

Linear Fluorescent Lamps for General Lighting Applications

1. Definitions

Linear Fluorescent Lamps

Linear Fluorescent Lamps are high energy-efficient low-pressure discharge lamps with a fluorescent powder coating to transform the mercury UV radiation into visible light. There are two main families of linear fluorescent lamps with tube diameters of:

- T8 (26mm) and T5 (16mm)

Also available are the following diameters:

- T12 (38mm)
- T10 (32mm)
- T2 (7mm).

General Lighting

General Lighting Lamps are lamps for general use in private, commercial & industrial application areas with the following characteristics:

- General Lighting sources provide a level of visible light in the range 400 to 800 nm.
- They are classified by the energy label and universally available.
- They are highly standardised and interchangeable.

For general lighting applications it is only possible to use lamps based on the performance standard IEC/EN 60081. Exceptions to this rule (lamps used for special applications) are listed in *Annex 2*.

2. Minimum Performance Standards

2.1. Efficacy Standard

Efficacy (lm/W) is the amount of light emitted measured in lumen (lm) by a lamp for each Watt (W) of power consumed. The efficacy is the key indicator for efficient power consumption. The minimum lumen per wattage values is outlined in *Annex 1*.

2.2. Colour Rendering Standard

Colour Rendering (Ra) is the ability of lamps to render colours faithfully and is measured on the Ra index. The index runs from 20 (indicative of severe colour distortion) until 100 (no colour distortion).

For General Lighting Applications the Minimum Colour Rendering [Ra] is ≥ 80 .

3. Testing requirements and conditions for the Minimum Performance Standards

The testing requirements and conditions to meet the minimum performance standard are described in *Annex 3* (based on standard EN50285).

4. Performance Standards for CE Mark

For the main fluorescent lamps in the European market (T8, T5 \geq 14W) the performance standards listed in *Annex 1* shall be the criteria to obtain the CE mark. Lamps listed in *Annex 2* (for special applications, generally low volumes) are exempted from this rule.

It is recommended that due to their higher efficacy for new installations only lamps of type T5 (\geq 14W) should be used.

5. Control Gear

It is recommended to use electronic control gears to operate all lamps listed to gain maximum performance, lifetime and efficacy.

All applied ballasts have to be in consensus with the Directive 2000/55/EC. They shall comply with the standard IEC/EN 60929.

6. WEEE

All fluorescent lamps have to fulfil the demands of WEEE (Waste of Electrical and Electronic Equipment / EU Directive 2002/96/EC) and have to be treated at end-of-life in consensus with National Laws in the European Union and to be marked accordingly.



7. Minimum Hazardous Substances Content (RoHS)

All Linear Fluorescent lamps have to fulfill the targets set by the EU Directive RoHS (2002/95/EC).

Addendum: This document is Best Available Technology (BAT) as of present day, 2006. Should new technologies introduced on the market, not be covered by *Annex I*; this Eco-Profile should be updated.

ANNEX 1: – Linear Fluorescent Lamps for general lighting applications

Linear Fluorescent Lamps for General Lighting Applications (according IEC 60081)

Ra = 80...89	 T8 (26 mm Ø) at 25 °C								 T5 (16 mm Ø) at 25 °C							
									High Efficiency				High Output			
Wattage	15	18	25	30	36	38	58	70	14	21	28	35	24	39	49	54
100h Initial value																
nominal light output (lm) for Tc < 5000K (e.g. 827, 830, 835, 840)	950	1350	1900	2400	3350	3300	5200	6200	1200	1900	2600	3300	1750	3100	4300	4450
nominal light output (lm) for Tc ? 5000K (e.g. 850, 865)	900	1300	1800	2300	3250	2950	5000		1100	1750	2400	3050	1600	2850	4100	4050
nominal efficacy (lm/W) for Tc < 5000K (e.g. 827, 830, 835, 840)	63	75	76	80	93	87	90	89	86	90	93	94	73	79	88	82
nominal efficacy (lm/W) for Tc ? 5000K (e.g. 850, 865)	60	72	72	77	90	78	86		79	83	86	87	67	73	84	75
100h Minimum Value IEC 60081 (92% of 100h initial)																
minimum light output (lm) for Tc < 5000K (e.g. 827, 830, 835, 840)	874	1242	1748	2208	3082	3036	4784	5704	1104	1748	2392	3036	1610	2852	3956	4094
minimum light output (lm) for Tc ? 5000K (e.g. 850, 865)	828	1196	1656	2116	2990	2714	4600		1012	1610	2208	2806	1472	2622	3772	3726
minimum efficacy (lm/W) for Tc < 5000K (e.g. 827, 830, 835, 840)	58	69	70	74	86	80	82	81	79	83	85	87	67	73	81	76
minimum efficacy (lm/W) for Tc ? 5000K (e.g. 850, 865)	55	66	66	71	83	71	79		72	77	79	80	61	67	77	69

