting.	wide	NA	≤0.9	>0.9	≥0.1 <0.5	NA	NA	NA	NA	NA
ID-M	C42-C63	indirect with direct lighting	medium	≤0.9	>0.9	NA	≥0.1 <0.5	NA	NA	NA	NA	NA
I-M	D11-D63	indirect lighting	medium	NA	NA	NA	≤0.1	NA	NA	>0.9	NA	NA
I-W	E02-E73	indirect lighting	wide	NA	NA	NA	≤0.1	NA	NA	≤0.9	>0.9	NA

The effectiveness of this Luminaire light distribution class indicator system shall be evaluated 18 months after its introduction.

### **I.8. Requirements on the light output ratio (LOR) of luminaires for fluorescent lamps without integrated ballast**

#### **a.) Starting requirements**

One year after the implementing measure comes into force:

For all luminaires for fluorescent lamps without integrated ballast, the minimum light output ratios are defined by the following table:

LOR (light output ratio) values		Direct (D)			direct-indirect (C)			indirect (I)		
		<i>D</i>			<i>C</i>			<i>I</i>		
		Downlights			Up/down lights			Uplights		
		flux > 90% downwards			flux between 90% and 10% down			flux < 10% down		
Recommended lamp type and power →		All T8, CFLni ≥ 25 W	All T5	CFLni < 25 W	All T8, CFLni ≥ 25 W	All T5	CFLni < 25 W	All T8, CFLni ≥ 25 W	All T5	CFLni < 25 W
Code	Luminaire type ↓									
LT01	bare lamp, no optics	no	no	no	0.85	0.94	0.85	no	no	no
LT02	Open, with reflector	0.60	0.66	0.40	0.70	0.77	0.60	0.75	0.83	0.65
LT03	Open, with asymmetric reflector	0.65	0.72	0.35	no	no	no	0.60	0.66	0.55
LT04	Open, with louver (lamellas, crossblades)	0.40	0.44	0.30	0.60	0.66	0.50	0.75	0.83	0.65
LT05	Open, with double parabolic optic	0.60	0.66	0.35	0.70	0.77	0.50	no	no	no
LT06	Open, other types	0.40	0.44	0.30	0.60	0.66	0.50	0.60	0.66	0.55
LT07	Closed, with transparent optic (IP5x)	0.55	0.61	0.45	0.65	0.72	0.55	0.75	0.83	0.60
LT08	Closed, with diffuser optic (> 70 mm width)	0.50	0.55	0.30	0.70	0.77	0.50	0.75	0.83	0.55
LT09	Closed, with diffuser optic (< 70 mm width)	0.40	0.44	no	no	no	no	no	no	no
LT10	Closed, with prismatic optic	0.55	0.61	0.35	0.65	0.72	0.55	0.75	0.83	0.55
LT11	Closed, with multi optical parts	0.55	0.61	0.40	0.65	0.72	0.55	0.75	0.83	0.55
LT12	Closed, other types	0.40	0.44	0.30	0.65	0.72	0.50	0.75	0.83	0.55



The columns for T5 lamps (FL5) are the values applicable if the luminaire is built to operate with a High Efficiency lamp. Values applicable to luminaires built to operate with High Output lamps are obtained by applying the following formula to the current values:  $LOR_{HO} = 1,1 \times LOR_{FL5}$

The effectiveness of the luminaire categorisation and the related minimum LOR requirements in the table above shall be evaluated 18 months after its introduction.

## b.) Staged requirements

Three years after the implementing measure comes into force:

For all luminaires for fluorescent lamps without integrated ballast, the minimum light output ratios shall not be lower than 0.50.

