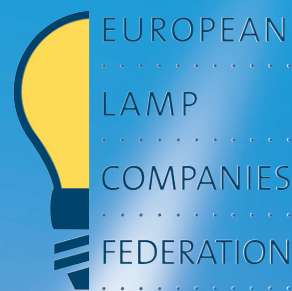




# CELMA

*Federation of National Manufacturers Associations for  
Luminaires and Electrotechnical Components for  
Luminaires in the European Union*



## **Guide of the European Lighting Industry (CELMA & ELC) for the application of the Commission Regulation (EC) No. 245/2009 amended by the Regulation No. 347/2010 setting EcoDesign requirements for “Tertiary sector lighting products”**

**Ecodesign requirements for fluorescent and high intensity discharge lighting products**

**2<sup>nd</sup> Edition  
December 2010**

## Commission Regulation (EC) No. 245/2009

**Commission Regulation of 18 March 2009 (EC) No. 245/2009** amended by the Commission Regulation of 21 April 2010 (EC) No. 347/2010 **setting ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps**, and repealing Directive 2000/55/EC of the European Parliament and of the Council. These Regulations are both implementing the Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.

## Remark for the 2<sup>nd</sup> edition of the CELMA/ELC Guide

The Regulation 245/2009 covers tertiary lighting sector products meaning lamps, ballasts and luminaires. The 2<sup>nd</sup> edition of the CELMA/ELC Guide contains all information about lamps, ballasts and luminaires as provided in the Regulation 245/2009 and its related Amendment 347/2010.

## Preface

The European Lighting industry is represented by CELMA ([www.celma.org](http://www.celma.org)) for the luminaires and components for luminaires and by the ELC ([www.elcfed.org](http://www.elcfed.org)) for the light sources.



**CELMA** is the Federation of National Manufacturers Associations for Luminaires and Electrotechnical Components for Luminaires in the European Union. CELMA has 19 member Associations and represents over 1,000 companies in 13 European countries. These producers, which include a majority of small and medium-sized companies, directly employ 107,000 people and generate more than 15 billion euros annually.



**ELC** is the European Lamp Companies Federation with 8 member companies, that collectively employ over 50,000 people in Europe, reach an annual turnover in Europe of 5 billion euros and account for 95 % of total European lamp production.

## Preface

This Guide is intended to help the market understanding the complex **Commission Regulation of 18 March 2009 (EC) No. 245/2009 which has been amended by the Commission Regulation of 21 April 2010 (EC) No. 347/2010 setting ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps**, and repealing Directive 2000/55/EC of the European Parliament and of the Council. These Regulations are both implementing the Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products. The information provided in this Guide is the interpretation of the regulation as understood by the members of CELMA and ELC.

Please note the Commission Communication 2010/C 92/04 about the publication of titles and references of transitory measurement methods for the implementation of Regulation (EC) No 245/2009.

The Commission Regulations (EC) No. 245/2009 and (EC) No. 347/2010 as well as the Commission Communication 2010/C 92/04 are available on the following website of the European Commission:  
[http://ec.europa.eu/energy/efficiency/ecodesign/legislation\\_en.htm](http://ec.europa.eu/energy/efficiency/ecodesign/legislation_en.htm).

The regulation for tertiary sector lighting products is a product related regulation which is application independent and addresses specific products, such as fluorescent lamps without integrated ballast, high intensity discharge lamps and ballasts and luminaires able to operate such lamps.

Mandatory ecodesign requirements (as set up in the Ecodesign Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products) apply to products placed on the market wherever they are installed. Such requirements can therefore not be made dependent on the application in which the product is used (such as office or street lighting).

Products subject to this regulation are meant to be used essentially for general lighting purposes, meaning that they contribute to the provision of artificial light replacing natural light for the purposes of normal human vision. Special purpose lamps (such as lamps used in computer screens, photocopiers, tanning appliances, terrarium lighting and other similar applications) are not part of this regulation.

Products bearing the CE marking have to fulfil the requirements of this regulation.



## Summary of requirements

### Summary of requirements as given in Regulation 245/2009/EC

The requirements concern products for general lighting and include all fluorescent lamps without integrated ballasts and high intensity discharge lamps, ballasts and luminaires.

There are 3 main stages and 2 intermediate stages, where in each stage, requirements are defined.

### Timetable of the different stages

<b>Stage 1</b> (1 year after entry into force)	<b>13.04.2010</b>
<b>Intermediate stage</b> (18 months after entry into force)	<b>13.10.2010</b>
<b>Stage 2</b> (3 years after entry into force)	<b>13.04.2012</b>
<b>Intermediate stage</b> (6 years after entry into force)	<b>13.04.2015</b>
<b>Stage 3</b> (8 years after entry into force)	<b>13.04.2017</b>

**No later than 5 years after the entry into force (13 April 2014) the regulation shall be reviewed by the Commission in view of the progress of the lighting technology.**

## Requirements for lamps

### Lamps

Lamps for special applications like UV, bakery and grocery lamps, colour lamps and some other special lamps are exempted from the scope of the regulation. (Please contact your lamp supplier if the lamp you are using in a special application is still available).

For HID lamps only the lamps, which have an E27, E40 or PGZ, are within the scope of the directive.

The possible phasing out is based upon achieving on performance criteria like:

- colour rendering ( $R_a$ )
- efficacy (lm/W)
- lamp lumen maintenance factor
- lamp survival factor

In practice it will have the following consequences:

In the **first stage (2010)** the following lamps are not to be put on the EU 27 market anymore:

- **halophosphate Fluorescent Lamps:**
  - T8 linear
  - U shaped
  - T9 circular
- T4 linear lamps

In the **second stage (2012)** the following lamps are not to be put on the EU 27 market anymore:

- **halophosphate Fluorescent Lamps:**
  - T10
  - T12
- **High Pressure Sodium – HPS / Metal Halide MH Lamps (E27/E40/PGZ12)**
  - Set up established performance criteria for MH E27/E40/PGZ12 lamps
  - Standard HPS E27/E40/PGZ12

In an **intermediate stage (2015)** the following lamps are not to be put on the EU 27 market anymore:

- **High pressure mercury lamps**
- **High Pressure Sodium-Plug-in/Retrofit lamps (HPM replacement)**

In the **third stage (2017)** the following lamps are not to be put on the EU 27 market anymore:

- **Low performing MH E27/E40/PGZ12 lamps**
- **Compact Fluorescent Lamps with 2 pin caps and integral starter switch**  
(Reason: These lamps are phased out in stage 3 as they do not in practice operate on A2 class ballasts).

#### Note:

- **Low pressure sodium lamps and ballasts are excluded from this regulation.**
- **Lamps from some manufacturers could fulfil the requirements; the CE marking is the distinguishing factor in this.**
- **Further detailed information on specific lamps can be obtained at several information platforms of all different lamp manufacturers.**

## Requirements for ballasts

### Fluorescent Lamp Ballasts

This regulation is a prolongation of the Directive 2000/55/EC (the "Ballast Directive") on energy efficiency requirements for ballasts for fluorescent lighting ("Ballast Directive") which is repealed by this regulation. The difference is that the EEI (Energy Efficiency Index) is not based on the system power (as it was in the "Ballast Directive"), but on the ballast efficiency; so lamp power divided by system power.

In the **first stage (13.04.2010)** the requirements are equal to the ones from the "Ballast Directive", only a conversion has taken place from system power to ballast efficiency. The measuring methods are still the same. Additional requirements are:

- Standby losses less or equal to 1 W per ballast
- Ballasts for current lamps in the market shall fulfil at least EEI = B2 requirements
- For new lamps not designed for current ballasts the efficiency requirements for ballasts are: class A3 (see Annex C.2.2, Table C.3,  $\eta_{\text{ballast}} \geq 0.94 * E_{\text{Bb}_{\text{FL}}}$ ).

In the **second stage (13.04.2012)** the requirements for standby losses are stricter:

- Less or equal to 0.5 W per ballast

In the **third stage (13.04.2017)** the requirements for non dimmable ballasts are:

- A2 or A2 BAT (Best Available Technology)

and for dimmable ballasts:

- A1 BAT

### The following ballasts are excluded from the regulation:

- Reference ballasts for the use in laboratories for lighting measurement techniques.
- Integrated ballasts as a non replaceable part of a luminaire – in this case all the requirements shall be fulfilled from the luminaire. Integrated ballasts are not usable within a luminaire or a special enclosure.
- Ballasts intended for use in emergency lighting luminaires and emergency sign luminaires and designed to operate the lamps in emergency conditions. Although the regulation at this point is unclear, according to the lighting industry's interpretation, the purpose of the regulation is that the ballasts capable of operating both in non-emergency luminaires and in emergency luminaires are not exempted.

## Requirements for ballasts

### HID Lamp Ballasts

In the **first stage (13.04.2010)** no requirements are defined.

In the **second stage (13.04.2012)** introduction of minimum ballast efficiency demands and the obligation to make them available either as a mark on the ballast or in the documentation. Marking the ballasts fulfilling requirements with:

- **EEI = A3**

In the **third stage (13.04.2017)** introduction of more strict efficiency requirements for the ballasts, marking with:

- **A2**

With the marking requirements (fluorescent and HID lamp ballasts) for example of EEI = A3 or A2 there is an identification if the ballasts fulfil the requirements regarding the stages 1 and 2 (EEI = XX) or the stage 3 (without EEI =).

#### The following ballasts are excluded from the regulation:

- Reference ballasts for the use in laboratories for lighting measurement techniques.
- Integrated ballasts as a non replaceable part of a luminaire – in this case all the requirements shall be fulfilled from the luminaire. Integrated ballasts are not usable within a luminaire or a special enclosure.
- Ballasts intended for use in emergency lighting luminaires and emergency sign luminaires and designed to operate the lamps in emergency conditions. Although the regulation at this point is somewhat vague, according to the lighting industry's interpretation, the purpose of the regulation is that the ballasts capable of operating both in non-emergency luminaires and in emergency luminaires are not exempted.



## Requirements for luminaires

### Luminaires

In the **first stage (13.04.2010)** the standby losses of the luminaires for fluorescent lamps are equal to the sum of the number of ballasts incorporated, neglecting other components inside the luminaire which may use power. So the standby losses are less than  $n$  watt, whereby  $n$  is the number of built in ballasts.

**Intermediate stage: 18 months after the entry into force of this regulation (from 13.10.2010 onwards).** Manufacturers of luminaires for fluorescent lamps without integrated ballast with total lamp luminous flux above 2,000 lumen shall provide at least the following information on free-access websites and in other forms they deem appropriate for each of their luminaire models. That information shall also be contained in the technical documentation file drawn up for the purposes of conformity assessment pursuant to Article 8 of Directive 2009/125/EC:

- a) if the luminaire is placed on the market together with the ballast, information on the efficiency of the ballast according in accordance with the ballast manufacturer's data
- b) if the luminaire is placed on the market together with the lamp, lamp efficacy (lm/W) of the lamp, in accordance with the lamp manufacturer's data
- c) if the ballast or the lamp are not placed on the market together with the luminaire, references used in manufacturers' catalogues must be provided on the types of lamps or ballasts compatible with the luminaire (e.g. ILCOS code for the lamps)
- d) maintenance instructions to ensure that the luminaire maintains, as far as possible, its original quality throughout its lifetime
- e) disassembly instructions

In the **second stage (13.04.2012)** a design requirement for both fluorescent and HID lamp luminaires is introduced. The luminaire must be designed so that it is suitable for stage 3 ballasts; this is in order to have a changeover in the third stage without delay.

CELMA recommends switching to stage 3 ballasts (A1 BAT, A2 and A2 BAT) as soon as possible (including luminaires for IP 4X).

The information provision of the intermediate state now applies also to HID lamp luminaires with total lamp luminous flux over 2,000 lumen.

The standby losses for luminaires for fluorescent lamps shall be less or equal to  $n/2$  watt, whereby  $n$  is the number of built in ballasts. (Again neglecting other power consumption of components inside the luminaire).

In the **third stage (13.04.2017)** the luminaires for fluorescent or HID lamps may only use ballasts of the third stage.

## Overview of the information and performance requirements / Overview of products which can no longer be placed on the EU market

		Fluorescent lighting solutions	High-intensity discharge lighting solutions
<b>Stage 1</b> from 13.04.2010	<b>Lamps</b>	Halophosphate T8 linear, T9 circular and U shape lamps T4 linear lamps Obligation to provide technical information on websites and in technical documentation.	Obligation to provide technical information on websites and in technical documentation.
	<b>Ballasts</b>	Non-dimmable ballasts: minimum EEI = B2 Dimmable ballasts: minimum EEI = A1 Standby losses $\leq 1$ W Non dimmable ballasts for new lamps which are not designed for existing ballasts: minimum EEI = A3 Marking requirements for ballasts mandatory. For example <b>EEI = A2</b>	No special requirements
<b>Inter-mediate stage</b> from 13.10.2010	<b>Luminaires</b>	Luminaire standby losses values = sum of ballast limit values (number of ballasts installed) After 18 months: Technical information must be provided on websites and in documentation for luminaires $> 2,000$ lm.	
<b>Stage 2</b> from 13.04.2012	<b>Lamps</b>	T10 and T12 Halophosphate lamps	Standard HPS and Lowest performing Metal Halide lamps (E27, E40 and PGZ12 base)
	<b>Ballasts</b>	Standby losses $\leq 0.5$ W	Introduction of efficiency limit values for HID ballasts  The energy efficiency of all HID ballasts must be indicated, e.g. $\eta = 80\%$ . Marking on the ballasts with <b>EEI = A3</b>
	<b>Luminaires</b>	Luminaire standby losses values = sum of ballast limit values (number of ballasts installed)  Luminaires must be <b>compatible</b> with stage 3 ballasts, except for luminaires $\geq$ IP 4X.	Technical information must be provided on websites and in documentation for luminaires $> 2,000$ lm.

