BRITISH STANDARD

BS EN
61228:2008

Fluorescent ultraviolet lamps used for tanning — Measurement and specification method

ICS 17.240; 29.140.30; 97.170

National foreword

This British Standard is the UK implementation of EN 61228:2008. It is identical to IEC 61228:2008. It supersedes BS EN 61228:1995 which will be withdrawn on 1 February 2011.

The UK participation in its preparation was entrusted by Technical Committee CPL/34, Lamps and related equipment, to Subcommittee CPL/34/1, Electric lamps.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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EN 61228

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English version

Fluorescent ultraviolet lamps used for tanning - Measurement and specification method
(IEC 61228:2008)

Lampes fluorescentes à ultraviolet utilisées pour le bronzage - Méthode de mesure et de spécification (CEI 61228:2008)

UV-Leuchtstofflampen für Bräunungszwecke - Verfahren zur Messung und Beschreibung (IEC 61228:2008)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 34A/1242/FDIS, future edition 2 of IEC 61228, prepared by SC 34A, Lamps, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61228 on 2008-02-01.

This European Standard supersedes EN 61228:1994 + A1:1996.

In EN 61128:2008, an equivalency code for the lamps is introduced. This equivalency code characterises the spectral energy distribution and is to be applied when replacing lamps in tanning equipment.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2008-11-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2011-02-01

Annex ZA has been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 61228:2008 was approved by CENELEC as a European Standard without any modification.

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CONTENTS

FLUORESCENT ULTRAVIOLET LAMPS USED FOR TANNING – MEASUREMENT AND SPECIFICATION METHOD

1 Scope

This International Standard describes the method of measuring, evaluating and specifying the characteristics of fluorescent ultraviolet lamps that are used in appliances for tanning purposes. It includes specific requirements regarding the marking of such lamps.

These recommendations relate only to type testing.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-845:1987, *International Electrotechnical Vocabulary (IEV) – Chapter 845: Lighting*

IEC 60081, *Double-capped fluorescent lamps – Performance specifications*

IEC 60901, *Single-capped fluorescent lamps – Performance specifications*

IEC 60335-2-27*, Household and similar electrical appliances – Safety – Part 2-27: Particular requirements for appliances for skin exposure to ultraviolet and infrared radiation*

CIE 63:1984, *The spectroradiometric measurement of light sources*

IEC 62471, *Photobiological safety of lamps and lamp systems*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
ultraviolet lamp
lamp which radiates especially strongly in the ultraviolet, the visible radiation produced, if any, not being of direct interest

[IEV 845-07-52]

3.2
fluorescent lamp
discharge lamp of the low-pressure mercury type in which most of the light is emitted by one or several layers of phosphors excited by the ultraviolet radiation from the discharge

[IEV 845-07-26]

3.3
type test
test or a series of tests made on a type test sample for the purpose of checking compliance of the design of a given product with the requirements of the relevant standard

3.4
spectroradiometer
instrument for measuring radiometric quantities in narrow wavelength intervals over a given spectral region

[IEV 845-05-07]

3.5
bandwidth at a given wavelength
width at half-amplitude points of the transmittance function of a monochromator (unit: nm)

3.6
spectral
adjective that, when applied to a quantity X pertaining to electromagnetic radiation, indicates:

– either that X is a function of the wavelength λ, symbol: $X(\lambda)$;

– or that the quantity referred to is the spectral concentration of X, symbol: $X_\lambda = \mathrm{d}X/\mathrm{d}\lambda$.

X_λ is also a function of λ and in order to stress this it may be written X_λ (λ) without any change of meaning

[IEV 845-01-16]

3.7
irradiance
quotient of the radiant flux $\mathrm{d}\phi_e$ incident on an element of the surface containing the point, by the area $\mathrm{d}A$ of that element (unit: W/m^2)

[IEV 845-01-37]

3.8
action spectrum
efficiency of monochromatic radiations for producing a specified phenomenon in a specified system

[IEV 845-06-14, modified]

3.9
effective
adjective that, when applied to a quantity pertaining to electromagnetic radiation, indicates that the quantity referred to is weighted according to a specified action spectrum

3.10
nominal value
approximate quantity value used to designate or identify a lamp

3.11
rated value
quantity value for a characteristic of a lamp for specified operating conditions

NOTE The value and/or conditions are specified in this standard, or assigned by the manufacture or responsible vendor.