## I.9. Requirements on the energy performance of luminaires for fluorescent lamps without integrated ballast

### a.) Starting requirements

One year after the implementing measure comes into force:

Luminaires for fluorescent lamps without integrated ballast shall be built for ballasts with an energy efficiency index of at least B, except the luminaires and lamp wattages indicated in the table below:

Luminaire type	Minimum ballast efficiency
Luminaires with bare lamp, no optic (LT01), with LFL or CFLni up to 36 W	D
Plastic luminaires with ingress protection grade at least IP4X (waterproof luminaires) (LT07)	C
Luminaires for lamps $\leq 18W$	C

The minimum Luminaire Efficacy Rating of luminaires for fluorescent lamps without integrated ballast is determined in the following table:

Light Distribution Class	LER	LER
	total lamp luminous flux $\Phi$ at 25 °C $\geq 2000$ lm [lm/W]	total lamp luminous flux $\Phi$ at 25 °C < 2000 lm [lm/W]
D-W	50	30
D-M	45	25
D-N	45	25
DI-W	60	40
DI-M	55	40
DI-N	50	40
ID-W	60	40
ID-M	60	40
I-M	55	40
I-W	45	40

In addition, the power consumption of luminaires for fluorescent lamps without integrated ballast shall not exceed the sum of the power consumption of the incorporated ballasts when the lamps they are operating do not emit any light (<1 %).

### b.) Staged requirements

Three years after the implementing measure comes into force:

Luminaires for fluorescent lamps without integrated ballast shall be built for ballasts with an energy efficiency index of at least B and shall be dimmable, except the luminaires indicated in the table below:

Luminaire type	Minimum ballast efficiency
Luminaires with bare lamp, no optic (LT01), for 18 W LFL or 36 LFL	D
Plastic luminaires with ingress protection grade at least IP4X (waterproof luminaires, LT07)	C

The minimum Luminaire Efficacy Rating of luminaires for fluorescent lamps without integrated ballast is determined in the following table:

Light Distribution Class	LER	LER
	total lamp luminous flux $\Phi$ at 25 °C $\geq$ 2000 lm [lm/W]	total lamp luminous flux $\Phi$ at 25 °C < 2000 lm [lm/W]
D-W	55	35
D-M	50	30
D-N	50	30
DI-W	65	45
DI-M	60	45
DI-N	55	45
ID-W	65	45
ID-M	65	45
I-M	60	45
I-W	50	45

In addition, the power consumption of luminaires built for fluorescent lamps without integrated ballast shall not exceed the sum of the power consumption of the incorporated ballasts, which shall not be more than 3 W, when the lamps they are operating do not emit any light (<1 %).

Raising the LER values by further 5 lm/W will be considered during the next review of the IM.

### c.) Benchmarks for best products

The most efficient luminaires for fluorescent lamps without integrated ballast are built for ballasts with an energy efficiency index of at least A and are dimmable. Their power consumption does not exceed 0.5 W when the lamps they are operating do not emit any light (<1 %).

They have the following Luminaire Efficacy Rating:

Light Distribution Class	LER total lamp luminous flux $\Phi$ at 25 °C $\geq$ 2000 lm [lm/W]	LER total lamp luminous flux $\Phi$ at 25 °C < 2000 lm [lm/W]
D-W	75	45
D-M	70	50
D-N	65	50
DI-W	80	60
DI-M	80	60
DI-N	75	60
ID-W	80	60
ID-M	75	60
I-M	75	60
I-W	70	60

#### **I.10. Requirement on waste of fluorescent lamps without integrated ballast, and luminaires and ballasts for such lamps**

One year after the implementing measure comes into force:

Fluorescent lamps without integrated ballast, and luminaires and ballasts for such lamps, 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.

## **Annex II**

### **Ecodesign requirements setting the conditions for the indication of suitability of lighting products (of all types) for office lighting**

Manufacturers who wish to include the indication "suitable for fixed lighting in office task areas" in the documentation of their lighting products (regardless of the technology used) shall ensure that their products respond to the following requirements.

If fluorescent lamps without integrated ballast and ballasts and luminaires operated with such lamps are indicated as "suitable for fixed lighting in office task areas", the Annex II requirements shall take precedence where they overlap with the requirements in Annex I. Where the Annex II requirements are complementary, both the Annex I and II requirements shall apply.

#### **II.1. Requirement on lamps indicated as "suitable for fixed lighting in office task areas"**

##### **a.) Starting requirements**

When the implementing measure comes into force:

For lamps having the indication "suitable for fixed lighting in office task areas" in their documentation, the minimum efficacy should match Label A according to the calculation method in Annex IV of Directive 98/11/EC. If these lamps are fluorescent lamps without integrated ballast, they should match at least grade A ++ according to Annex I.1 of the implementing measure.