13.04.2014 at the latest	Review of the Regulation		
<b>Inter- mediate stage</b> 6 years after entry into force <b>13.04.2015</b>	<b>Lamps</b>		High Pressure Mercury (HPM) lamps (E27, E40 and PGZ12) and retrofit/plug in high pressure sodium (HPS) lamps (E27, E40 and PGZ12) designed to operate on HPM ballasts
	<b>Lamps</b>	CFLni 2 pin lamps	Metal Halide lamps, not meeting minimum requirements $\leq 405 \text{ W}$ (E27, E40 and PGZ12)
	<b>Ballasts</b>	$\eta_{\text{ballast}} \geq \text{EBb}_{\text{FL}}$ (new ballast limit value formula where: <b>for <math>P_{\text{lamp}} \leq 5 \text{ W}</math>: <math>\text{EBb}_{\text{FL}} = 0.71</math></b> <b>for <math>5 \text{ W} &lt; P_{\text{lamp}} &lt; 100 \text{ W}</math>:</b> $\text{EBb}_{\text{FL}} = P_{\text{lamp}} / [2 \text{ W} * \sqrt{P_{\text{lamp}} / 36 \text{ W}} + 38 / 36 * P_{\text{lamp}} + 1 \text{ W}]$ <b>for <math>P_{\text{lamp}} \geq 100 \text{ W}</math>: <math>\text{EBb}_{\text{FL}} = 0.91</math></b> ) corresponds to phasing out of EEI = A3, B1 and B2 ( <i>permissible classes are <b>A2, A2 BAT</b> and for dimmable ballasts <b>A1 BAT</b></i> ) Marking on the ballasts only with <b>A2, A2 BAT</b> or <b>A1 BAT</b> (without "EEI = X").	Higher limit values than in stage 2: $30 \text{ W} < P < 30 \text{ W}, \eta \geq 78 \%$ $30 \text{ W} < P < 75 \text{ W}, \eta \geq 85 \%$ $75 \text{ W} < P < 105 \text{ W}, \eta \geq 87 \%$ $105 \text{ W} < P < 405 \text{ W}, \eta \geq 90 \%$ $30 \text{ W} < P > 405 \text{ W}, \eta \geq 92 \%$  The energy efficiency of all HID ballasts must be indicated. Marking on the ballasts with <b>A2</b> .
	<b>Luminaires</b>	All luminaires must be <b>compatible</b> with stage 3 ballasts.	All luminaires must be <b>compatible</b> with stage 3 ballasts.

*Recommendations***Recommendations from the European Lighting Industry****Recommendations with respect to lamps**

- Because T10 and T12 lamps are no longer allowed to be put on the market in stage 2 (2012), **the lighting industry recommends to substitute as soon as possible T10 and T12 lamps with T8 lamps with Colour Rendering Index CRI above 80. Luminaires operating without a starter switch should be replaced by a new luminaire.**
- As low performing high pressure sodium lamps will be phased out in stage 2 (2012), **the lighting industry recommends to do any refurbishment only based upon high efficient high pressure sodium lamps.**
- Because high pressure mercury lamps will be phased out in 2015, **the lighting industry recommends to replace existing installations as soon as possible.**
- As compact fluorescent 2 pin lamps will be phased out in stage 3 (2017), **the lighting industry recommends to use new designs of luminaires with lamps operating with electronic ballasts.**

**Recommendations with respect to ballasts**

- **The lighting industry recommends switching to stage 3 ballasts (A1 BAT, A2 and A2 BAT) as soon as possible (including luminaires for IP 4X).**
- For luminaires for higher ambient temperatures or for robust operation, the lighting industry recommends the luminaires manufacturers to contact the ballast manufacturers to clarify the technical solution (magnetic ballasts or electronic ballasts which are fulfilling the energy efficiency requirements) for such kind of luminaires.

**Recommendations with respect to luminaires**

- Although ballasts for fluorescent applications with the energy classification EEI = B1 or EEI = B2 will not be phased out until at stage 3, **the lighting industry recommends the luminaires manufacturers to use stage 3 ballasts (A1 BAT, A2 and A2 BAT) as soon as possible.**
- Also A3 ballasts will be banned in stage 3. Therefore the lighting industry also recommends the luminaires manufacturers to use stage 3 ballasts (A1 BAT, A2 and A2 BAT) as soon as possible.

**Recommendations with respect to benchmarks**

- **The lighting industry does not recommend using the proposed indicative benchmarks in the Annexes V, VI and VII of the regulation.** The reason is that these indicative benchmarks could hamper the free circulation of lighting products on the market as they could be made mandatory for specific uses (such as public procurement building regulations, etc) by some EU Member States only.

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## Annex A

### Regulation Introduction

#### A.1 Basis: The Ecodesign Framework Directive

The [Directive 2009/125/EC](#) establishing a framework for the setting of ecodesign requirements for energy-related products defines the general statutory conditions for promoting the integration of environmental aspects into the development and design of energy-related products and thus improving the environmental impacts of those products, especially their energy efficiency.

The Framework Directive itself is not directly effective. The specific requirements that products need to fulfil, are defined in the "implementing measures", such as this Regulation for Tertiary Sector Lighting products.

#### A.2 Placing on the market

Article 2, paragraph 4 of the EcoDesign Framework Directive (2009/125/EC) defines "placing on the market" as making a product available for the first time on the Community market with a view to its distribution or use within the Community whether for reward or free of charge and irrespective of the selling technique. For full details refer to the Commission "Guide to the implementation of Directives based on the New Approach and the Global Approach (Blue Guide)" as well as to the [joint ELC / CELMA Position Paper on the Term „placing on the market” of the EcoDesign Directive](#) available on ELC and CELMA websites.

([http://www.elcfed.org/documents/Position\\_ELC\\_Placing%20on%20the%20market\\_20090416\\_final.pdf](http://www.elcfed.org/documents/Position_ELC_Placing%20on%20the%20market_20090416_final.pdf)  
[http://www.celma.org/archives/temp/CELMA\\_TC\(SM\)078\\_ELC\\_CELMA\\_position\\_paper\\_Placing\\_on\\_the\\_market\\_EuP\\_final.pdf](http://www.celma.org/archives/temp/CELMA_TC(SM)078_ELC_CELMA_position_paper_Placing_on_the_market_EuP_final.pdf)).

#### A.3 CE marking requirements

The CE marking requirements are set out in Article 5, paragraph 2 of the EcoDesign framework Directive as well as in Annex III.

The CE marking must be affixed on the luminaire, the ballast and the lamp.

In case of **luminaires**, the following EU legislation must be fulfilled in future for the application of the CE marking:

- **Low Voltage Directive 2006/95/EC**
- **Electromagnetic compatibility Directive 2004/108/EC**
- **Regulation No. 245/2009 amended by Regulation No. 347/2010** implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC

In case of **ballasts**, the following EU legislations must be fulfilled in future for the affixing of the CE marking:

- **Low Voltage Directive 2006/95/EC**
- **Regulation No. 245/2009 amended by Regulation No. 347/2010** implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC.

**The Ballast Directive 2000/55/EC is repealed by this Regulation!**

In the CE declaration of conformity, the manufacturer must confirm that this EU legislation is fulfilled.

#### **A.4 Standards**

Where an energy-related product is manufactured in accordance with harmonised standards, the reference numbers of which have been published in the Official Journal of the European Union, it is presumed that that energy-related product conforms to the essential requirements of the relevant legislation.

#### **A.5 CE declaration of conformity**

After placing an energy-related product on the market, the manufacturer or its authorised representative must keep relevant documents relating to the conformity assessment and EU declarations of conformity for inspection by the Authorities for a period of **ten years** after the last of that energy-related product has been manufactured. Where the manufacturer is not established within the European economic area and in the absence of an authorised representative, the obligation lies with the importer.

The EC declaration of conformity must contain the following elements:

- a) the name and address of the manufacturer or of its authorised representative;
- b) a description of the model sufficient for unambiguous identification;
- c) where appropriate, the references of the harmonised standards applied;
- d) where appropriate, the other technical standards and specifications used;
- e) where appropriate, the declaration of compliance with other relevant Community legislation providing for the affixing of the CE marking;
- f) identification and signature of the person empowered to bind the manufacturer or its authorised representative.



## Annex B

### Lamp requirements

#### B.1 Introduction

The Regulation 245/2009 amended by the Regulation 347/2010 covers fluorescent lamps without integrated ballast (linear fluorescent lamps, compact fluorescent lamps, circular lamps, U-shaped lamps) (single and double capped) and high intensity discharge lamps with lamp caps E27/E40/PGZ12.

The regulation introduces the following requirements for lamps:

- **Energy efficiency requirements**

- Minimum lamp efficiency (luminous efficacy) requirements

**Remark:** The efficacy of a lamp ( $\eta_{\text{source}}$ ) is defined by the quotient of the luminous flux emitted  $\Phi_v$  by the power consumed ( $P_{\text{source}}$ ) without taking account of the power dissipated by electrical equipment. It is expressed in lumens per watt [lm/W] and based on nominal values.

T5 lamps which do not have their optimum ambient temperature at 25 °C therefore must comply with the lamp efficacy requirements at their optimum ambient temperature of 35° C.

- **Product feature requirements**

- Minimum colour rendering index Ra requirements

**Remark:** Colour rendering index (Ra) is a measure of the effect of an illuminant on the colour appearance of objects by comparison with their colour appearance under a reference illuminant.

- Minimum lamp lumen maintenance factor (LLMF) requirements

**Remark:** The lamp lumen maintenance factor (LLMF) indicates the ratio of the luminous flux emitted by a lamp at a given time in its life to the initial luminous flux.

- Minimum lamp survival factor (LSF) requirements

**Remark:** The lamp survival factor (LSF) indicates the fraction of the total number of lamps that continue to operate at a given time under defined conditions and switching frequency.

- **Product information requirements**

- Provision of defined technical information on the Internet and other documentation deemed appropriate.

The Regulation defines:

- **exemptions** for lamps, see B.2.
- **correction factors** or deduction percentages for lamp efficacy values for lamps with defined features, see B.3.

## B.2 Exemptions

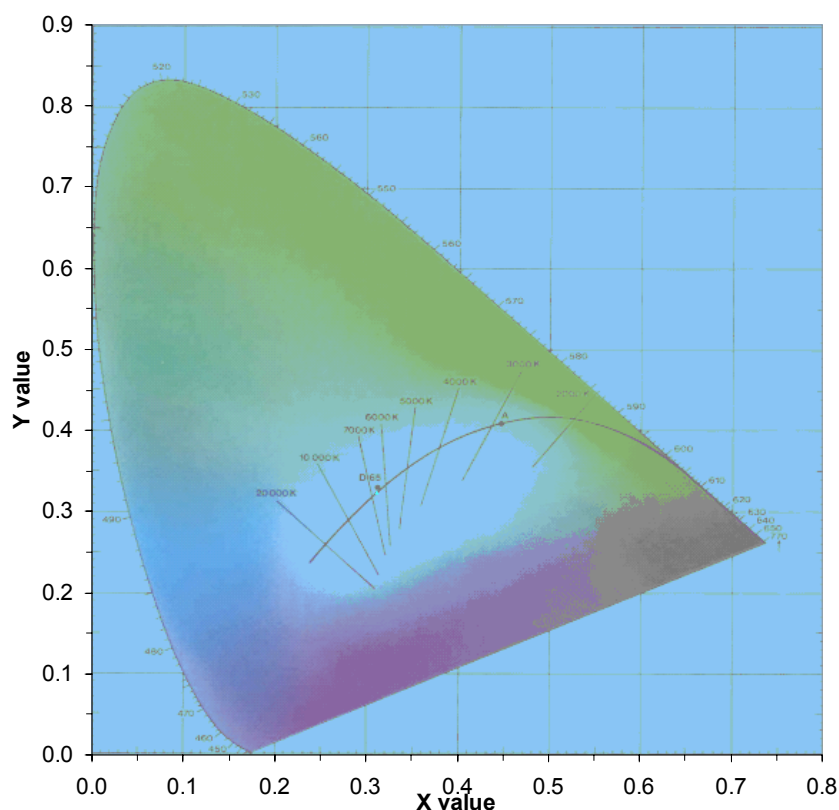
According to the regulation and its amendments, the provisions of the regulation **do not apply to the following lamps**:

**A) lamps that are not white light sources;**

White light sources are light sources with the following coordinates on the CIE halophosphate colour chart:

x coordinats:  $0.270 < x < 0.530$

y coordinats:  $-2.3172x^2 + 2.3653x - 0.2199 < y < -2.3172x^2 + 2.3653x - 0.1595$ .



This exemption does not apply to high pressure sodium vapour lamps.