4 General test conditions

4.1 Ageing

Before the initial measurements, lamps shall be aged for a period of 5 h ± 0,25 h under normal operating conditions.

4.2 Operating position

During ageing and measurement, lamps shall be operated in a horizontal position. Ageing is preferably in a horizontal position; a vertical position may also be applied.

4.3 Ambient temperature

The measurement shall be made in a draught-free atmosphere at an ambient temperature of 25 °C ± 1 °C.

NOTE If applicable, lamps may also be measured under conditions different from the above standard ambient temperature conditions to establish the optimum UV irradiance, as described in Annex A.

4.4 Test voltage

The test voltage applied to the circuit shall be as specified on the relevant lamp data sheet.

4.5 Ballast

Lamps shall be operated with a reference ballast. In cases where a reference ballast has not been established, an appropriate test ballast shall be specified by the lamp manufacturer or responsible vendor. The ballast shall be operating at a frequency of 50 – 60 Hz.

5 Test requirements

5.1 General

Spectroradiometric measurements shall be made in accordance with the relevant recommendations of the CIE (International commission on illumination), as given in CIE 63.

Additional information about UV measurements is given in Annex B of IEC 62471.

Requirements for electrical measurements are given in Annex B of IEC 60081 and IEC 60901.

5.2 Spectroradiometric measuring system

Lamps shall be measured in an appropriate spectroradiometric system to obtain the spectral irradiance.

The system input optics shall have cosine response to accurately measure irradiance.

The spectroradiometer shall have a bandwidth not exceeding 2,5 nm.

The distance between detector and lamp axis is not specified but shall be not less than 10 cm.

NOTE 1 For the publication of the final lamp specifications, the measured irradiance values are corrected to arrive at irradiance values at 25 cm distance from the lamp axis (see 6.3).

NOTE 2 A bandwidth of 1 nm is advisable for greater measurement accuracy in cases where a rapid change of the spectral irradiance occurs within a small bandwidth area.

NOTE 3 The bandwidth should be at least 2,5 times the measurement interval.(e.g. 2,5 nm bandwidth requires 1 nm measurement interval)

6 Measurement and evaluation procedure

6.1 Measurement

The spectral irradiance shall be measured at intervals of 1 nm from 250 nm to 400 nm. Under the test conditions, the lamp power, current and voltage shall be recorded.

6.2 Calculation of the total effective UV irradiance

The total effective UV irradiance shall be calculated from the spectral irradiance using the following formula:

$$E_{\text{eff}} = \Sigma\, E_\lambda \,.\, S(\lambda) \,.\, \Delta\lambda$$

where

E_{eff} is the total effective irradiance (W/m^2);

E_λ is the spectral irradiance (W/(m^2.nm));

$S(\lambda)$ is the weighting factor according to the applicable action spectrum;

$\Delta\lambda$ is the wavelength interval (nm).

The wavelength interval for the calculation shall preferably be equal to the bandwidth.

The applicable action spectra for erythema and NMSC are given in Annex B.

For the total effective UV irradiance weighted according to the erythema action spectrum, the summation shall be performed over the following wavelength range:

250 nm $\leq \lambda \leq$ 400 nm.

For the total effective UV irradiance weighted according to the NMSC action spectrum, the summation shall be performed over two wavelength ranges:

250 nm $\leq \lambda \leq$ 320 nm, and

320 nm $< \lambda \leq$ 400 nm.

NOTE The limit of 320 nm is chosen in accordance with IEC 60335-2-27, where for this application the CIE nomenclature UV-A and UV-B with a limit of 315 nm is not used.

6.3 Correction factors

In order to arrive at the final total effective UV irradiance values, the following two correction factors may have to be applied:

a) for lamps having the optimum UV irradiance at an ambient temperature other than 25 °C, a factor to obtain the optimum UV irradiance, as described in Annex A;

b) for lamps measured at a distance other than 25 cm, a factor to obtain the UV irradiance at 25 cm distance. This geometrical factor can be obtained for each lamp type either experimentally or by calculation.