For practical reasons, it is necessary to measure the T5 lamps at an ambient temperature of 25°C; they reach their optimum efficiency at 35°C (increase by factor of 1,1).

Note 1: - Use for calculation of life cycle analysis (TCO – total cost of ownership).

Note 2: - Must be used for the minimum efficacy to pass the CE Mark.

Please note:

Should another diameter or wattage be used, the following rules apply.

For T8 lamps ≤50W – the lamp must reach the minimum value of the nearest equivalent lamp with regards to wattage and/or diameter.

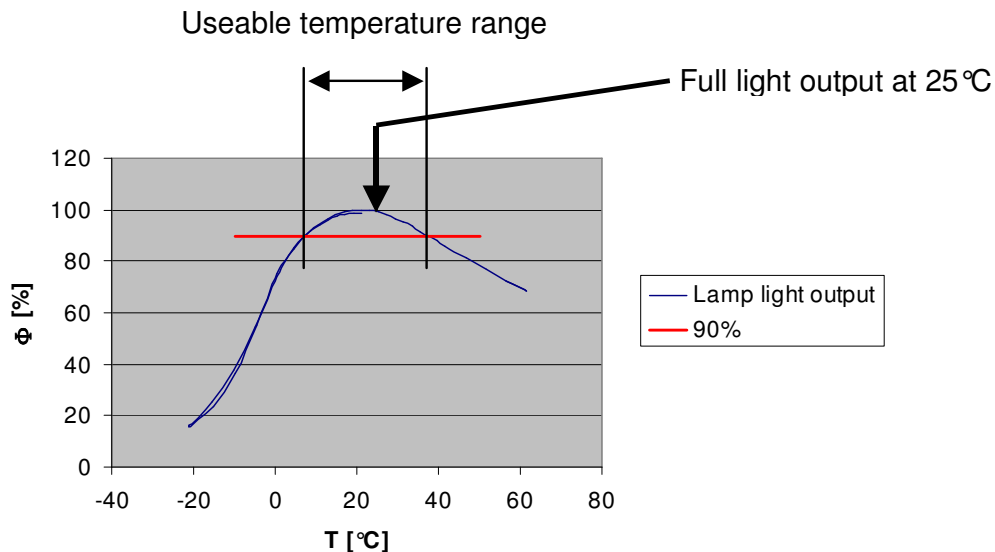
For special applications like lamp operation at low (outdoor) especially, high (hot fixtures) ambient temperatures, lamp manufactures have optimised their lamps for maximizing lumen output under these special conditions. These lamps do not fulfill the data mentioned above at 25°C, but at an ambient temperature for that the lamp design has been optimised.

Annex 2: *Lamps not used for general lighting but for special applications and thus excluded from performance criteria specified in Annex 1:*