**B) lamps that are directional light sources;**

Directional light sources (DLS) are lamps which emit at least 80 % light output within a solid angle of  $\pi$  sr (corresponding to a cone with an angle of  $120^\circ$ ) Hereby it refers to all kind of reflector lamps.

**C) products intended for use in applications other than general lighting and products incorporated into products which do not provide a general lighting function or lamps covered by the requirements of Directives 94/9/EC of the European Parliament and of the Council or Directive 1999/92/EC of the European Parliament and of the Council.**

Examples: spectral lamps for spectroscopy purpose, mercury lamps for lithography, short arc lamps for projectors

**D) blended high intensity discharge lamps having :**

- 6 % or more of total radiation in the 250 – 400 nm range, and
- 11 % or more of total radiation in the 630 – 780 nm range, and
- 5 % or more of total radiation in the 640 – 700 nm range

**blended high intensity discharge lamps having** the peak of radiation between 315 – 400 nm (UVA) or 280 – 315 nm (UVB)

**E) double capped fluorescent lamps with the following features:**

- diameter of 7 mm (T2) or less,
- diameter of 16 mm (T5) and lamp power  $P \leq 13$  W (lamps for emergency lighting) or  $P > 80$  W (high power lamps for industrial lighting),
- diameter of 38 mm (T12), G13 2 pin lamp cap and  $\pm 5$  nm (+ magenta, - green) colour compensating filter value limit (cc), CIE coordinates  $x = 0.330$   $y = 0.335$  and  $x = 0.415$   $y = 0.377$ , these lamps are generally called “Cinema Fluorescent Lamps”.

(Remark: The G-13 Medium lamp cap designation referred to in the regulation is not used in Europe; it is known here as G13)

- diameter of 38 mm (T12) and external ignition strip;  
(Remark: Conventionally used for e.g. cold stores or lighting control systems)

**F) single capped fluorescent lamps with the following features:**

- diameter of 16 mm (T5), 2G11 4 pin lamp cap,  $T_c = 3200$  K with CIE coordinates  $x = 0.415$ ;  $y = 0.377$  and  $T_c = 5500$  K with CIE coordinates  $x = 0.330$ ;  $y = 0.335$ ;  
exempting lamps for special applications like TV/Studio lighting

**G) high intensity discharge lamps,  $T_c > 7000$  K;**

Meaning that aquarium metal halide lamps are exempted

**H) high intensity discharge lamps with a specific UV output  $> 2$  mW/klm**

Meaning that pet-care lamps are exempted

**I) high intensity discharge lamps with lamp cap other than E27, E40, PGZ12.**

**Remark:** Lamps with lamp caps such as G8.5, G12, R7S, etc are not affected

### **B.3 Lamp efficacy correction factors for fluorescent lamps and high intensity discharge lamps**

#### **B.3.1 Corrections applicable to both single and double capped fluorescent lamps**

Table B.1 shows the deduction factors given in the regulation. These numbers are cumulative. It means in practice that for e.g. a lamp with a colour temperature of 6500 K and with an extra insulation sleeve for cold store applications, 20 % of the efficacy thresholds may be deducted.

**Table B.1 – Lamp efficacy correction factors**  
(Table 6 in the Regulation)

Lamp parameter	Deduction from luminous efficacy at 25 °C
$T_c \geq 5000$ K	- 10 %
$95 > Ra > 90$	- 20 %
$Ra > 95$	- 30 %
Second lamp envelope	- 10 %
Lamp Survival Factor $\geq 0.50$ after 40,000 burning hours	- 5 %

The deductions indicated are cumulative.

### **B.3.2 Corrections applicable to high intensity discharge lamps**

Lamps with  $T_c \geq 5000$  K or a second lamp envelope must fulfil at least 90 % of the applicable lamp efficacy requirements in Tables 7, 8 and 9 of the Regulation.

### **B.4 Requirements for fluorescent lamps**

The following requirements apply to

- **double capped fluorescent lamps**
- **single capped fluorescent lamps**

#### **B.4.1 Lamp efficacy requirements**

**Remark:** Evaluation of the lamp efficacy for single capped fluorescent lamps is defined into EN 60901 and for double capped fluorescent lamps into EN 60081.

#### **Stage 1 (2010) – One year after the Regulation enters into force**

The following tables set out detailed minimum luminous efficacy values (rated luminous efficacy) for single and double capped fluorescent lamps (Annex III, Tables 1-5 and 7-10 of the Regulation).

All the values stated refer only to the lamp and take no account of power dissipated by external control gears.

In addition, cumulative deduction percentages (see *Table B.1*) apply to the lamp parameters for colour temperature ( $T_c$ ), colour rendering index ( $R_a$ ) and second lamp envelope.

One year after the regulation enters into force, the following luminous efficacy requirements will apply to fluorescent lamps.

**Double capped fluorescent lamps** with 16 mm and 26 mm diameters (T5 and T8 lamps) will need to achieve at least the rated luminous efficacies stated in Table 1 at 25 °C.

Where nominal wattages differ from those indicated in Table 1, the following shall apply:

- Lamps need to achieve the luminous efficacy required for the nearest nominal wattage in the table. Exceptions here are T8 lamps above 50 W, which must reach a luminous efficacy of 83 lm/W.
- If neither of the two nearest nominal wattages in the table is nearer than the other, the lamp in question needs to conform to the higher luminous efficacy of the two.
- If the nominal wattage is higher than the highest wattage in the table, the lamp in question needs to conform to the efficacy of that highest wattage.

**Table B.2 – Rated minimum efficacy values for T8 and T5 lamps**

(Table 1 of the Regulation)

T8 (26 mm Ø)		T5 (16 mm Ø) High efficiency		T5 (16 mm Ø) High output	
Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value	Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value	Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value
15	63	14	86	24	73
18	75	21	90	39	79
25	76	28	93	49	88
30	80	35	94	54	82
36	93			80	77
38	87				
58	90				
70	89				

**Single capped fluorescent lamps** will need to achieve at least the rated luminous efficacy values indicated in table B.3, B.4, B.5 or B.6 – depending on lamp design – at 25 °C.

Where nominal wattages or lamp shapes differ from those listed in tables B.3–B.6:

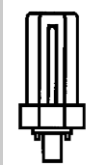
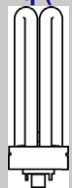
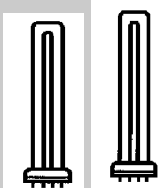
- Lamps need to achieve the luminous efficacy for the nearest nominal wattage or shape.
- If neither of the two nearest nominal wattages in the table is nearer than the other, the lamp in question need to conform to the higher luminous efficacy of the two.
- If the nominal wattage is higher than the highest wattage in the table, the lamp in question need to conform to the efficacy of that highest wattage.

**Remark:** In case the nominal wattages or lamp shapes are different from those listed in tables B.3 to B.6, lamps must reach the luminous efficacy of the nearest equivalent in terms of wattage and shape. If the nominal wattage is at equal distance from two in the table, it shall conform to the higher efficacy of the two. If the nominal wattage is higher than the highest wattage, it shall conform to the efficacy of that of the highest wattage..

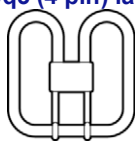
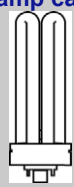
**Table B.3 – Rated minimum efficacy values for single capped fluorescent lamps operated by electromagnetic and electronic ballasts**  
(Table 2 of the Regulation)

Small single parallel tube, lamp cap G23 (2 pin) or 2G7 (4 pin)		Double parallel tubes, lamp cap G24d (2 pin) or G24q (4 pin)		Triple parallel tubes, lamp cap GX24d (2 pin) or GX24q (4 pin)	
Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value	Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value	Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value
5	48	10	60	13	62
7	57	13	69	18	67
9	67	18	67	26	66
11	76	26	66		
4 legs in one plane, lamp cap 2G10 (4 pin)		Long single parallel tube, lamp cap 2G11 (4 pin)			
Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value	Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value		
18	61	18	67		
24	71	24	75		
36	78	34	82		
		36	81		

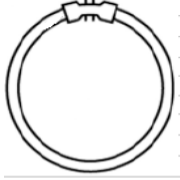
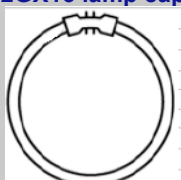
**Table B.4 – Rated minimum efficacy values for single capped fluorescent lamps operated only by electronic ballast**  
(Table 3 of the Regulation)

Triple parallel tubes, lamp cap GX24q (4 pin)		Four parallel tubes, lamp cap GX24q (4 pin)		Long single parallel tube, lamp cap 2G11 (4 pin)	
					
Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value	Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value	Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value
32	75	57	75	40	83
42	74	70	74	55	82
57	75			80	75
70	74				

**Table B.5 – Rated minimum efficacy values for single capped fluorescent lamps with square shape or (very) high output**  
(Table 4 of the Regulation)

Single flat plane tube, GR8 (2 pin), GR10q (4 pin) or GRY10q3 (4 pin) lamp cap		Four or three parallel T5 tubes, 2G8 (4 pin) lamp cap	
			
Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value	Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value
10	65	60	67
16	66	82	75
21	64	85	71
28	73	120	75
38	71		
55	71		

**Table B.6 – Rated minimum efficacy values for circular T9 and T5 lamps**  
(Table 5 of the Regulation)

T9 circular, tube diameter 29 mm with G10q lamp cap		T5 circular, tube diameter 16 mm with 2GX13 lamp cap	
			
Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value	Nominal wattage (W)	Rated luminous efficacy (lm/W), 100 h initial value
22	52	22	77
32	64	40	78
40	70	55	75
60	60	60	80

"Spiral-shaped double capped fluorescent lamps of all diameters equal to or larger than 16 mm (T5) shall comply with the requirements set out in Table above for T9 circular lamps."

## Stage 2 (2012) – Three year after the Regulation enters into force

The following lamp efficacy requirements will apply to fluorescent lamps three years after the Regulation enters into force.

### Double capped fluorescent lamps

The requirements that apply to double capped fluorescent lamps with 26 mm diameter (T8) during stage 1 will apply to all double capped fluorescent lamps of other diameters than those covered in the first stage (other diameters than T5 16mm and T8 26 mm).

These lamps will need to conform to the minimum efficacy of the T8 lamp, which is their nearest equivalent in terms of nominal wattage. If the nominal wattage is higher than the highest wattage in the table, the lamp in question will need to conform to the efficacy of that highest wattage.

The corrections defined for stage 1 (Table 6) will continue to apply.

**Remark:** The need to meet these requirements will result in the removal of all T10 and T12 lamps from the market.

### Single capped fluorescent lamps

No new requirements.

## Stage 3 (2017) – Eight years after the Regulation enters into force

All fluorescent lamps (double and single capped) shall be able to operate with ballasts of energy efficiency class A2 or more efficient ballasts according to stage 3 of the Regulation for ballasts. (They may additionally operate with ballasts of less efficient classes than A2).

## B.4.2 Product feature requirements

### Stage 1 (2010) – One year after the Regulation enters into force

Double capped T8 and T5 fluorescent lamps and single capped fluorescent lamps will need a colour rendering index (Ra) of at least 80.

**Remark:** T8 and T5 lamps will thus need to meet minimum colour rendering index and efficacy requirements. As a consequence, standard light colours (halophosphate lamps) will be removed from the market. T10 and T12 lamps (halophosphate lamps) will not be removed from the market until stage 2.

### Stage 2 (2012) – Three years after the Regulation enters into force

All fluorescent lamps will need a colour rendering index (Ra) of at least 80.

**Remark:** The minimum colour rendering requirements will thus also apply to T10 (32 mm) and T12 (38 mm) lamps, as a result of which halophosphate lamps will be removed from the market.

All fluorescent lamps will need to have at least the lamp lumen maintenance factors stated in Table B.7.

**Table B.7 – Lamp lumen maintenance factors for single or double capped fluorescent lamps – Stage 2**  
(Table 11 of the Regulation)

Lamp lumen maintenance factor	Burning hours			
Lamp types	2,000	4,000	8,000	16,000
Double-Capped Fluorescent lamps operating on non-high frequency ballasts	0.95	0.92	0.90	-
T8 Double-Capped Fluorescent lamps on high frequency ballast with warmstart	0.96	0.92	0.91	0.90
Other Double-Capped Fluorescent lamps on high frequency ballast with warmstart	0.95	0.92	0.90	0.90
Circular Single-Capped Fluorescent lamps operating on non-high frequency ballasts, T8 U-shaped double-capped fluorescent lamps and spiral-shaped double capped fluorescent lamps of all diameters equal to or larger than 16 mm (T5)	0.80	0.74	-	-
	0.72 at 5,000 burning hours			
Circular Single-Capped Fluorescent lamps operating on high frequency ballasts	0.85	0.83	0.80	-
	0.75 at 12,000 burning hours			
Other Single-Capped Fluorescent lamps operating on non-high frequency ballasts	0.85	0.78	0.75	-
Other Single-Capped Fluorescent lamps on high frequency ballast with warmstart	0.90	0.84	0.81	0.78

**Table B.7a – Deduction percentages for fluorescent lamp lumen maintenance requirements**  
(Table 11a of the Regulation)

Lamp parameter	Deduction from lamp lumen maintenance requirement
Lamps with $95 \geq Ra > 90$	At burning hours $\leq 8000h$ : - 5 % At burning hours $> 8000h$ : -10 %
Lamps with $Ra > 95$	At burning hours $\leq 4000h$ : -10 % At burning hours $> 4000h$ : -15 %
Lamps with a colour temperature $\geq 5000K$	-10 %



All fluorescent lamps will need to have at least the lamp survival factors stated in Table B.8:

**Table B.8 – Lamp survival factors for single or double capped fluorescent lamps – Stage 2**  
(Table 12 of the Regulation)

Lamp survival factor	Burning hours			
Lamp types	2,000	4,000	8,000	16,000
Double-Capped Fluorescent lamps operating on non-high frequency ballasts	0.99	0.97	0.90	-
Double-Capped Fluorescent lamps on high frequency ballast with warmstart	0.99	0.97	0.92	0.90
Circular Single-Capped Fluorescent lamps operating on non-high frequency ballasts, T8 U-shaped double-capped fluorescent lamps and spiral-shaped double capped fluorescent lamps of all diameters equal to or larger than 16 mm (T5)	0.98	0.77	-	-
	0.50 at 5,000 burning hours			
Circular Single-Capped Fluorescent lamps operating on high frequency ballasts	0.99	0.97	0.85	-
	0.50 at 12,000 burning hours			
Other Single-Capped Fluorescent lamps operating on non-high frequency ballasts	0.98	0.90	0.50	-
Other Single-Capped Fluorescent lamps on high frequency ballast with warmstart	0.99	0.98	0.88	-

### Stage 3 (2017) – Eight years after the Regulation enters into force

No new requirements.