7 Lamp specification

The following information shall be given for each lamp type in the manufacturers literature:

a) lamp dimensions;

b) for reflector lamps, the reflector angle α, i.e. the angle subtended at the lamp axis by the reflector coating;

c) the type of ballast for which the lamp is designed;

d) the rated electrical characteristics:
   - lamp wattage;
   - lamp current;
   - lamp voltage;

e) three rated total effective UV irradiance values at 25 cm distance from the lamp axis and weighted according to Annex B:
   - the erythema action spectrum over the wavelength range 250 nm $\leq \lambda \leq$ 400 nm;
   - the NMSC action spectrum over the wavelength range 250 nm $\leq \lambda \leq$ 320 nm;
   - the NMSC action spectrum over the wavelength range 320 nm $< \lambda \leq$ 400 nm.

f) the equivalency code (see Clause 8).

The values under items d) and e) shall be given under conditions of optimum UV irradiance.

The values under item e) shall be given in mW/m^2 and rounded to the nearest integer.

8 Lamp marking

The following information shall be legibly and durably marked on the lamp:

a) the type reference of the lamp, containing:
   – a mark of origin (this may take the form of a trade mark, the manufacturer's name or the name of the responsible vendor);
   – the nominal lamp wattage (marked "W" or "watts");
   – a further identification of the specific lamp type (mostly in the form of a commercial designation);

b) the equivalency code, in the form: "Wattage–Reflector type code–UV code".
   – The wattage in the equivalency code shall be the nominal lamp wattage.
   – The following reflector type code shall be used in the equivalency code:
     O for non-reflector lamps;
     B for lamps with a broad reflector angle $\alpha > 230°$;
     N for lamps with a narrow reflector angle $\alpha < 200°$;
     R for lamps with a regular reflector $200° \leq \alpha \leq 230°$.

– The following UV code shall be used in the equivalency code:

UV code = X/Y

X = total erythema effective UV irradiance over the range 250 nm – 400 nm;

Y = ratio of the NMSC effective UV irradiances ≤ 320 nm and > 320 nm.

X is to be given in mW/m^2 rounded to the nearest integer, Y is to be rounded to the nearest first decimal. The effective values are at 25 cm distance and under conditions of optimum UV irradiance.

EXAMPLE

100 W reflector lamp with 220° reflector angle

erythema effective UV irradiance (250 nm – 400 nm) = 47 mW/m^2

short wave NMSC effective UV irradiance (≤ 320 nm) = 61 mW/m^2

long wave NMSC effective UV irradiance (> 320 nm) = 19 mW/m^2

Equivalency code: 100–R–47/3,2

Annex A
(normative)

Determination of the optimum UV irradiance of fluorescent UV lamps

Many fluorescent UV lamps for tanning have a very high wall loading. When operated at the standard ambient temperature of 25 °C, the vapour pressure will be too high and the emitted UV radiation will be lower than its optimum value. In many appliances, forced cooling is applied in order to reach optimum conditions for the radiation. The electrical characteristics and the effective UV irradiance have to be specified under these conditions for optimum UV irradiance.

To arrive at the values at optimum UV irradiance two methods can be applied:

a) the measurement is made under non-standard ambient conditions to control the vapour pressure, i.e. by a lower ambient temperature or by local cooling. The conditions to be applied are dependent on the lamp type and shall be described in the manufacturer's documentation.

b) the measurement is made under standard ambient conditions and a correction factor is applied to the results. This correction factor can be determined for each lamp type from a continuous plot of the UV irradiance, emitted by the phosphor, during the run-up of the lamp until a stable situation is reached. From this plot, the maximum value and the value after stabilisation can be measured. The correction factor to be applied follows from the quotient of the maximum value by the stabilised value. At the time of maximum UV irradiance the lamp wattage, current and voltage have to be recorded.

In case of dispute, the second method shall be the reference measuring method.