These lamps should have the following lamp lumen maintenance factors (LLMF):

<b>Burning hours</b>	<b>5000</b>	<b>10000</b>	<b>15000</b>
<b>LLMF</b>	0.91	0.87	0.85

In addition, these lamps shall be dimmable to at least 30 % of their full power.

##### **b.) Benchmarks for best products**

There are no outstanding office lighting lamps currently available compared to the starting requirements, therefore the benchmarks are the same as the minimum requirements.

#### **II.2. Requirements on ballasts indicated as "suitable for fixed lighting in office task areas"**

##### **a.) Starting requirements**

When the implementing measure comes into force:

Ballasts having the indication "suitable for fixed lighting in office task areas" in their documentation shall have an energy efficiency index A according to Annex I.5 and shall be dimmable.

**b.) Benchmarks for best products**

There are no outstanding office lighting ballasts currently available compared to the starting requirements, therefore the benchmarks are the same as the minimum requirements.

**II.3. Requirements on luminaires indicated as "suitable for fixed lighting in office task areas"**

**a.) Starting requirements**

When the implementing measure comes into force:

Luminaires having the indication "suitable for fixed lighting in office task areas" in their documentation shall have a corrected Luminaire Efficacy Rating (LERc, see Annex I.7) according to the following tables.

*Luminaires with total lamp luminous flux ( $\Phi@25\text{ °C} \geq 2000\text{ lm}$ )*

Luminaire light distribution class indicator	<b>LERc</b>
D-W	64
D-M	59
D-N	54
DI-W	58
DI-M	54
DI-N	49
ID-W	39
ID-M	34
I-M	30
I-W	33

*Luminaires with total lamp luminous flux ( $\Phi@25\text{ }^{\circ}\text{C} < 2000\text{ lm}$ )*

Luminaire light distribution class indicator	LERc
D-W	54
D-M	49
D-N	45
DI-W	48
DI-M	45
DI-N	41
ID-W	33
ID-M	28
I-M	25
I-W	27

For luminaires relying on non fluorescent lamp technology where the LERc formula of Annex I.7 cannot be applied, LERc should be calculated as follows:

$$\text{LERc} = \text{DFF} \times \text{LER} + 0.5 \times \text{UFF} \times \text{LER}$$

where

LER = total luminaire lumen output (working conditions 25 °C)/total input power

DFF is the downward light flux fraction (CEN Flux code N4)

UFF is the upward light flux fraction (CEN Flux code N9)

The light distribution class should be determined as explained in Annex I.7.

In many new types, the LER is same as the lamp efficacy if it is a directional light source.

Luminaires having the indication "suitable for fixed lighting in office task areas" shall have a luminaire maintenance factor LMF > 0.95 in normal office pollution degrees (as determined in CIE 97) with a cleaning cycle of 4 years.

In addition, these luminaires shall be compatible with lighting control systems offering the following features:

- presence detection
- light responsive dimming (for daylight and/or room reflectance variations)
- dimming to compensate for luminaire pollution, changes in room surface reflection over time (e.g. change in brightness of carpet, furniture, ..) and changes over illumination requirements of the area (e.g. to switch from task area illumination requirements to surrounding illumination area).

The compatibility can also be ensured by incorporating the appropriate components in the luminaires themselves.

The compatibility or the features offered by the incorporated components shall be indicated in the luminaire's product documentation.

### **b.) Staged requirements**

Three years after the implementing measure comes into force:

Luminaires having the indication "suitable for fixed lighting in office task areas" in their documentation shall have a corrected Luminaire Efficacy Rating (LERc, see Annex I.7) according to the following tables.