### B.4.3 Product information requirements

#### Stage 1 (2010) – One year after the Regulation enters into force

Manufacturers must provide at least the following information on free-access websites and in other forms they deem appropriate for **all** fluorescent lamps (and high intensity discharge lamps) that are within the scope of the Regulation. That information must also be contained in the technical documentation drawn up for the purposes of conformity assessment pursuant to Article 8 of Directive 2005/32/EC:

- a) Nominal and rated lamp wattage;  
 A "nominal" value means an approximate quantity value used to designate or identify a product.  
 A "rated" value means a quantity value for a characteristic of a product for operating conditions specified in this Regulation or in applicable standards. Unless stated otherwise, all product parameter limits are expressed in rated values.  
 For example a T5 24W has a nominal wattage of 24W. This is the wattage used to designate the product. In practice the lamp consumes 22.5 W at optimum operation. This is the rated wattage.
- b) Nominal and rated lamp luminous flux;  
 The same argumentation for wattage can be applied on luminous flux.
- c) Rated lamp efficacy at 100 h in standard conditions (25 °C / T5 lamps 35 °C).  
 For fluorescent lamps, values need to be stated for both 50 Hz (mains frequency) and, where applicable, high frequency (> 50 Hz) operation
- d) Rated lamp lumen maintenance factor at 2,000 h, 4,000 h, 6,000 h, 8,000 h, 12,000 h, 16,000 h and 20,000 h.  
 For new lamps, values for > 8,000 h are not necessary where no data is yet available.  
 "Lamp Lumen Maintenance Factor" (LLMF), which means the ratio of the luminous flux emitted by the lamp at a given time in its life to the initial luminous flux.
- e) Rated lamp survival factor at 2,000 h, 4,000 h, 6,000 h, 8,000 h, 12,000 h, 16,000 h and 20,000 h  
 For new lamps, values for > 8,000 h are not necessary where no data is yet available.  
 "Lamp Survival Factor" (LSF), which means the fraction of the total number of lamps which continue to operate at a given time under defined conditions and switching frequency.

- f) Lamp mercury content in X,X mg;
- g) Colour rendering index (Ra) of the lamp;
- h) Colour temperature (Tc) of the lamp;
- i) Ambient temperature at which the lamp is designed to develop its maximum luminous flux. If a lamp does not fulfil at least 90 % of the relevant luminous efficacy requirement in Annex III.1.1. at an ambient temperature of 25 °C (T5 lamps 100 %), it will not be classed as suitable for indoor use at standard room temperatures.

**Remark:** At this point, product information is used to restrict application.

**Stage 2 (2012) - Three years after the Regulation enters into force**

**Stage 3 (2017) - Eight years after the Regulation enters into force**

No new requirements for all fluorescent lamps.

## **B.5 High intensity discharge lamps**

The Regulation defines requirements for the following high intensity discharge lamps:

- High pressure mercury lamps
- High pressure sodium lamps
- Metal halide lamps

### **B.5.1 Lamp efficacy requirements**

**Remark:** Efficiency requirements for metal halide lamps will increase through stage 2 & stage 3. Lighting Industry recommends to pro actively consider these requirements for new installations and refurbishment.

**Stage 1 (2010) – One year after the Regulation enters into force**

No requirements

**Stage 2 (2012) – Three years after the Regulation enters into force**

High pressure sodium vapour lamps with Ra ≤ 60 must have at least the luminous efficacies shown in Table B.9:

**Table B.9 – Rated minimum efficacy values for high pressure sodium vapour lamps**  
(Table 7 of the Regulation)

Nominal lamp wattage [W]	Rated luminous efficacy [lm/W] – Clear lamps	Rated luminous efficacy [lm/W] – Not clear lamps
$W \leq 45$	$\geq 60$	$\geq 60$
$45 < W \leq 55$	$\geq 80$	$\geq 70$
$55 < W \leq 75$	$\geq 90$	$\geq 80$
$75 < W \leq 105$	$\geq 100$	$\geq 95$
$105 < W \leq 155$	$\geq 110$	$\geq 105$
$155 < W \leq 255$	$\geq 125$	$\geq 115$
$255 < W \leq 605$	$\geq 135$	$\geq 130$

**Remark:** This means that low performing (standard) high pressure sodium lamps will be removed from the market. Replacement products are fully available.

**Remark:** High pressure sodium lamps (plug-in or retrofit lamps) designed to replace high pressure mercury vapour lamps one-to-one and to operate on the electrical gear that controls them (chokes) do not need to meet the requirements in Tables 7 and 13 until six years after the Regulation enters into force.

**Recommendation:** The European lighting industry recommends to do any refurbishment only based upon high efficient high pressure sodium lamps.

Metal halide lamps with  $R_a \leq 80$  and high pressure sodium vapour lamps with  $R_a > 60$  need to have at least the rated luminous efficacies in Table B.10:

**Table B.10 – Rated minimum luminous efficacy values for metal halide lamps**  
(Table 8 of the Regulation)

Nominal lamp wattage [W]	Rated luminous efficacy [lm/W] – Clear lamps	Rated luminous efficacy [lm/W] – Not clear lamps
$W \leq 55$	$\geq 60$	$\geq 60$
$55 < W \leq 75$	$\geq 75$	$\geq 70$
$75 < W \leq 105$	$\geq 80$	$\geq 75$
$105 < W \leq 155$	$\geq 80$	$\geq 75$
$155 < W \leq 255$	$\geq 80$	$\geq 75$
$255 < W \leq 405$	$\geq 85$	$\geq 75$

**Remark:** More efficient products that meet these requirements are already available on the market.

#### Stage 2a (2015) – Six years after the Regulation enters into force

Six years after the Regulation enters into force, other high intensity discharge lamps need to have at least the rated luminous efficacies in Table B.11:

**Table B.11 – Rated minimum luminous efficacy values for other high intensity discharge lamps**  
(Table 9 of the Regulation)

Nominal lamp wattage [W]	Rated luminous efficacy [lm/W]
$W \leq 40$	50
$40 < W \leq 50$	55
$50 < W \leq 70$	65
$70 < W \leq 125$	70
$125 < W$	75

**Recommendation:** The lighting industry recommends to replace existing installations, using Mercury Vapor lamps, as soon as possible.

### Stage 3 (2017) – Eight years after the Regulation enters into force

Metal halide lamps need to have at least the rated luminous efficacies in Table B.12:

**Table B.12 – Rated minimum luminous efficacy values for metal halide lamps (stage 3)**  
(Table 10 of the Regulation)

Nominal lamp wattage (W)	Rated luminous efficacy [lm/W] – clear lamps	Rated luminous efficacy [lm/W] – Not clear lamps
$W \leq 55$	$\geq 70$	$\geq 65$
$55 < W \leq 75$	$\geq 80$	$\geq 75$
$75 < W \leq 105$	$\geq 85$	$\geq 80$
$105 < W \leq 155$	$\geq 85$	$\geq 80$
$155 < W \leq 255$	$\geq 85$	$\geq 80$
$255 < W \leq 405$	$\geq 90$	$\geq 85$

### B.5.2 Product feature requirements

#### Stage 1(2010) – One year after the Regulation enters into force

No requirements

#### Stage 2 (2012) – Three years after the Regulation enters into force

High pressure sodium lamps need to have at least the lamp lumen maintenance factors and lamp survival factors in Table B.13:

**Table B.13 – Lamp lumen maintenance factors and lamp survival factors for high pressure sodium lamps – Stage 2**  
(Table 13 of the Regulation)

High pressure sodium lamp category and burning hours for measurement		Lamp lumen maintenance factor	Lamp survival factor
P ≤ 75 W LLMF and LSF measured at 12000 burning hours	Ra ≤ 60	> 0.80	> 0.90
	Ra > 60	> 0.75	> 0.75
	all retrofit lamps designed to operate on high pressure mercury vapour lamp ballast	> 0.75	> 0.80
P > 75 W LLMF and LSF measured at 16000 burning hours	Ra ≤ 60	> 0.85	> 0.90
	Ra > 60	> 0.70	> 0.65
	all retrofit lamps designed to operate on high pressure mercury vapour lamp ballast	> 0.75	> 0.55

The requirements in Table B.13 for retrofit lamps designed to operate on high pressure mercury vapour lamp ballast shall be applicable until 6 years after the entry into force of this regulation.

### Stage 3 (2017) – Eight years after the Regulation enters into force

Metal halide lamps need to have at least the lamp lumen maintenance factors and lamp survival factors in Table B.14:

**Table B.14 - Lamp lumen maintenance factors and lamp survival factors for metal halide lamps – Stage 3**  
(Table 14 of the Regulation)

Burning hours	Lamp lumen maintenance factor	Lamp survival factor
12,000	> 0,80	> 0,80

#### **B.5.3 Product information requirements**

Stage 1 (2010), Stage 2 (2012) and Stage 3 (2017)

The same as for fluorescent lamps.

**Note:** Further detailed information on specific lamps can be obtained at the several information platforms of all different lamp manufacturers.

## Annex C

### Ballasts requirements

#### C.1 Introduction

Lamp ballasts determine the operating point of the lamps and thus affect the efficiency of the ballast/lamp system. The energy efficiency and marking requirements of Regulation 245/2009 amended by Regulation 347/2010 allows a sustainable energy-conscious choice of ballasts taking account the technical requirements and environmental conditions of the relevant application. Since luminaires are normally sold with ballasts built-in, the choice of ballast is primarily a matter for the luminaire manufacturer, who has to consider the requirements of designers, architects, clients and installers during the design of their luminaires.

Regulation 245/2009 amended by Regulation 347/2010 prescribes energy efficiency and product information requirements. The requirements prescribed for ballasts for fluorescent lamps are different from those for ballasts for high intensity discharge lamps.

Where there is the possibility of different lamps being operated by a single ballast (**multi-power ballast**), the requirements apply to each individual lamp type and the information must be declared on the ballast or in the documentation for each individual lamp. Where only one declaration is made (collective declaration), the value declared must be the least favourable values ones.

In the case of **multi-lamp ballasts** (e.g. 4 x 14 W T5 lamps), the energy efficiency requirements for the ballast is equal to the requirement for a single lamp ballast.

One year after entry into force of this regulation, the previous Directive 2000/55/EC will be withdrawn, i.e. on 13.04.2011.

Please note that emergency lighting luminaires are exempted from this regulation. Also the ballasts designed to operate lamps in emergency lighting luminaires in emergency lighting conditions are exempted. Although the regulation at this point is unclear, according to the lighting industry's interpretation, the purpose of the regulation is that the ballasts capable of operating both in non-emergency luminaires and in emergency lighting luminaires are not exempted.

Luminaires for special operation conditions such as higher ambient temperatures (above 25°C) or mechanical vibrations do require special ballasts for these purposes. CELMA recommends the luminaire manufacturers to contact the ballasts producers to clarify the technical solution (magnetic ballasts or electronic ballasts which are fulfilling the energy efficiency requirements) for such kind of luminaires.

Table C.1 provides an overview of the ballast requirements for the three implementation stages of Regulation 245/2009.

**Table C.1 – Implementation stages and ballast requirements**

		Stage 1 from April 2010	Stage 2 from April 2012	Stage 3 from April 2017
<b>Fluorescent lamp ballasts</b>	Non-dimmable ballasts	At least EEI = B2 for existing ballast/lamp systems and at least EEI = A3 for new lamps systems		A2 BAT and A2 based on limit value formulas
	Dimmable ballasts	At least EEI = A1		A1 BAT based on limit value formulas
	Standby losses	≤ 1 W per ballast	≤ 0.5 W per ballast	
	Product information	EEI classification: ballast, websites and technical documentation		Classification according to limit value formulas: ballast, websites and technical documentation
<b>High intensity discharge lamp ballasts</b>	Non-dimmable ballasts	-	Minimum efficiency $\eta_{\text{ballast}}$ , marking EEI = A3	Minimum efficiency $\eta_{\text{ballast}}$ , marking A2
	Dimmable ballasts	-	-	-
	Standby losses	-	-	-
	Product information	-	Indication of $\eta_{\text{ballast}}$ , ballast, websites and technical documentation	Indication of $\eta_{\text{ballast}}$ , ballast, websites and technical documentation

## C.2 Ballasts for fluorescent lamps

### C.2.1 Ballast energy performance requirements for normal operation

Under Directive 2000/55/EC, ballasts were assessed on the basis of the overall input power of fluorescent lamp circuits. Under the new Regulation 245/2009 amended by the Regulation 347/2010 the basis for assessing ballasts for fluorescent lamps has changed from overall system input power to ballast efficiency.

