
Safety requirements for electronic flash apparatus for photographic purposes (IEC 60491:1984)

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EUROPEAN STANDARD

EN 60491

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 1995

UDC 771.448.6:621.3:614.8
ICS 37.040.10

Supersedes HD 327 S2:1988 and its amendment

Descriptors: Electronic equipment, flash apparatus, photography, safety requirements, test methods, marking

English version

**Safety requirements for electronic flash apparatus
for photographic purposes
(IEC 491:1984, modified)**

Règles de sécurité pour les appareils
électroniques à éclairs pour la
photographie
(CEI 491:1984, modifiée)

Sicherheitsbestimmungen für
elektronische Fotoblitzgeräte
(IEC 491:1984, modifiziert)

This European Standard was approved by CENELEC on 1995-09-20. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of the International Standard IEC 491:1984, prepared by IEC SC 12B^{*)}, Safety, of IEC TC 12, Radiocommunications, together with common modifications prepared by Reporting Secretariat SR 12B, was approved by CENELEC as HD 327 S2 on 1988-03-01. Some additional common modifications were approved by CENELEC as amendment A1 to HD 327 S2 on 1990-12-10.

This Harmonization Document and its amendment were submitted to the formal vote for conversion into a European Standard and were approved by CENELEC as EN 60491 on 1995-09-20.

The following date was 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) 1996-09-01


Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 491:1984 was approved by CENELEC as a European Standard with agreed common modifications as given below.

COMMON MODIFICATIONS

5.2 Add to the first paragraph:

c) Apparatus of Class II construction shall be marked with the double square symbol  (417-IEC-5172).

Delete the first line of the explanation.

Replace the second line of the explanation by:

The symbol specified under c) shall be so placed that it will be obvious that it is a part of the technical information and is unlikely to be confused with the maker's name or trade mark.

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8.3.4 Add after the fourth paragraph:
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A capacitor manufactured and approved according to the CECC system complies with the condition for use of a single capacitor.

15.1 Add after the first paragraph:

Mains cords of Class II apparatus shall be of the sheathed type.

^{*)} IEC SC 12B has been replaced by IEC TC 92, Safety of audio, video and similar electronic equipment.

Annex ZA (normative)

**Normative references to international publications
with their corresponding European publications**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 27	series	Letter symbols to be used in electrical technology	HD 245	series
IEC 68-2-2	1974	Basic environmental testing procedures Part 2: Tests - Test B: Dry heat	EN 60068-2-2 ¹⁾	1993
IEC 68-2-3	1969	Test Ca: Damp heat, steady state	HD 323.2.3 S2 ²⁾	1987
IEC 68-2-6	1982	Test Fc and guidance : Vibration (Sinusoidal)	HD 323.2.6 S2 ³⁾	1988
IEC 83	1975	Plugs and socket-outlets for domestic and similar general use - Standards	-	-
IEC 85	1984	Thermal evaluation and classification of electrical insulation	HD 566 S1	1990
IEC 127	1974	Cartridge fuse-links for miniature fuses Supplement 1: Colour coding	HD 109 S3 ⁴⁾	1983
IEC 167	1964	Methods of test for the determination of the insulation resistance of solid insulating materials	HD 568 S1	1990
IEC 173	1964	Colours of the cores of flexible cables and cords	HD 27 S1	1983
IEC 227-1 (mod)	1979	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V Part 1 : General requirements	HD 21.1 S2 + amendments	1982

1) EN 60068-2-2 includes supplement A:1976 to IEC 68-2-2.

2) HD 323.2.3 S2 includes A1:1984 to IEC 68-2-3.

3) HD 323.2.6 S2 is superseded by EN 60068-2-6:1995, which is based on IEC 68-2-6:1995.

4) HD 109 S3 is superseded by the EN 60127 series, which is based on the new IEC 127 series, Miniature fuses.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 227-2 (mod)	1979	Part 2: Test methods	HD 21.2 S2 + amendments	1988
IEC 245	series	Rubber insulated cables of rated voltages up to and including 450/750 V	HD 22	series
IEC 249-1	1982	Base materials for printed circuits Part 1: Test methods	EN 60249-1 ⁶⁾	1993
IEC 249-2	series	Part 2: Specifications	EN 60249-2	series
IEC 260	1968	Test enclosures of non-injection type constant relative humidity	HD 98 S1	1977
IEC 317	series	Specifications for particular types of winding wires	EN 60317	series
IEC 320 (mod)	1981	Appliance couplers for household and similar general purposes	EN 60320-1 ⁶⁾ + corr. November A11	1987 1993 1994
IEC 417	1973	Graphical symbols for use on equipment Index, survey and compilation of the single sheets	HD 243 S12 ⁷⁾	1995
IEC 536	1976	Classification of electrical and electronic equipment with regard to protection against electric shock	HD 366 S1	1977
IEC 598-2-9	1979 ⁸⁾	Luminaires Part 2: Particular requirements Section 9: Photo and film luminaires (non- professional)	-	-
IEC 664	1980	Insulation co-ordination within low-voltage systems including clearances and creepage distances for equipment	-	-
IEC 799 (mod)	1984	Cord sets	EN 60799	1987
ISO 306	1974	Plastics Determination of the Vicat softening temperature of thermoplastics	-	-

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5) EN 60249-1 includes A1:1984 + A2:1989 + A3:1991 to IEC 249-1.