*Luminaires with total lamp luminous flux ( $\Phi@25\text{ }^{\circ}\text{C} \geq 2000\text{ lm}$ )*

Luminaire light distribution class indicator	<b>LERc</b>
D-W	68
D-M	63
D-N	58
DI-W	60
DI-M	58
DI-N	53
ID-W	43
ID-M	38
I-M	33
I-W	35

*Luminaires with total lamp luminous flux ( $\Phi@25\text{ }^{\circ}\text{C} < 2000\text{ lm}$ )*

Luminaire light distribution class indicator	<b>LERc</b>
D-W	57
D-M	53
D-N	48
DI-W	50
DI-M	48
DI-N	44
ID-W	36
ID-M	32
I-M	28
I-W	29

**c.) Benchmarks for best products**

For luminaires having the indication "suitable for fixed lighting in office task areas" in their documentation, the current best technology have a corrected Luminaire Efficacy Rating (LERc, see Annex I.7) according to the following tables.

*Luminaires with total lamp luminous flux ( $\Phi@25\text{ }^{\circ}\text{C} \geq 2000\text{ lm}$ )*

Luminaire light distribution class indicator	LERc
D-W	75
D-M	70
D-N	65
DI-W	65
DI-M	65
DI-N	60
ID-W	50
ID-M	45
I-M	40
I-W	40

*Luminaires with total lamp luminous flux ( $\Phi@25\text{ }^{\circ}\text{C} < 2000\text{ lm}$ )*

Luminaire light distribution class indicator	LERc
D-W	63
D-M	59
D-N	55
DI-W	55
DI-M	55
DI-N	50
ID-W	42
ID-M	38
I-M	34
I-W	34

**II.4. Requirement on waste of lamps, ballasts and luminaires indicated as "suitable for fixed lighting in office task areas"**

When the implementing measure comes into force:

Lamps, ballasts and luminaires having the indication "suitable for fixed lighting in office task areas" in their documentation, without prejudice to good engineering practice and unless inappropriate for the intended use, shall 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.



## **Explanatory Notes**

The purpose of the implementing measure – in the following abbreviated as "IM" – is to set ecodesign requirements related to fluorescent lamps without integrated ballast, as well as for ballasts and luminaires manufactured for use with these lamps. In addition, the IM sets the conditions for the indication of suitability of lighting products (of all types) for office lighting. The IM is meant to contribute to achieving the requirements of Article 16 of Directive 2005/32/EC in relation to "lighting in the tertiary sector".

### **Form of the implementing measure**

The intention is to give to the implementing measure the form of a directly applicable decision or regulation.

### **Scope and interaction of the requirements**

This working document builds on the Preparatory study for Ecodesign Requirements on Office Lighting<sup>1</sup>. Although the study concentrated on the characteristics of lighting equipment installed in offices, it came to the conclusion that some of the recommended improvements were applicable to the concerned lighting products independently from their application area. Consequently, this working document proposes some ecodesign requirements applicable to all fluorescent lamps without integrated ballast, and to ballasts and luminaires used with such lamps.

On the other hand, some other identified product-level improvement options are only implementable in office lighting applications, as in other applications they would not be appropriate. Also, it would be beneficial to ensure that all lighting products installed in offices, regardless of their technology, conform to minimum performance requirements. However, under the Ecodesign Directive, it is impossible to impose requirements on how the products are installed and maintained after the manufacturer has placed them on the market.

This IM would bring a solution to the problem by setting up the possibility for a voluntary "suitable for fixed lighting in office task areas" indication in the product documentation of any lighting product. Manufacturers wishing to include this indication (comparable to a quality label) would have to comply with some office lighting specific product level requirements. The IM would not require manufacturers to include this indication, however further installation level measures outside the framework of the Ecodesign Directive (at local, national or even EU level if appropriate) could in the future. Already now the Commission would recommend complementary measures to national, regional and local authorities: in their building energy efficiency legislation and public procurement procedures, they would be encouraged to require for office buildings lighting products which have the indication "suitable for fixed lighting in office task areas" in their product documentation.

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<sup>1</sup> By VITO, April 2007, available on [www.eup4light.net](http://www.eup4light.net)

## **Dynamic requirements**

In addition to the starting requirements applicable one year after the entry into force of the IM, further requirements are proposed for many of the product aspects, to be introduced in a staged approach, in order to create a dynamic incentive to improve the products. The benchmarks on best products provided in the measure also serve the same purpose: although indicative, they represent the best technology available currently towards which manufacturers should strive, as they may become requirements at the next review of the IM.