Ballast efficiency is the quotient of the lamp output power and the total input power of the lamp-ballast circuit. The total input power of the fluorescent lamp circuit is measured in accordance with EN 50294 (Measurement method of total input power of ballast-lamp circuits) and calibrated to meet specific requirements regarding reference conditions ( $P_{tot.ref.}$ ). Measuring/calculating the total input power of fluorescent lamp circuits takes into account the luminous flux behaviour of the lamps when operated by electronic ballasts.

In EN 50294, total input power with electronic ballasts is calculated on the basis of formula 1:

$$[1] \quad P_{tot.ref.} = P_{tot.meas.} \times \frac{P_{Lnom.}}{P_{Lref.meas.}} \times \frac{Light_{ref.}}{Light_{test}}$$

To ascertain the efficiency of an electronic ballast  $\eta_{ballast}$ , the lamp output power  $P_{Lnom.}$  is divided by the total input power  $P_{tot.ref.}$ .

$$[1a] \quad \eta_{ballast} = \frac{P_{Lnom.}}{P_{tot.ref.}} = \frac{P_{Lref.meas.}}{P_{tot.meas.}} \times \frac{Light_{test}}{Light_{ref.}}$$

Where:

$P_{tot.ref.}$	total input power of the ballast-lamp circuit under test correlated to comparable reference conditions (in watt)
$P_{tot.meas.}$	measured total input power into the ballast-lamp circuit under test (in watt)
$P_{Lnom.}$	rated lamp or typical HF power of relevant reference lamp according to the lamp data sheet (in watt)
$P_{Lref.meas.}$	measured lamp power in the circuit with reference ballast (in watt)
$Light_{ref.}$	light output of the reference lamp connected to reference ballast measured by photocell meter reading
$Light_{test}$	light output of the reference lamp connected to the test ballast measured by photocell meter reading

**Remark:** The expression  $P_{Lnom.}$  is in line with EN 50294 and indicates the rated lamp or typical HF power of the relevant reference lamp but not its nominal value. For T5 lamps the typical lamp power at 35 °C is being used.

Total input power with magnetic ballasts is calculated on the basis of formula 2:

$$[2] \quad P_{tot.ref.} = P_{tot.meas.} \left( \frac{P_{Lref.meas.}}{P_{Lmeas.}} 0,95 \right) - (P_{Lref.meas.} - P_{Lnom.})$$

Applying a factor of 0.95 takes account of the characteristics of a lamp operated by magnetic ballast. This factor must also be applied when calculating magnetic ballast efficiency.

So to calculate the efficiency  $\eta_{ballast}$  of magnetic ballast, the lamp output power  $P_{Lnom}$  is multiplied by the factor 0.95 and divided by the total input power  $P_{tot.ref.}$ .

$$[2a] \quad \eta_{ballast} = 0,95 \frac{P_{Lnom.}}{P_{tot.ref.}} = 0,95 \frac{P_{Lnom}}{P_{tot.meas.} \left( \frac{P_{Lref.meas.}}{P_{Lmeas.}} 0,95 \right) - (P_{Lref.meas.} - P_{Lnom.})}$$

Where:

$P_{Lmeas.}$  measured lamp power in the circuit with test ballast (in watt)  
 $P_{Lnom.}$  rated lamp power (50 Hz) of relevant reference lamp according to the lamp data sheet (in watt)

The standard mains electricity supply voltage across the EU is 230 V, so measurements and calculations are performed on the basis of this line voltage. 230 V is being adopted as the nominal voltage in a growing number of countries worldwide (e.g. Australia, India, etc.).

Once ballast efficiency has been measured/calculated, ballasts can be given an energy efficiency class and marked accordingly.

### Stage 1 (13.04.2010) – one year after the regulation enters into force

Table C.2 is taken from Regulation 347/2010 and shows the efficiency and EEI classes of ballasts designed to operate the different lamp types listed. The ballast efficiency classes shown are based on the limit values for total input power applied in the CELMA energy efficiency classification system.

What is new in the table is the class A2 BAT (BAT = **B**est **A**vailable **T**echnology), which is reserved for devices achieving state-of-the-art efficiency. The idea of introducing A2 BAT is to create scope for raising requirements at a later date.

**Table C.2 – Requirements for non-dimmable ballasts for fluorescent lamps  
(Table 17 of the Regulation)**

LAMP DATA					BALLAST EFFICIENCY ( $P_{lamp} / P_{input}$ )				
Lamp type	Nominal wattage	ILCOS CODE	Rated/typical wattage		A2 BAT	A2	A3	B1	B2
			50Hz	HF					
	W		W	W					
T8	15	FD-15-E-G13-26/450	15	13.5	87,8 %	84,4 %	75,0 %	67,9 %	62,0 %
T8	18	FD-18-E-G13-26/600	18	16	87,7 %	84,2 %	76,2 %	71,3 %	65,8 %
T8	30	FD-30-E-G13-26/900	30	24	82,1 %	77,4 %	72,7 %	79,2 %	75,0 %
T8	36	FD-36-E-G13-26/1200	36	32	91,4 %	88,9 %	84,2 %	83,4 %	79,5 %
T8	38	FD-38-E-G13-26/1050	38.5	32	87,7 %	84,2 %	80,0 %	84,1 %	80,4 %
T8	58	FD-58-E-G13-26/1500	58	50	93,0 %	90,9 %	84,7 %	86,1 %	82,2 %
T8	70	FD-70-E-G13-26/1800	69.5	60	90,9 %	88,2 %	83,3 %	86,3 %	83,1 %
TC-L	18	FSD-18-E-2G11	18	16	87,7 %	84,2 %	76,2 %	71,3 %	65,8 %
TC-L	24	FSD-24-E-2G11	24	22	90,7 %	88,0 %	81,5 %	76,0 %	71,3 %
TC-L	36	FSD-36-E-2G11	36	32	91,4 %	88,9 %	84,2 %	83,4 %	79,5 %
TCF	18	FSS-18-E-2G10	18	16	87,7 %	84,2 %	76,2 %	71,3 %	65,8 %
TCF	24	FSS-24-E-2G10	24	22	90,7 %	88,0 %	81,5 %	76,0 %	71,3 %
TCF	36	FSS-36-E-2G10	36	32	91,4 %	88,9 %	84,2 %	83,4 %	79,5 %



LAMP DATA					BALLAST EFFICIENCY ( $P_{\text{lamp}} / P_{\text{input}}$ )				
Lamp type	Nominal wattage	ILCOS CODE	Rated/typical wattage		A2 BAT	A2	A3	B1	B2
			50Hz	HF					
	W		W	W					
TC-D / DE	10	FSQ-10-E-G24q=1 FSQ-10-I-G24d=1	10	9.5	89,4 %	86,4 %	73,1 %	67,9 %	59,4 %
TC-D / DE	13	FSQ-13-E-G24q=1 FSQ-13-I-G24d=1	13	12.5	91,7 %	89,3 %	78,1 %	72,6 %	65,0 %
TC-D / DE	18	FSQ-18-E-G24q=2 FSQ-18-I-G24d=2	18	16.5	89,8 %	86,8 %	78,6 %	71,3 %	65,8 %
TC-D / DE	26	FSQ-26-E-G24q=1 FSQ-26-I-G24d=1	26	24	91,4 %	88,9 %	82,8 %	77,2 %	72,6 %
TC-T / TE	13	FSM-13-E-GX24q=1 FSM-13-I-GX24d=1	13	12.5	91,7 %	89,3 %	78,1 %	72,6 %	65,0 %
TC-T / TE	18	FSM-18-E-GX24q=2 FSM-18-I-GX24d=2	18	16.5	89,8 %	86,8 %	78,6 %	71,3 %	65,8 %
TC-T / TC-TE	26	FSM-26-E-GX24q=3 FSM-26-I-GX24d=3	26.5	24	91,4 %	88,9 %	82,8 %	77,5 %	73,0 %
TC-DD / DDE	10	FSS-10-E-GR10q FSS-10-L/P/H-GR10q	10.5	9.5	86,4 %	82,6 %	70,4 %	68,8 %	60,5 %
TC-DD / DDE	16	FSS-16-E-GR10q FSS-16-I-GR8 FSS-10-L/P/H-GR10q	16	15	87,0 %	83,3 %	75,0 %	72,4 %	66,1 %
TC-DD / DDE	21	FSS-21-E-GR10q FSS-21-I-GR10q FSS-21-L/P/H-GR10q	21	19,5	89,7 %	86,7 %	78,0 %	73,9 %	68,8 %
TC-DD / DDE	28	FSS-28-E-GR10q FSS-28-I-GR8 FSS-28-L/P/H-GR10q	28	24,5	89,1 %	86,0 %	80,3 %	78,2 %	73,9 %
TC-DD / DDE	38	FSS-38-E-GR10q FSS-38-L/P/H-GR10q	38.5	34,5	92,0 %	89,6 %	85,2 %	84,1 %	80,4 %
TC	5	FSD-5-I-G23 FSD-5-E-2G7	5.4	5	72,7 %	66,7 %	58,8 %	49,3 %	41,4 %
TC	7	FSD-7-I-G23 FSD-7-E-2G7	7.1	6.5	77,6 %	72,2 %	65,0 %	55,7 %	47,8 %
TC	9	FSD-9-I-G23 FSD-9-E-2G7	8.7	8	78,0 %	72,7 %	66,7 %	60,3 %	52,6 %
TC	11	FSD-11-I-G23 FSD-11-E-2G7	11.8	11	83,0 %	78,6 %	73,3 %	66,7 %	59,6 %
T5	4	FD-4-E-G5-16/150	4.5	3.6	64,9 %	58,1 %	50,0 %	45,0 %	37,2 %
T5	6	FD-6-E-G5-16/225	6	5.4	71,3 %	65,1 %	58,1 %	51,8 %	43,8 %
T5	8	FD-8-E-G5-16/300	7.1	7.5	69,9 %	63,6 %	58,6 %	48,9 %	42,7 %
T5	13	FD-13-E-G5-16/525	13	12.8	84,2 %	80,0 %	75,3 %	72,6 %	65,0 %
T9-C	22	FSC-22-E-G10q-29/200	22	19	89,4 %	86,4 %	79,2 %	74,6 %	69,7 %
T9-C	32	FSC-32-E-G10q-29/300	32	30	88,9 %	85,7 %	81,1 %	80,0 %	76,0 %
T9-C	40	FSC-40-E-G10q-29/400	40	32	89,5 %	86,5 %	82,1 %	82,6 %	79,2 %
T2	6	FDH-6-L/P-W4.3x8.5d-7/220		5	72,7 %	66,7 %	58,8 %		
T2	8	FDH-8-L/P-W4.3x8.5d-7/320		7.8	76,5 %	70,9 %	65,0 %		
T2	11	FDH-11-L/P-W4.3x8.5d-7/420		10.8	81,8 %	77,1 %	72,0 %		
T2	13	FDH-13-L/P-W4.3x8.5d-7/520		13.3	84,7 %	80,6 %	76,0 %		
T2	21	FDH-21-L/P-W4.3x8.5d-7/		21	88,9 %	85,7 %	79,2 %		
T2	23	FDH-23-L/P-W4.3x8.5d-7/		23	89,8 %	86,8 %	80,7 %		
T5-E	14	FDH-14-G5-L/P-16/550		13.7	84,7 %	80,6 %	72,1 %		
T5-E	21	FDH-21-G5-L/P-16/850		20.7	89,3 %	86,3 %	79,6 %		
T5-E	24	FDH-24-G5-L/P-16/550		22.5	89,6 %	86,5 %	80,4 %		
T5-E	28	FDH-28-G5-L/P-16/1150		27.8	89,8 %	86,9 %	81,8 %		
T5-E	35	FDH-35-G5-L/P-16/1450		34.7	91,5 %	89,0 %	82,6 %		
T5-E	39	FDH-39-G5-L/P-16/850		38	91,0 %	88,4 %	82,6 %		