6) EN 60320-1 includes A1:1984 + A2:1985 to IEC 320.

7) HD 243 S12 includes supplements A:1974 to M:1994 to IEC 417.

8) IEC 598-2-9:1987 is harmonized as EN 60598-2-9:1989.

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE
NORME DE LA CEI

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à éclairs pour la photographie

Safety requirements for electronic flash apparatus
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Note. — In this standard, the requirements proper are printed in roman type.

Test specifications are printed in italic type.

Explanatory matter is printed in smaller roman type.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY REQUIREMENTS FOR ELECTRONIC FLASH APPARATUS
FOR PHOTOGRAPHIC PURPOSES

FOREWORD

- 1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 12B: Safety, of IEC Technical Committee No. 12: Radiocommunications.

It replaces the first edition of IEC Publication 491 (1974).

The text of this standard is based upon the following documents:

Six Months' Rule	Report on Voting
12B(CO)167	12B(CO)176

Further information can be found in the Report on Voting indicated in the table above.

Other IEC publications quoted in this standard:

- Publications Nos. 27: Letter Symbols to be Used in Electrical Technology.
- 68-2-2 (1974): Basic Environmental Testing Procedures, Part 2: Tests Tests B: Dry Heat.
- 68-2-3 (1969): Test Ca: Damp Heat, Steady State.
- 68-2-6 (1982): Test Fc and Guidance: Vibration (sinusoidal).
- 83 (1975): Plugs and Socket-outlets for Domestic and Similar General Use. Standards.
- 85 (1984): Thermal Evaluation and Classification of Electrical Insulation.
- 127 (1974): Cartridge Fuse-links for Miniature Fuses.
- 167 (1964): Methods of Test for the Determination of the Insulation Resistance of Solid Insulating Materials.
- 173 (1964): Colours of the Cores of Flexible Cables and Cords.
- 227: Polyvinyl Chloride Insulated Cables of Rated Voltages up to and Including 450/750 V.
- 227-1 (1979): Part 1: General requirements.
- 227-2 (1979): Part 2: Test Methods.
- 245: Rubber Insulated Cables of Rated Voltages up to and Including 450/750 V.
- 249-1 (1982): Base Materials for Printed Circuits, Part 1: Test Methods.

- 249-2 (1970): Part 2: Specifications.
260 (1968): Test Enclosures of Non-injection Type for Constant Relative Humidity.
317: Specifications for Particular Types of Winding Wires.
320 (1981): Appliance Couplers for Household and Similar General Purposes.
417 (1973): Graphical Symbols for Use on Equipment. Index, Survey and Compilation of the Single Sheets.
- 536 (1976): Classification of Electrical and Electronic Equipment with Regard to Protection against Electric Shock.
- 598-2-9 (1979): Luminaires, Part 2: Particular Requirements, Section Nine Photo and Film Luminaires (non-professional).
- 664 (1980): Insulation Co-ordination within Low-voltage Systems Including Clearances and Creepage Distances for Equipment.
- 799 (1984): Cord Sets.

Other publication quoted:

ISO Standard 306 (1974): Plastics -- Determination of the Vicat Softening Temperature of Thermoplastics.

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SAFETY REQUIREMENTS FOR ELECTRONIC FLASH APPARATUS FOR PHOTOGRAPHIC PURPOSES

1. Scope

- 1.1 This standard applies to the following electronic flash apparatus for photographic purposes, having a stored energy not exceeding 2000 J, together with associated apparatus and not intended to be subjected to dripping or splashing:
- apparatus of the single-flash type which can have more than one flash head operating at the same time;
 - apparatus for the illumination of sequential photographic exposures;
 - battery chargers and supply units to be used in connection with electronic flash apparatus for photographic purposes. These auxiliary units may form a part of the mains plug;
 - accessories, such as light regulators and slave units, specified in the instruction leaflet.

This standard does not apply to stroboscopes.

As long as no appropriate requirements exist for apparatus having a stored energy exceeding 2000 J, this standard may be used, in so far as it is applicable.

Additional requirements may be necessary, e.g. for explosion and thermal radiation.

With regard to the supply, the following categories are covered:

- mains-operated apparatus;
- battery-operated apparatus;
- apparatus having a combination of mains and battery supply.

This standard is intended to cover apparatus which can be used both in moderate and tropical climates.

For the modelling lamps combined with electronic flash apparatus for photographic purposes, additional requirements may be taken from IEC Publication 598-2-9: Luminaires, Section Nine — Photo and Film Luminaires (Non-professional), as far as applicable.