## **Definitions**

For luminaires, the scope is restricted either by the individual lumen output of the lamps that go into them (>1000 lm), which is appropriate for fluorescent lamps without integrated ballast, or by the total lumen output of the incorporated lamps (which is appropriate for LEDs, and relevant only in Annex II).

## **Market structure of the products covered by this IM**

In the fluorescent lamps without integrated ballast market, the luminaires are manufactured for particular lamp types and powers, and the particular ballasts that go with these lamps. This means that through requirements put on a given luminaire, it is possible to affect the market for corresponding lamp and ballast types too. This IM makes use of this possibility in several provisions (Annex I.9, II.3), while setting requirements also on lamps and ballasts when they are sold individually.

## **New luminaire categorisation systems**

As explained in the preparatory study (pages 184-188), currently there exists no internationally accepted and simple system for the categorisation of luminaires. Annex I.7 sets up such a system of luminaire categorisation according to their light distribution classes, and used for the minimum luminaire efficacy requirements in Annex I.9 and Annex II.3. On the other hand, CELMA have proposed a categorisation by type of luminaire, which is taken up for the luminaire output ratio requirements in Annex I.8. The advantages and drawbacks of both systems are subject to further examination.

## **Impact on other legislation**

Some of the proposed requirements may have to be implemented through other existing legislation: the RoHS Directive (2002/95/EC), the Energy Labelling of Household Lamps Directive (98/11/EC), the directive setting minimum energy efficiency requirements on ballasts for fluorescent lamps (2000/55/EC). The first two are legally independent of the Ecodesign framework, so proposals to adopt measures under them would have to be made separately. Directive 2000/55/EC declared an implementing measure of the Ecodesign Directive (see Article 21 of 2005/32/EC). It will be repealed through this IM and its provisions replaced by the provisions on ballasts contained in this IM.

## Voluntary agreements

No voluntary agreement has been put forward by industry.

## List of elements to be added later in the IM

- Recitals
- Applicable measurement standards or measurement methods to be applied
- Formal clauses of the IM (entry into force etc.)

## Detailed explanatory notes on the different parts of the Working Document

### Annex I

#### Exemptions:

##### Lamps:

Type	Explanation
Coloured lamps and lamps for special applications, i.e. lamps of which the chromaticity coordinates are located outside the tolerance zones for white lamps as defined in standard EN 60081, Annex D, fig. D.1, D.2, D.3, D.4, D.5 and D.6.	Not suited for general lighting applications, justified special performance requirements not comparable to requirements on general lighting, small market share
Lamps with more than 90 % light output in a solid angle of $2\pi$ (reflector lamps)	An approach on reflector lamps will be investigated under domestic lighting
Lamps with a diameter less than 0,8 T5 (e.g. T2)	Mainly used in displays and signs, not suited for general lighting applications, justified special performance requirements not comparable to requirements on general lighting
Lamps with an external ignition strip	Lamps used in cold environmental temperatures, justified special performance requirements

Note that requirements on leachable mercury content still apply to these lamps.

##### Luminaires:

The list is based on one provided by CELMA. Some exemptions were removed from their original proposal, as they were overlapping with entire table categories or seemed to create big loopholes. The other definitions may need to be refined as well at a later stage.

### **I.1. Product information requirements for fluorescent lamps without integrated ballast**

The combination of LSF, LLMF and Luminaire Maintenance Factor is necessary to optimize the maintenance period on order to achieve the minimum operating costs.

## **I.2. Requirements on lamp efficacy for fluorescent lamps without integrated ballast**

Common minimum requirements are set within the LFL lamp group and within the CFLni lamp group. In addition, more ambitious requirements are introduced on specific lamp types within the two groups. For some of these types, minimum requirements are set at levels that a given type cannot fulfil currently at that lamp power. The reason for this is the wide interchangeability of the numerous existing lamp types – for the same functionality a similar but more efficient lamp type can be chosen by the designers instead, with little sacrifice on the design side. In other cases efficacy values are also given at lamp powers that do not exist yet (as for the lower and higher end of T5 ranges) – if ever they are introduced, they should not be an excuse for lower efficacy, or other existing alternatives should be used.