LAMP DATA					BALLAST EFFICIENCY ( $P_{\text{lamp}} / P_{\text{input}}$ )				
Lamp type	Nominal wattage	ILCOS CODE	Rated/typical wattage		A2 BAT	A2	A3	B1	B2
			50Hz	HF					
	W		W	W					
T5-E	49	FDH-49-G5-L/P-16/1450		49.3	91,6 %	89,2 %	84,6 %		
T5-E	54	FDH-54-G5-L/P-16/1150		53.8	92,0 %	89,7 %	85,4 %		
T5-E	80	FDH-80-G5-L/P-16/1150		80	93,0 %	90,9 %	87,0 %		
T5-E	95	FDH-95-G5-L/P-16/1150		95	92,7 %	90,5 %	84,1 %		
T5-E	120	FDH-120-G5-L/P-16/1450		120	92,5 %	90,2 %	84,5 %		
T5-C	22	FSCH-22-L/P-2GX13-16/225		22.3	88,1 %	84,8 %	78,8 %		
T5-C	40	FSCH-40-L/P-2GX13-16/300		39.9	91,4 %	88,9 %	83,3 %		
T5-C	55	FSCH-55-L/P-2GX13-16/300		55	92,4 %	90,2 %	84,6 %		
T5-C	60	FSCH-60-L/P-2GX13-16/375		60	93,0 %	90,9 %	85,7 %		
TC-LE	40	FSDH-40-L/P-2G11		40	91,4 %	88,9 %	83,3 %		
TC-LE	55	FSDH-55-L/P-2G11		55	92,4 %	90,2 %	84,6 %		
TC-LE	80	FSDH-80-L/P-2G11		80	93,0 %	90,9 %	87,0 %		
TC-TE	32	FSMH-32-L/P-2GX24q=3		32	91,4 %	88,9 %	82,1 %		
TC-TE	42	FSMH-42-L/P-2GX24q=4		43	93,5 %	91,5 %	86,0 %		
TC-TE	57	FSM6H-57-L/P-2GX24q=5 FSM8H-57-L/P-2GX24q=5		56	91,4 %	88,9 %	83,6 %		
TC-TE	70	FSM6H-70-L/P-2GX24q=6 FSM8H-70-L/P-2GX24q=6		70	93,0 %	90,9 %	85,4 %		
TC-TE	60	FSM6H-60-L/P-2G8=1		63	92,3 %	90,0 %	84,0 %		
TC-TE	62	FSM8H-62-L/P-2G8=2		62	92,2 %	89,9 %	83,8 %		
TC-TE	82	FSM8H-82-L/P-2G8=2		82	92,4 %	90,1 %	83,7 %		
TC-TE	85	FSM6H-85-L/P-2G8=1		87	92,8 %	90,6 %	84,5 %		
TC-TE	120	FSM6H-120-L/P-2G8=1 FSM8H-120-L/P-2G8=1		122	92,6 %	90,4 %	84,7 %		
TC-DD	55	FSSH-55-L/P-GR10q		55	92,4 %	90,2 %	84,6 %		

**Remarks:** The higher efficacy achieved by fluorescent lamps in High Frequency (HF) operation is not taken into account here. Thus this table gives no indication to compare the overall efficiency of magnetic and electronic (HF) operated fluorescent lamps on a system level.

## Stage 2 (13.04.2012) – Three years after the regulation enters into force

No additional requirements are set out for normal operation in stage 2.

## Stage 3 (13.04.2017) – Eight years after the regulation enters into force

In stage 3, Regulation 245/2009 requires that ballasts should conform to the efficiency limit values of the formulas 3, 4 and 5.

Table C.2 will lose its validity in stage 3 and ballasts will no longer be classified according to the values shown in it.

FL-Ballasts have to fulfil the requirements of the formula:

$$\eta_{\text{ballast}} \geq \text{EBb}_{\text{FL}}$$

Where:

$$[3] \quad \text{EBb}_{\text{FL}} = 0.71 \quad \text{for } P_{\text{lamp}} \leq 5 \text{ W}$$

$$[4] \quad \text{EBb}_{\text{FL}} = \frac{P_{\text{lamp}}}{2W \sqrt{\frac{P_{\text{lamp}} / W}{36} + \frac{38}{36} P_{\text{lamp}} + 1W}} \quad \text{for } 5 \text{ W} < P_{\text{lamp}} < 100 \text{ W}$$

$$[5] \quad \text{EBb}_{\text{FL}} = 0.91 \quad \text{for } P_{\text{lamp}} \geq 100 \text{ W}$$

$\text{EBb}_{\text{FL}}$  “Efficiency Base ballast” means the relationship between the rated lamp power  $P_{\text{lamp}}$  ( $= P_{\text{Lnom.}}$ ) and the ballast efficiency

$P_{\text{lamp}}$  ( $= P_{\text{Lnom.}}$ ) is the rated lamp (or typical HF) power of relevant reference lamp according to the lamp data sheet (in Watts)

**Remark:**  $P_{\text{Lnom}}$  indicates the rated or typical HF-Power of the lamp measured at the rated ambient temperature. For T5-E and T5-C lamps the typical lamp power is measured at 35 °C.

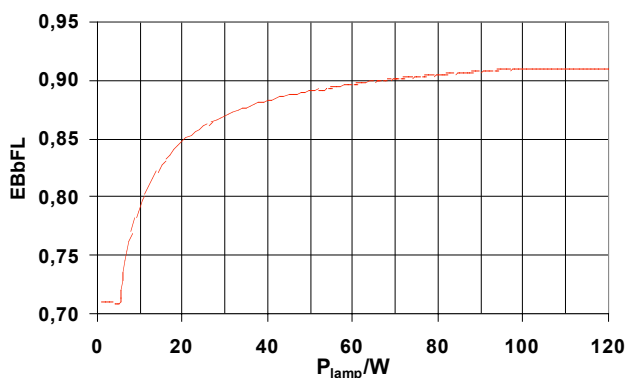


Figure C.1 –  $\text{EBb}_{\text{FL}}$  “Efficiency Base ballast” according to the lamp power

#### Calculation examples based on formula 4:

**A) Sample magnetic ballast** for a 36 W T8 lamp with a total input power  $P_{tot.ref.}$  of 38.7 W ( $P_{lamp} = 36$  W):

- Efficiency limit value from formula 4:  $EBb_{FL} = 87.8 \%$
- Sample ballast efficiency  $\eta_{ballast} = 36 \text{ W} * 0.95 / 38.7 \text{ W} = 88.4 \%$

This sample magnetic ballast meets the efficiency requirements of formula 4 with the ballast losses only around 4.5 W. This loss is approx. 30 % lower than the values of conventional EEI = B1 ballasts today meaning that such a ballast could only be used for special applications and is not a conceivable option for normal applications.

**B) Sample electronic ballast** for a 36 W T8 fluorescent lamp with a total input power of 38 W ( $P_{lamp} = 32$  W):

- Efficiency limit value from formula 4:  $EBb_{LL} = 87.3 \%$
- Sample ballast efficiency  $\eta_{ballast} = 32 \text{ W} / 38 \text{ W} = 84.2 \%$

This sample electronic ballast does not meet the efficiency requirements of formula 4; the approx. 6 W power loss puts it below the calculated limit value.

**C) Sample electronic ballast** for two 54 W fluorescent lamps with a total input power  $P_{tot.ref.}$  of 114.5 W ( $P_{lamp} = 53.8$  W for each lamp):

- Efficiency limit value from formula 4 ( $P_{lamp} = 53.8$  W):  $EBb_{LL} = 89.3 \%$
- Sample ballast efficiency  $\eta_{ballast} = 2 * 53.8 \text{ W} / 114.5 \text{ W} = 94 \%$

Please note that this ballast can be indicated to meet ballast efficiency class A2 BAT ( $EBb_{FL}$ ) which requires a minimum efficiency of 92 % at  $P_{lamp} = 53.8$  W (see Annex C.2.5)

#### **C.2.2 Ballast energy performance requirements for normal operation of new lamp systems not yet available in the market**

When new lamp systems are introduced, the ballasts for the lamps must be classified in accordance with Table C.3.

**Table C.3 – Requirements for non-dimmable ballasts for lamps not included in Table C.2**  
(Table 18 of the Regulation)

$\eta_{ballast,}$	Energy Efficiency Index
$\geq 0.94 * EBb_{FL}$	A3
$\geq EBb_{FL}$	A2
$\geq 1 - 0.75 * (1 - EBb_{FL})$	A2 BAT

### **C.2.3 Ballast energy performance requirements for normal operation of dimmable systems**

Along with A2 BAT, the regulation also defines A1 BAT for dimmable systems. The requirements are shown in Table C.4.

In the case of dimmable ballasts, the input power of the system must not exceed  $P_{in} < 0.5 P_{Lnom}/\eta_{ballast}$  at "25 % lumen output".  $P_{Lnom}$  is the rated lamp power of the system used.

**Table C.4 – Requirements for dimmable ballasts for lamps**  
(Table 19 of the Regulation)

Complied class at 100% lumen output	Energy Efficiency Index of dimmable ballast
A3	A1
A2	A1 BAT

### **C.2.4 Energy performance requirements for standby operation (dimmable and non-dimmable systems)**

Sensors and other network connections are not taken into account for the standby operation of fluorescent lamp ballasts, i.e. they are not connected for measurement. For ballasts with a combined function for maintained mains and emergency operation, the battery is disconnected (under consideration in consultation with commission).

In stage 1, a limit value of 1 W per ballast is defined. In stage 2, that value is reduced to 0.5 W.

Please note that ballasts which have automatically shut down after fault detection are not regarded as operating in standby mode.

### **C.2.5 Indication of the energy efficiency of fluorescent lamp ballasts**

Ballast efficiency classes are indicated in documentation and on rating plates as follows:

#### **A) Indication based on Table C.2 values (stages 1 and 2):**

**EEI = A1 BAT, EEI = A1, EEI = A2 BAT, EEI = A2, EEI = A3, EEI = B1, EEI = B2**

This marking shows that the ballast complies with the energy efficiency requirements in Table C.2, i.e. the stage 1 and 2 stipulations of the Regulation for fluorescent lamp ballasts. Information on standby losses is contained in the technical documentation.

#### **B) Indication based on formula 3, 4 and 5 requirements (stage 3):**

**A2 or A2 BAT**

This marking shows that the ballast complies with the energy efficiency requirements based on the limit value formulas, i.e. the stage 3 requirements for ballasts. Information on standby losses is contained in the technical documentation.

**Table C.5 – Classification of fluorescent lamp ballasts according to stage 3**

$\eta_{ballast}$	Energy Efficiency Index
$\geq EBb_{FL}$	A2 A1BAT
$\geq 1-0.75*(1-EBb_{FL})$	A2 BAT

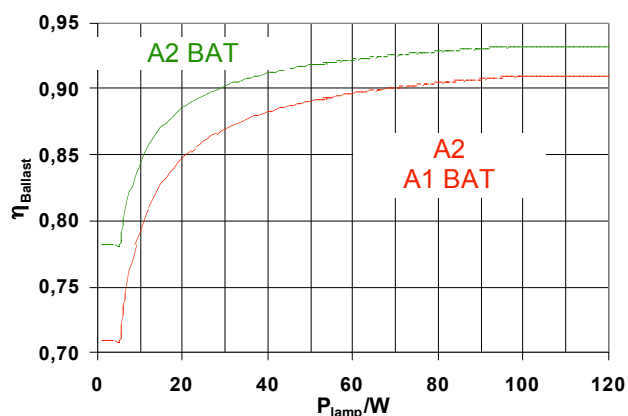


Figure C.2 – Ballast efficiency requirements vs. lamp power for efficiency classes A2, A2 BAT and A1 BAT

The Figure C.3 shows the possible marking of ballasts and the use on luminaires.

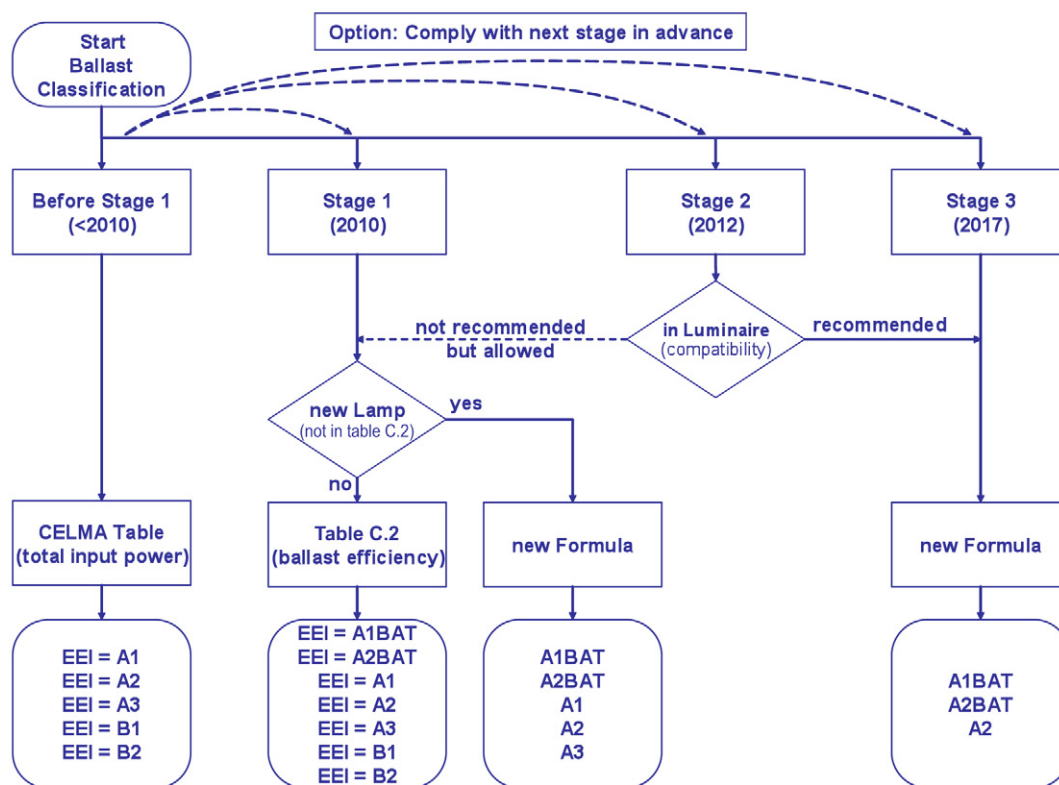


Figure C.3 – Ballast efficiency classification overview

**Remarks:** Ballasts fulfilling the requirements of a later stage before it becomes mandatory should be marked according to the requirements of the later stage only.