Annex B
(normative)

Ultraviolet action spectra

The UV action spectra to be applied are the erythema and the NMSC (non-melanoma skin cancer) action spectra, as given in IEC 60335-2-27.

The action spectra are shown graphically in Figure B.1 and the weighting factors $S(\lambda)$ are listed in Table B.1.

NOTE The erythema action spectrum is defined from the following parameters:

Wavelength λ (nm)	**Weighting factor $S(\lambda)$**
$\lambda \leq 298$	1
$298 < \lambda \leq 328$	$10^{0,094(298 - \lambda)}$
$328 < \lambda \leq 400$	$10^{0,015(140 - \lambda)}$

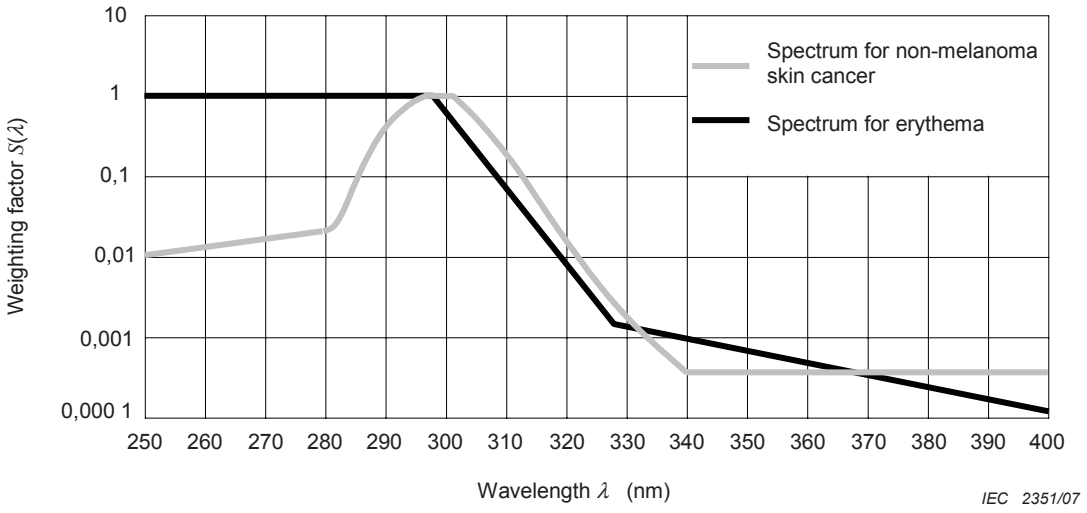

Figure B.1 – UV action spectra for erythema and NMSC

Table B.1 – Weighting factors $S(\lambda)$ for the erythema and the NMSC action spectrum

Wavelength	Weighting factor	
nm	Erythema	NMSC
250	1,000000	0,010900
251	1,000000	0,011139
252	1,000000	0,011383
253	1,000000	0,011633
254	1,000000	0,011888
255	1,000000	0,012158
256	1,000000	0,012435
257	1,000000	0,012718
258	1,000000	0,013007
259	1,000000	0,013303
260	1,000000	0,013605
261	1,000000	0,013915
262	1,000000	0,014231
263	1,000000	0,014555
264	1,000000	0,014886
265	1,000000	0,015225
266	1,000000	0,015571
267	1,000000	0,015925
268	1,000000	0,016287
269	1,000000	0,016658
270	1,000000	0,017037
271	1,000000	0,017424
272	1,000000	0,017821
273	1,000000	0,018226
274	1,000000	0,018641
275	1,000000	0,019065
276	1,000000	0,019498
277	1,000000	0,019942
278	1,000000	0,020395
279	1,000000	0,020859
280	1,000000	0,021334
281	1,000000	0,025368
282	1,000000	0,030166
283	1,000000	0,035871
284	1,000000	0,057388
285	1,000000	0,088044
286	1,000000	0,129670
287	1,000000	0,183618
288	1,000000	0,250586
289	1,000000	0,330048
290	1,000000	0,420338
291	1,000000	0,514138
292	1,000000	0,609954
293	1,000000	0,703140
294	1,000000	0,788659
295	1,000000	0,861948
296	1,000000	0,919650
297	1,000000	0,958965
298	1,000000	0,988917
299	0,805378	1,000000