For some special lamps, correction factors are introduced based on colour rendering, colour temperature or certain design features.

The benchmarks set at Grade A++ level can only be met by high efficiency T5 lamps and 36 W T8 lamps.

The benchmarks set at Grade A+ level can also be met by high output T5 lamps, all T8 lamps and some CFLni.

Class A remains equal to the current levels in the labelling directive.

The Grade (A, A+, A++) depends strongly on the shape of fluorescent lamps, and the shape of the lamp often has to fit with the luminaires. As a consequence the use of these lamps might be affected by future luminaire efficacy requirements. Banning lower grade fluorescent lamps cannot be done without affecting the availability of retrofit lamps for existing luminaires and is currently therefore not considered.

For fluorescent lamps the maximum efficacy ( $\Phi/W$ ) can only be obtained in High Frequency (HF) operation ( $\geq 60$  Hz), and as a consequence the use of magnetic ballasts might be limited by luminaire efficacy requirements.

## **I.3. Requirements on the lamp lumen maintenance factor for fluorescent lamps without integrated ballast**

In addition to ensuring proper light output through a sufficiently long product life time, this requirement actually phases out halophosphate lamps, which contain more mercury than other LFLs. Thus the requirement has a beneficial effect on the environmental aspect of mercury as well.

## **I.4. Requirement on mercury in lamps for fluorescent lamps without integrated ballast**

In order to address the growing concern that mercury from disposal of fluorescent lamps might leach into surface and subsurface water, the U.S. Environmental Protection Agency established a maximum concentration level for mercury at 0.2 milligrams of leachable mercury per liter of extract fluid. The concentration level for mercury is generally determined by a standard analysis known as the Toxicity Characteristic Leaching Procedure (TCLP), a well known test procedure implemented in 1990 by the Environmental Protection Agency.

When carrying out the TCLP test, test lamps are pulverized to form lamp waste material similar to that which would result from lamp disposal in land fills or other disposal locations. The ambient conditions in disposal locations may be such as to promote formation of leachable mercury. The TCLP test conditions themselves tend to allow for formation of leachable mercury in amounts greater than the established limit of 0.2 milligrams per liter.

During the disposal of the lamp, and in the TCLP test, the glass enclosure of the lamp is broken. Elemental mercury that is contained in the lamp is then exposed to the metal components in an aqueous environment. Elemental mercury, when exposed to both the metal components and the aqueous environment, is oxidized to leachable mercury. The metal components in the lamp provide the source of oxidizable iron and oxidizable copper that promotes the formation of leachable mercury.

Several techniques have been developed which prevent the formation of mercury that can leach into the environment. The methods currently used are concerned with a method of delivering a chemical agent or metal upon disposal of a lamp or during the TCLP test. For instance, Fowler et al. (U.S. Pat. No. 5,229,686 and U.S. Pat. No. 5,229,687) describe methods that incorporate chemical agents in the lamp in either a glass capsule or the basing cement. These chemical agents include various salts such as bromide anions, chloride anions, iodide anions, iodate anions, periodate anions, and sulfide anions, to name a few. Other chemical agents include powders such as iron powder, copper powder, tin powder, and titanium powder.

In U.S. Pat. No. 5,821,682 Foust et al. describe the addition of a mercury antioxidant for superior TCLP test performance. Mercury antioxidants include, for example, ascorbic acid, sodium ascorbate, and sodium gluconate. These materials have been found to reduce or prevent the formation of leachable mercurous and mercuric compounds resulting from the oxidation of elemental mercury. Unfortunately, manufacturing processes typically use a separate dispensing step to introduce the mercury antioxidant.

In US Patent US20020190646 A1, another method is described which provides in the lamp structure an effective amount of a silver salt, a gold salt or combination thereof.