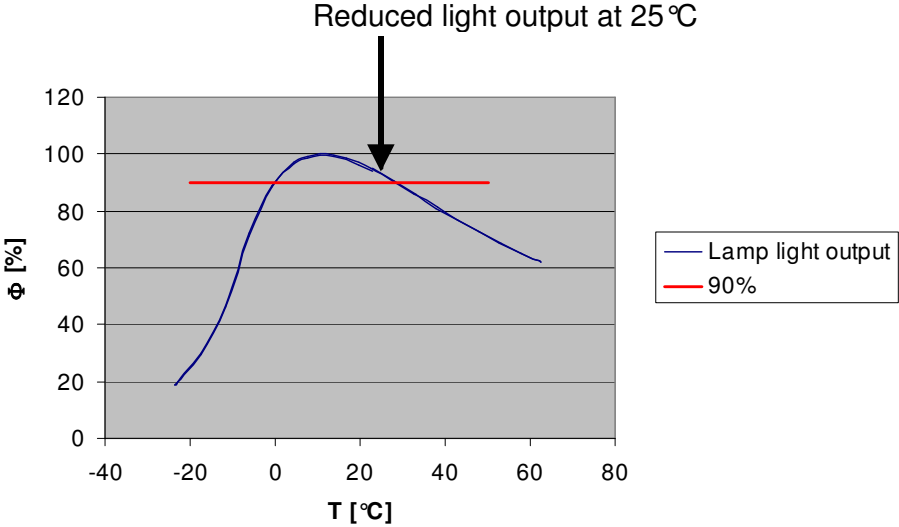
- They are not marketed or commercialised primarily for the production of visible light.
- They are marketed however where:
 - the non-visible radiation has highest importance;
 - different looking lamp designs are relevant for use; and
 - different applications require specific lamps.
- Fluorescent lamps for special purposes include for instance:
 - Black light lamps
 - Disinfection lamps
 - Medical/Therapy lamps
 - Food lighting applications, bakeries etc
 - Pet care lamps i.e. aquaria lamps
 - Lamps designed for UV emission like sun tanning lamps
 - Lamps with special components like integrated reflectors, an external protective sleeve or with an external ignition strip.
 - Lamps with special ignition features for example those designed for low temperatures.
 - Long length lamps (length i.e. 1850mm and longer)
 - Amalgam lamps (see explanation for special temperature applications)
 - Cold Cathode Fluorescent Lamp
 - T9 circle lamps
 - T5 circle lamps
 - T2 lamps
 - T1 lamps
 - T5 lamps $\leq 13\text{W}$
 - Lamps giving coloured light
 - Colour Rendering Index ≥ 90
 - T5 lamps $> 80\text{W}$

Explanation for special temperature applications

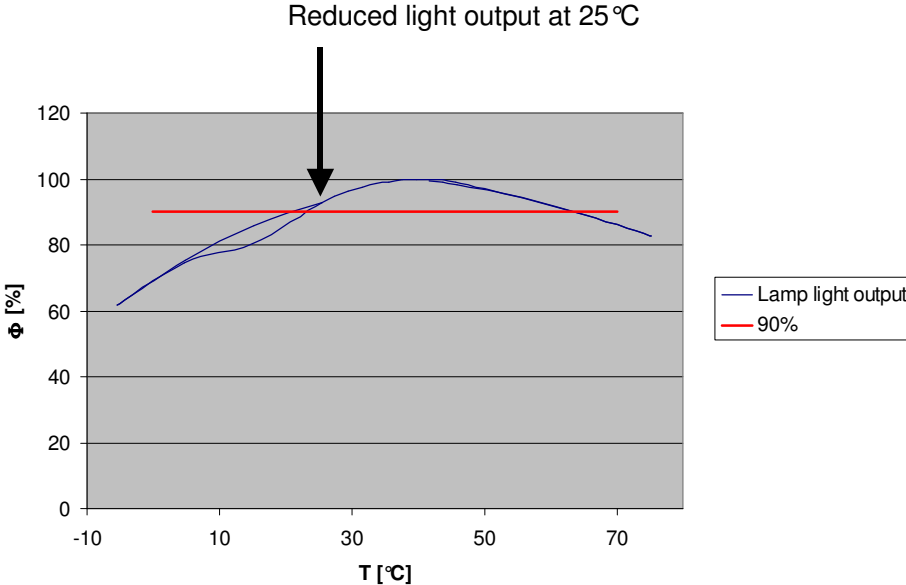
Fluorescent lamps in general have a strong dependency of their light output from the Hg vapour pressure in the lamp and therefore from the lamp ambient temperature.



There are designs of special lamps with maximum light output in a temperature range defined according to the customer needs (e.g. outdoor application).



There are lamps that use amalgam for Hg vapour pressure control, which increases the usable temperature range of the lamp (e.g. hot fixture application).



Annex 3: *Testing requirements and conditions for the Minimum Performance Standards (based on standard EN 50285)*

1. Test conditions

Lamps shall be tested in accordance with the relevant clauses of the standards listed below.

- For double-capped fluorescent lamps IEC 60081

2. Verification

The minimum sample size shall be twenty lamps. The sample shall be representative of a manufacturer's production. This can be achieved by randomly selecting lamps from at least four different points of sale.

The results of the tests shall comply with requirements given in *Annex 1*. If the results do not comply with these requirements, the manufacturer's test records shall be requested.