Wavelength	Weighting factor	
nm	Erythema	NMSC
300	0,648634	0,991996
301	0,522396	0,967660
302	0,420727	0,929095
303	0,338844	0,798410
304	0,272898	0,677339
305	0,219786	0,567466
306	0,177011	0,470257
307	0,142561	0,385911
308	0,114815	0,313889
309	0,092469	0,253391
310	0,074473	0,203182
311	0,059979	0,162032
312	0,048306	0,128671
313	0,038905	0,101794
314	0,031333	0,079247
315	0,025235	0,061659
316	0,020324	0,047902
317	0,016368	0,037223
318	0,013183	0,028934
319	0,010617	0,022529
320	0,008551	0,017584
321	0,006887	0,013758
322	0,005546	0,010804
323	0,004467	0,008525
324	0,003597	0,006756
325	0,002897	0,005385
326	0,002333	0,004316
327	0,001879	0,003483
328	0,001514	0,002830
329	0,001462	0,002316
330	0,001413	0,001911
331	0,001365	0,001590
332	0,001318	0,001333
333	0,001274	0,001129
334	0,001230	0,000964
335	0,001189	0,000810
336	0,001148	0,000688
337	0,001109	0,000589
338	0,001072	0,000510
339	0,001035	0,000446
340	0,001000	0,000394
341	0,000966	0,000394
342	0,000933	0,000394
343	0,000902	0,000394
344	0,000871	0,000394
345	0,000841	0,000394
346	0,000813	0,000394
347	0,000785	0,000394
348	0,000759	0,000394
349	0,000733	0,000394

Wavelength	Weighting factor	
nm	Erythema	NMSC
350	0,000708	0,000394
351	0,000684	0,000394
352	0,000661	0,000394
353	0,000638	0,000394
354	0,000617	0,000394
355	0,000596	0,000394
356	0,000575	0,000394
357	0,000556	0,000394
358	0,000537	0,000394
359	0,000519	0,000394
360	0,000501	0,000394
361	0,000484	0,000394
362	0,000468	0,000394
363	0,000452	0,000394
364	0,000437	0,000394
365	0,000422	0,000394
366	0,000407	0,000394
367	0,000394	0,000394
368	0,000380	0,000394
369	0,000367	0,000394
370	0,000355	0,000394
371	0,000343	0,000394
372	0,000331	0,000394
373	0,000320	0,000394
374	0,000309	0,000394
375	0,000299	0,000394
376	0,000288	0,000394
377	0,000279	0,000394
378	0,000269	0,000394
379	0,000260	0,000394
380	0,000251	0,000394
381	0,000243	0,000394
382	0,000234	0,000394
383	0,000226	0,000394
384	0,000219	0,000394
385	0,000211	0,000394
386	0,000204	0,000394
387	0,000197	0,000394
388	0,000191	0,000394
389	0,000184	0,000394
390	0,000178	0,000394
391	0,000172	0,000394
392	0,000166	0,000394
393	0,000160	0,000394
394	0,000155	0,000394
395	0,000150	0,000394
396	0,000145	0,000394
397	0,000140	0,000394
398	0,000135	0,000394
399	0,000130	0,000394
400	0,000126	0,000394

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050-845	1987	International Electrotechnical Vocabulary (IEV) - Chapter 845: Lighting	-	-
IEC 60081	-[1)]	Double-capped fluorescent lamps - Performance specifications	EN 60081	1998[2)]
IEC 60335-2-27	-[1)]	Household and similar electrical appliances - Safety - Part 2-27: Particular requirements for appliances for skin exposure to ultraviolet and infrared radiation	EN 60335-2-27	2003[2)]
IEC 60901	-[1)]	Single-capped fluorescent lamps - Performance specifications	EN 60901	1996[2)]
IEC 62471	-[1)]	Photobiological safety of lamps and lamp systems	-	-
CIE 63	1984	The spectroradiometric measurement of light sources	-	-

[1)] Undated reference.

[2)] Valid edition at date of issue.

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