### **I.5. Product information requirements for ballasts used with fluorescent lamps without integrated ballast**

It is proposed to make compulsory for all ballasts an efficiency labelling similar to the one introduced by CELMA on a voluntary basis. The Ecodesign Directive's provisions on product information are enough to achieve this, as it is sufficient to display the Energy Efficiency Index on the product itself, on the packaging and in the product documentation in the format "EEI = A-n" just as it is done currently. It does not make sense to have requirements on distributors, as ballasts are always parts of other products and rarely sold directly to end users. The EEI is thus not meant to be an energy label under the meaning of Directive 92/75/EEC. The EEI has to be indicated on the product itself, not as a separate label. The voluntary CELMA Energy Efficiency Index is currently displayed in the same way on the ballasts themselves.

However, the grading is reviewed and current categories are made more ambitious according to the findings of the preparatory study. An explicit differentiation of dimmable and non-dimmable ballasts is introduced into the EEI classes.

Independently from the lamp type, a given lamp power always goes with the same total input power for the ballast-lamp circuit. It is thus possible to cover all existing ballasts by connecting the requirements directly to the lamp power instead of the lamp

type. This is useful as there are an increasing number of lamp types available on the market.

### **I.6 Requirements on the efficiency of ballasts used with fluorescent lamps without integrated ballast**

The starting requirements do not change significantly the values of the second phase of minimum efficiency requirements introduced in Annex IV of Directive 2000/55/EC (in force since 21 November 2005). Even though the market share of ballasts with an Energy Efficiency Index of A level according to CELMA classification is below 55 % (a condition for introducing a third phase, set out in a joint declaration by the European Parliament, the Council and the Commission in 2000), it would be inappropriate to raise the minimum requirements on all ballasts. Ballasts with currently the worst energy efficiency (CELMA B2 type) are used in very low cost luminaires (about 10 euros) with fluorescent lamps. These low cost luminaires are often installed in technical rooms (e.g. cellars) of buildings where they are not frequently used, or in domestic applications with very cost sensitive consumers who might shift to other less efficient solutions to the slightest increase in purchase price. Instead, by placing requirements (also staged) on minimum ballast efficiency within different luminaires (see Annex I.9), the desired market transformation towards a higher market share of more efficient ballasts can still be achieved.

### **I.8. Requirements on the light output ratio (LOR) of luminaires for fluorescent lamps without integrated ballast**

The proportion of the light emitted by the lamp transmitted by the luminaire (the luminaire light output ratio) has an impact on energy efficiency. If the luminaire does not let through enough light, higher power lamps will have to be installed. Thus it makes sense to set minimum levels on the light output ratio of luminaires. As a general rule, in the medium term it seems sensible to state that luminaires should let through at least half of the light that the lamps contained in them emit. However, benchmarks values are difficult to set, as luminaires can be of various types and used in different applications. For example functional luminaires are most often designed to direct the light without glare or spill to the target. A narrow complicated beam requires a more complicated optic system and hence these luminaires have a lower light output ratio (LOR). As a consequence LOR as such is not considered for further benchmarking because in practice many light distributions are needed and cannot be compared to each other.

Some preliminary remarks to improve the classification proposed by CELMA:

Exclusion 1 open, louvre etc is contradictory with LT04

Exclusion 2 and 3, closed architectural and special attachments are both creating big loopholes.

The definitions of the luminaire types should be exactly and clearly defined to admit an indisputable appraisal.

LT07 should not only include IP5x but also IP6x.

### **I.9. Requirements on the energy performance of luminaires for fluorescent lamps without integrated ballast**

#### On the efficiency of the incorporated ballasts:

The rationale for low efficiency ballasts for cheap luminaires with bare lamp and no optic was explained under I.7.

Plastic waterproof luminaires need ballasts operating at lower temperatures such as category B1.

Luminaires for lamps under 18W are very compact and need smaller ballasts than those in category A3.

#### On the Luminaire Efficacy Rating:

As luminaires for fluorescent lamps without integrated ballast are manufactured with or at least for very determined ballasts and for particular lamp types, it is possible to set requirements on the total luminaire efficacy which is a combination of the three parameters of luminaire Light Output Ratio, lamp efficacy and ballast efficiency. Thus in addition to the individual requirements set on the three parameters, it is possible to ensure that the overall performance of the luminaire is further improved.