### **C.2.6 Product information requirements for fluorescent lamp ballasts**

Table C.6 shows the overview of product information which should be provided from the manufacturer.

**Table C.6 – Product information FL-Ballasts**

	Stage 1 from 13.04.2010	Stage 2 from 13.04.2012	Stage 3 from 13.04. 2017
On ballast	Indication of energy efficiency index (e.g. EEI = A2 BAT, EEI = A2, EEI = B1 or EEI = B2)		Indication of energy efficiency index based on limit value formulas (e.g. A2 BAT or A2 )
Free-access website			
Technical documentation			

## **C.3 Ballasts for high intensity discharge lamps**

### **C.3.1 Energy performance requirements for normal operation**

Regulation 245/2009 rates the efficiency of ballasts for high intensity discharge lamps and specifies minimum values for it.

Efficiency is lamp output power divided by total input power. The measurement method required for rating efficiency is currently (at the moment of publishing this document) being standardised within International Electrotechnical Commission (IEC) and may be used for either electronic or magnetic ballasts for high intensity discharge lamps. The ballast to be rated is connected to an equivalent circuit and measured. To establish its efficiency, the measured or calculated lamp power is then divided by the total input power of the measuring circuit.

The standard mains electricity supply voltage across the EU is 230 V, so measurements and calculations are performed on the basis of this line voltage. 230 V is being adopted as the nominal voltage in a growing number of countries worldwide (e.g. Australia, India etc.).

#### **Stage 1 (13.04.2010) – One year after the regulation enters into force**

No requirements are defined for high intensity discharge lamps in stage 1.

#### **Stage 2 (13.04.2012) – Three years after the regulation enters into force**

Table C.7 is taken from Regulation 245/2009 and shows the minimum efficiency permissible after stage 2 enters into force.

**Table C.7 – Minimum efficiency for ballasts for high intensity discharge lamps – Stage 2**  
(Table 15 of the Regulation)  
**EEI = A3**

Nominal lamp wattage (P) W	Minimum ballast efficiency ( $\eta_{\text{ballast}}$ ) %
$P < 30$	65
$30 \leq P \leq 75$	75
$75 < P \leq 105$	80
$105 < P \leq 405$	85
$P > 405$	90

### Stage 3 (13.04.2017) – Eight years after the regulation enters into force

Table C.8 is taken from Regulation 245/2009 and shows the minimum efficiency permissible after stage 3 enters into force.

**Table C.8 – Minimum efficiency for ballasts for high intensity discharge lamps – Stage 3**  
(Table 16 of the Regulation)  
**A2**

Nominal lamp wattage (P) W	Minimum ballast efficiency ( $\eta_{\text{ballast}}$ ) %
$P \leq 30$	78
$30 < P \leq 75$	85
$75 < P \leq 105$	87
$105 < P \leq 405$	90
$P > 405$	92

### C.3.2 Energy performance requirements for standby operation

No limit values have been defined for ballasts for high intensity discharge lamps in standby operation.

### C.3.3 Product information requirements for high intensity discharge lamp ballasts

Table C.9 shows the overview of product information which should be provided from the manufacturer.

**Table C.9 – Product information HID Ballasts**

	Stage 1 from 13.04.2010	Stage 2 from 13.04. 2012	Stage 3 from 13.04. 2017
On ballast	No requirements	Indication of efficiency	
Free-access website			
Technical documentation			

### C.3.4 Indication of efficiency of high intensity discharge lamp ballasts

The typical measured efficiency of the product series is indicated on ballasts themselves and in the product documentation.

If the ballast fulfils the requirements of Table C.7:

$$EEI = A3$$

If the ballast fulfils the requirements of Table C.8:

$$A2$$

The detailed measurement method is under development as on IEC standard.

CE marking on ballast constitutes confirmation by the manufacturer that the ballast conforms to the requirements of Regulation 245/2009.



#### **C.4 Indicative benchmarks for ballasts**

The regulation includes benchmark values of the best available technology for specific lighting tasks at the time the regulation enters into force. These values are purely informative. The lighting industry does not recommend using the proposed indicative benchmarks as they could hamper the free circulation of lighting products on the market because they could be made mandatory for specific uses (such as public procurement building regulations, etc) by some EU Member States only.

##### **Annex 5 of the Regulation contains general information on the indicative benchmarks for lamps, ballasts and luminaires**

- Fluorescent lamp ballasts should conform to energy efficiency class A1 BAT and be dimmable down to 10 % light output.
- Ballasts for high intensity discharge lamps should be dimmable without steps down to 40 % light output and have a ballast efficiency rating of at least 90 %.

##### **Annex 6 of the Regulation contains general information on the indicative benchmarks for office lighting**

The regulation sets out the following characteristics for benchmark ballasts:

- Fluorescent lamp ballasts should conform to energy efficiency class A1 BAT and be dimmable down to 10 % light output.
- Ballasts for high intensity discharge lamps should have an efficiency rating of 88 % up to 100 W lamp power and 90 % efficiency above 100 W. Ballasts for high intensity discharge lamps with a power rating over 50 W should be dimmable.

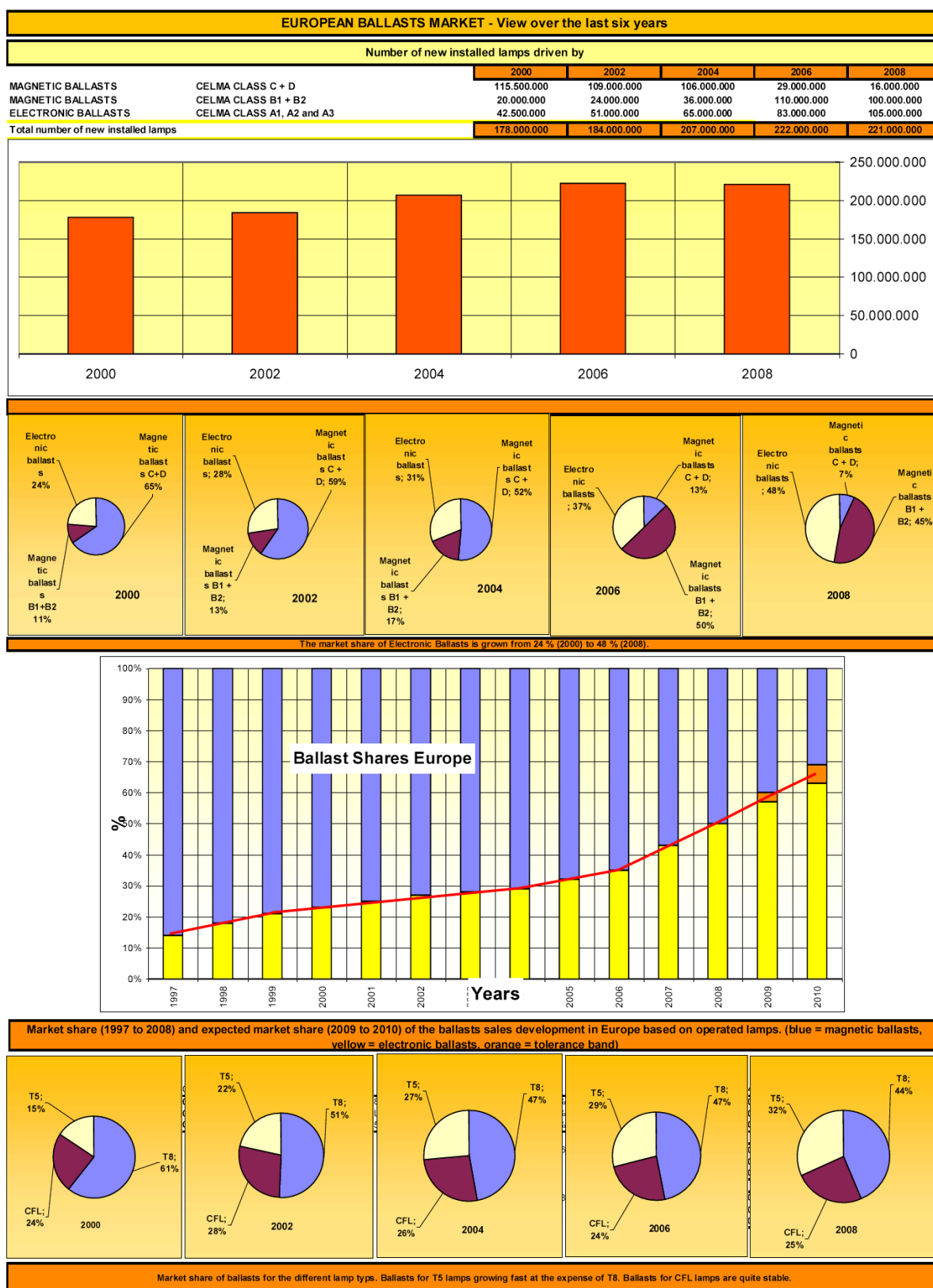
##### **Annex 7 of the Regulation contains information on indicative benchmarks for street lighting**

The regulation sets out the following characteristics for benchmark ballasts:

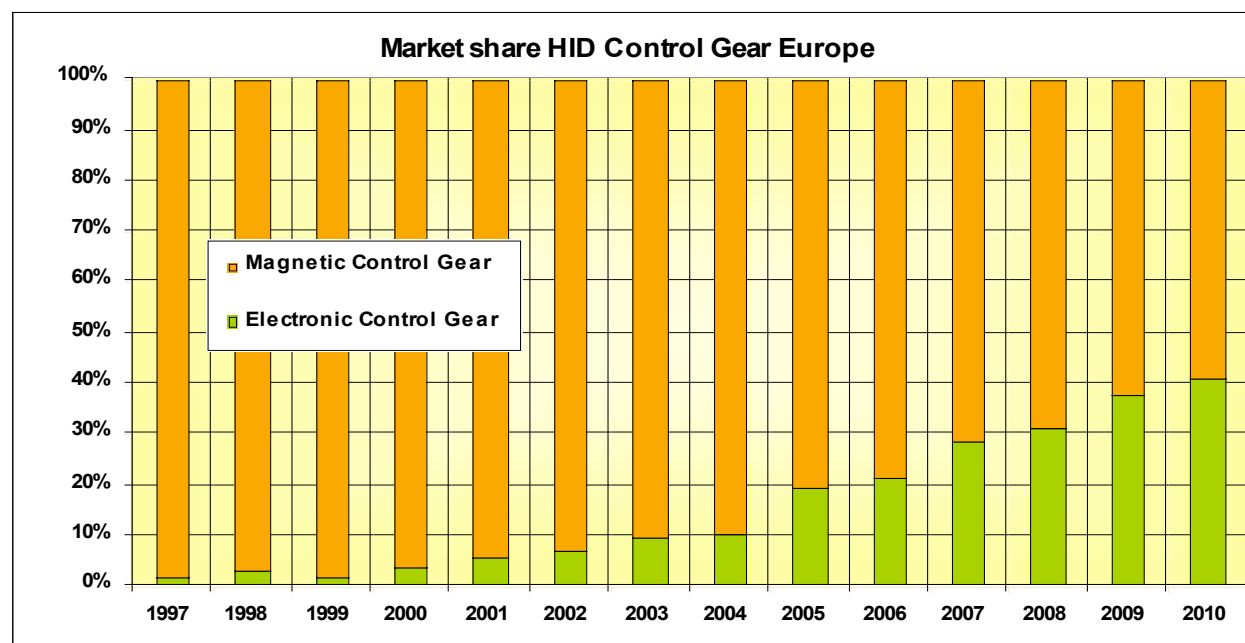
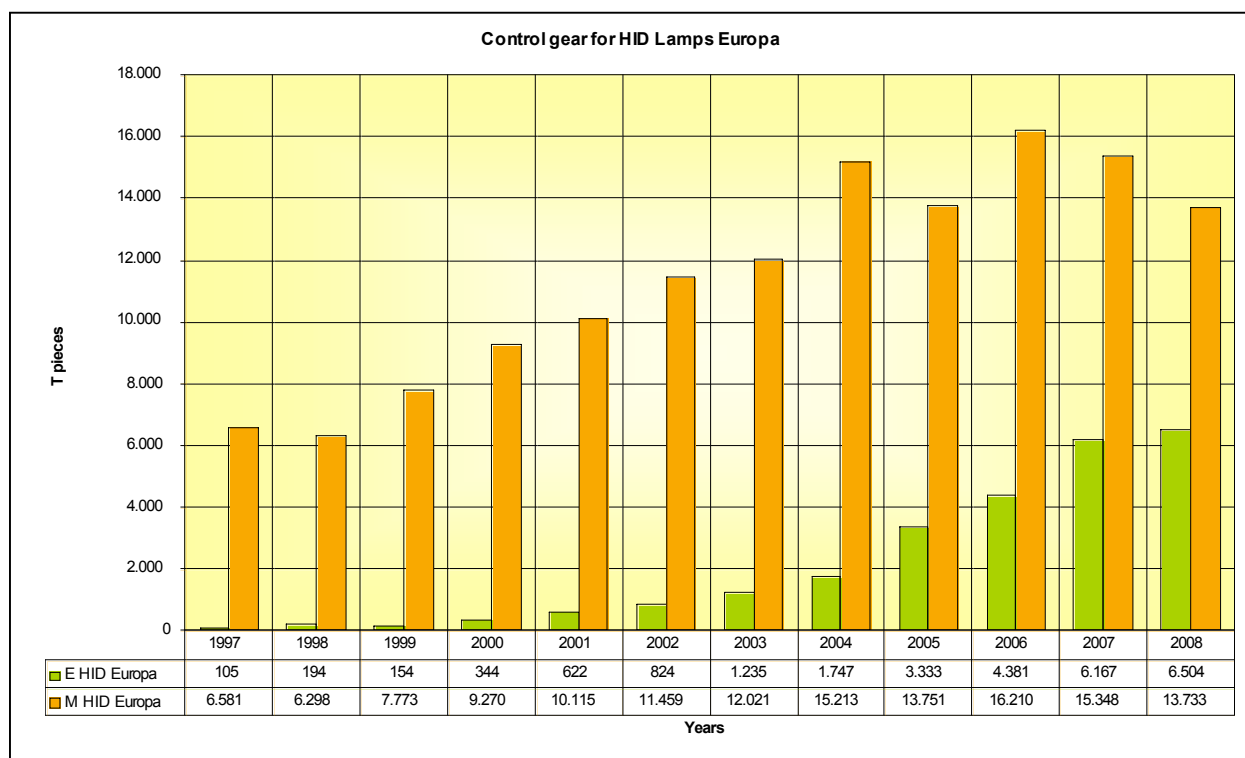
- Fluorescent lamp ballasts should conform to energy efficiency class A1 BAT and be dimmable down to 10 % light output.
- Ballasts for high intensity discharge lamps should have an efficiency rating of 87 % up to 100 W lamp power and 89 % efficiency above 100 W. Ballasts for high intensity discharge lamps with a power rating over 55 W should be dimmable.

**Recommendation:** The lighting industry does not recommend using the proposed indicative benchmarks in the Annexes V, VI and VII of the Regulation. The reason is that these indicative benchmarks could hamper the free circulation of lighting products on the market as they could be made mandatory for specific uses (such as public procurement building regulations, etc) by some EU Member States only.

## C.5 Ballast Market for fluorescent lamps in Europe



## C.6 Ballast Market for HID lamps in Europe



## Annex D

### Luminaires requirements

#### D.1 Introduction

For the purposes of Regulation 245/2009 amended by Regulation 347/2010, luminaires include lamps and ballasts. While ballasts are generally integrated, lamps are designed for replacement and are not normally supplied with the product. Luminaires distribute the light emitted by lamps according to the requirements of the relevant lighting application. Quality criteria's (e.g. glare limitation, shielding angle, etc) play an important role in lighting. These are not considered in this regulation.

The requirements are basically for general lighting and included fluorescent and high pressure discharge lamp luminaires.

#### D.2 Exemptions

The regulation does not apply to:

- emergency lighting luminaires and emergency sign luminaires within the meaning of Directive 2006/95/EC
- explosion-protected luminaires covered by the requirements of Directive 94/9/EC and Directive 1999/92/EC
- luminaires integrated into machinery covered by the requirements of Directive 2006/42/EC
- luminaires integrated into medical products covered by the requirements of Directive 93/42/EEC
- luminaires that are toy components covered by the requirements of Directive 88/378/EEC

#### D.3 Energy efficiency requirements for luminaires

As a matter of principle, ballasts and lamps used in luminaires must conform to the relevant limit values stipulated by the Regulation.

**Table D.1 – Energy efficiency requirements for luminaires**

Luminaires for fluorescent lamps or high intensity discharge lamps		Stage 1 from 13.04.2010	Stage 2 from 13.04.2012	Stage 3 from 13.04.2017
Energy efficiency requirements for fluorescent lamp luminaires	Non-dimmable ballasts	Luminaire limit values = sum of ballast limit values (number of ballasts used – network connections or sensors are not assessed for standby losses). $n$ = number of ballasts per luminaire		
	Dimmable ballasts			
	Standby losses	$n \times 1$ Watt	$n \times 0.5$ Watt	$n \times 0.5$ Watt
Compatibility requirements for fluorescent and high intensity discharge lamps			Luminaires must be <b>compatible</b> with stage 3 ballast requirements. Exceptions: luminaires with at least IP 4X.	All luminaires must be <b>compatible</b> with stage 3 ballast requirements.
Energy efficiency requirements of high intensity discharge lamp luminaires	Non-dimmable ballasts	No special requirements.	Luminaire limit values = sum of ballast limit values (number of ballasts used – network connections or sensors are not assessed for standby losses).	
	Dimmable ballasts			
	Standby losses			

This “compatibility” means that from the beginning of the stage 2, luminaires shall already be “compatible” with stage 3 ballasts. This option must be offered without major change of the luminaire design. The target of the requirement is also to save energy at the earlier stage 2. Although it is allowed to supply luminaires of stage 2 with ballast of stage 2 the regulation tries to stimulate the use of stage 3 ballasts.

**Recommendation:** The lighting industry recommends luminaire manufacturers to use stage 3 ballasts (A1 BAT, A2 and A2 BAT) as soon as possible.

This recommendation from the lighting industry underlines the framework for energy conservation and carbon emission reductions stipulated by the legislator for Regulation 245/2009.

In the case of ballasts for fluorescent lamps, the recommendation can already be widely realised.

Stage 3 ballasts for high intensity discharge lamps are already available for some applications.

Luminaires  $\geq$  IP 4X are exempted from the requirement to use stage 3 ballasts in luminaire implementation stage 2 because the legislator has acknowledged the special needs of such luminaires. Experience of using electronic ballasts in luminaires  $\geq$  IP 4X is still limited. In the coming years work will be geared to gather experience in the relevant applications in order to develop and standardise technical solutions. The switch-over for these luminaires must be realised by 2017.

#### **D.4 Product information requirements**

##### **Intermediate stage 1 (13.10.2010) – 18 months after the Regulation enters into force**

In the case of luminaires for high intensity discharge lamps, there are no product information requirements in the first luminaire implementation stage.

In the case of luminaires for fluorescent lamps with a total lamp lumen output  $> 2,000$  lm, information must be provided on free-access websites and in other appropriate forms (catalogue, specifications, data sheets) for each type of luminaire, not on the luminaire rating plate.

The technical information must also be included in the documentation relating to the EC declaration of conformity:

- a) The efficiency of the ballasts used in accordance with the ballast manufacturer's data;

Clarification / interpretation from the lighting industry for point a): extract the ballast efficiency information of the ballast label and publish it on the website and in the technical file.

- b) The efficiency of the lamps if these are supplied with the luminaires;

Clarification / interpretation from the lighting industry for point b): the information shall be published on the website and in the technical file.

- c) If ballasts or lamps are not placed on the market together with the luminaires, the types of ballast and lamp approved for use in the luminaire must be identified;

Clarification / interpretation from the lighting industry for point c): the information shall be published on the website and in the technical file.

- d) Instructions for maintenance (e.g. cleaning, lamp replacement) needed to maintain the energy efficiency of the luminaires.

Clarification / interpretation from the lighting industry for point d): maintenance instructions shall contain instructions on:

- how to change the lamp(s) and
- how to clean the luminaire

The information shall be published on their website and it is recommended to give a reference in their technical file.

- e) Disassembly instructions to ensure that the luminaire can be properly disposed of at the end of its life.

Clarification / interpretation from the lighting industry for point e): disassembling instructions of the luminaire at the end of life shall contain instructions for:

- removing discharge lamps and/or batteries,
- relevant collection procedures according WEEE

The information shall be published on their website and it is recommended to give a reference in their technical file.

For voluntary use, pictograms are available on the CELMA website ([www.celma.org](http://www.celma.org)) for above items d) and e).

## **Stage 2 (13.04.2012) – Three years after the Regulation enters into force**

Luminaires for high intensity discharge lamps need to meet the same requirements in stage 2 as luminaires for fluorescent lamps in stage 1. In addition:

- f) to ensure that luminaires have the required characteristics, there needs to be an indication on the luminaire that it is designed for use with clear and/or coated lamps.

## **Stage 3 (13.04.2017) - eight years after the Regulation enters into force**

No other requirements in stage 3.

### **D.5 Indicative benchmarks for luminaires**

The regulation indicates the benchmark values of the best available technology for specific lighting tasks at the time the regulation enters into force.

<b>Recommendation:</b>	The lighting industry does not recommend using the proposed indicative benchmarks in the Annexes V, VI and VII of the regulation. The reason is that these indicative benchmarks could hamper the free circulation of lighting products on the market as they could be made mandatory for specific uses (such as public procurement building regulations, etc) by some EU Member States only.
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**Annex 5 of the regulation contains information on the indicative benchmarks for lamps, ballasts and luminaires.**

For luminaires, the CEN flux code or full photometric data should be provided for compliance with the benchmark recommendations.

**Annex 6 of the regulation contains information on the indicative benchmarks for office lighting.**

The regulation sets out the following characteristics for benchmark luminaires:

- LMF > 0.95 in normal ambient pollution and with a 4-year cleaning cycle
- At least one lamp type is compatible with the Annex 5 benchmarks
- Luminaires are suitable for operation with lighting control systems offering:
  - presence detection
  - daylight-dependent regulation of the artificial lighting
  - brightness control to take account of changes in lighting requirements
  - brightness control to compensate for soil age and changes in light output and lamp efficacy
- Except for general-diffuse luminaires with no light-controlling elements, information should additionally be provided about the luminaire maintenance factor LMF.
- If the cleaning cycle is < 4 years, cleaning instructions must be provided in tabular form.
- In the case of luminaires with directional light sources such as reflector lamps or LEDs, the LLMF (lamp lumen maintenance factor) x LMF (luminaire maintenance factor) value should be provided instead of just the LMF value.

**Annex 7 of the Regulation contains information on indicative benchmarks for street lighting.**

The regulation sets out the following characteristics for benchmark luminaires:

- IP 65 ingress protection for the optical system of street lights for class ME1-ME6 and MEW1-MEW6 roads
- IP 5x ingress protection for the optical system of street lights for class CE0-CE5, S1-S6, ES, EV and A roads

The proportion of light emitted going above the horizon shall be limited according to Table 25 of the Regulation 245/2009.

In areas of high light pollution, no more than 1 % should go above the horizontal. To the lighting industry's knowledge, there is no definition of high light pollution.

Luminaires are compatible with appropriate dimming and control systems that take account of available daylight as well as traffic and weather conditions and also compensate for variations in surface reflection and the initial dimensioning of the installation due to the lamp lumen maintenance factor.

The following information must also be provided:

- Utilisation factor values for standard road conditions in tabular form for the road classes defined. The table also contains UF values for road widths, pole heights, maximum pole spacing and luminaire overhang and inclination as appropriate for the given road class and luminaire design.
- Installation instructions for optimising the utilisation factor.
- Additional installation recommendations to minimise obtrusive light
- In the case of luminaires with directional light sources such as reflector lamps or LEDs, the LLMF (lamp lumen maintenance factor) x LMF (luminaire maintenance factor) value should be provided instead of just the LMF value.
- For luminaires with optical elements, the LMF value should be indicated in tabular form.

<b>Recommendation:</b>	The lighting industry does not recommend using the proposed indicative benchmarks in the Annexes V, VI and VII of the regulation. The reason is that these indicative benchmarks could hamper the free circulation of lighting products on the market as they could be made mandatory for specific uses (such as public procurement building regulations, etc) by some EU Member States only.
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## **Annex E**

### **Market Surveillance**

#### **E.1 Verification procedure for market surveillance**

When performing the market surveillance checks referred to in Article 3 (2) of Directive 2005/32/EC, the authorities of the Member States shall apply the following verification procedure for the requirements set out in Annex III.

##### **For 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 provisions set out in Annex III Part 1, as applicable, to this Regulation if the average results of the batch do not vary from the limit, threshold or declared values by more than 10 %.

Otherwise, the model shall be considered not to comply.

##### **For ballasts and luminaires**

Member State authorities shall test one single unit.

The model shall be considered to comply with the provisions set out in Annex III, Parts 2 and 3, as applicable, to this Regulation if the results do not exceed the limit values.

Otherwise, three more units shall be tested. The model shall be considered to comply with this Regulation if the average of the results of the latter three tests does not exceed the limit values.

Otherwise, the model shall be considered not to comply.



# CELMA

*Federation of National Manufacturers Associations for  
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**DISCLAIMER**

*This document provides only guidance to the definitive requirements detailed in the Commission Regulation (EC) N° 245/2009. Responsibility for compliance with the Regulation rests firmly with the manufacturer or the person placing the lighting products on the EU market for the first time. Compliance with the CELMA/ELC Guide DOES NOT necessarily provide compliance with the Commission Regulation (EC) N° 245/2009.*