- 1.2 This standard does not apply to apparatus designed for a rated supply voltage exceeding 250 V (r.m.s.) against earth.
- 1.3 This standard is concerned with safety only and not with the other properties of the apparatus (see Clause 3).

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2. Definitions

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The following definitions apply for the purpose of this standard.
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- 2.1 The *type test* of a product is the complete series of tests to be carried out on a number of specimens representative of the type, with the object of determining whether a particular manufacturer can be considered to be able to produce products meeting the standard.
- 2.2 *By hand* denotes that the operation does not require the use of a tool, coin or any other object.

2.3 *Accessible part* denotes a part which can be touched by the standard test finger (see Sub-clause 8.1.1).

Any accessible area of a non-conducting part is considered as being covered with a conductive layer (see Sub-clause 4.3.1).

2.4 *Live part* denotes a part, contact with which may cause a significant electric shock (see Sub-clause 8.1.1).

2.5 *Creepage distance* denotes the shortest distance along the surface of an insulation material between two conductive parts. (According to IEC Publication 664: Insulation Co-ordination within Low-voltage Systems Including Clearances and Creepage Distances for Equipment.)

2.6 *Clearance* denotes the shortest distance in air between two conductive parts.

2.7 *Supply mains* denotes any power source with an operating voltage of more than 34 V (peak) which is not used solely to supply the equipment specified in Sub-clause 1.1.

2.8 *Rated supply voltage* denotes the mains voltage for which the manufacturer has designed the apparatus.

2.9 *Part directly connected to the supply mains* denotes a part of an apparatus which is in electrical connection with the supply mains in such a way that a connection between the part and either pole of the supply mains causes in that connection a current equal to or greater than 9 A.

A current of 9 A is chosen as the minimum rupturing current of a 6 A fuse.

In tests to determine which parts are directly connected to the supply mains, fuses in the apparatus are not short-circuited.

2.10 *Part conductively connected to the supply mains* denotes a part of an apparatus which is in electrical connection with the supply mains in such a way that a connection through a resistance of 2000 Ω between the part and either pole of the supply mains causes in that resistance a current greater than 0.7 mA (peak), the apparatus not being connected to earth.

2.11 *Supply unit* denotes an apparatus which takes energy from the mains and from which one or more other apparatus are fed.

2.12 *Battery charger* denotes an apparatus which is directly fed from the supply mains and which provides energy in the form necessary to charge a battery.

2.13 *Terminal device* denotes a part of an apparatus by which connection is made to external conductors or other apparatus; it may contain several terminal contacts.

2.14 *Thermal release* denotes a device which prevents the maintenance of excessively high temperatures in certain parts of the apparatus by disconnecting those parts from their supply.

2.15 *Safety switch* denotes a device which interrupts the supply when a cover is opened.

2.16 *Printed board* denotes a base material cut to size, containing all holes and bearing at least one conductive pattern.

- 2.17 *Conductive pattern* denotes a configuration formed by electrically conductive material of a printed board.
- 2.18 *Class I apparatus* denotes an equipment in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in such a way that means are provided for the connection of accessible conductive parts to the protective (earthing) conductor in the fixed wiring of the installation in such a way that accessible conductive parts cannot become live in the event of a failure of the basic insulation.
- Such apparatus may have parts consisting of Class II construction.
- 2.19 *Class II apparatus* denotes an equipment in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions.
- 2.20 *Basic insulation* denotes an insulation applied to live parts to provide basic protection against electric shock.
- 2.21 *Supplementary insulation* denotes an independent insulation applied in addition to basic insulation in order to provide protection against electric shock in the event of a failure of the basic insulation.
- 2.22 *Double insulation* denotes an insulation comprising both basic insulation and supplementary insulation.
- 2.23 *Reinforced insulation* denotes a single insulation system applied to live parts which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in this standard.

The term “insulation system” does not imply that the insulation should be one homogeneous piece. It may comprise several layers which cannot be tested singly as supplementary or basic insulation.

The definitions given in Sub-clauses 2.18 to 2.23 are according to IEC Publication 536: Classification of Electrical and Electronic Equipment with Regard to Protection against Electric Shock.

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3. General requirements

The apparatus shall be so designed and constructed as to present no danger, either in normal use or under fault conditions, providing particularly:

- personal protection against electric shock;
- personal protection against the effects of excessive temperature;
- protection against fire.

In general, compliance is checked under normal operating conditions and under fault conditions specified in Sub-clauses 4.2 and 4.3, by carrying out all the tests indicated.

4. General conditions for tests

4.1 Conduct of tests

4.1.1 Tests according to this standard are type tests.

4.1.2 All tests are carried out on one and the same apparatus and in the order of the clauses as far as this is possible.

4.1.3 Unless otherwise specified, tests are made under normal operating conditions at an ambient temperature within the range of 15 °C to 35 °C, a relative humidity of 45% to 75% and an air pressure of 860 mbar to 1 060 mbar.

4.1.4 Unless otherwise specified:

- waveforms are substantially sinusoidal;
- measurements of voltages and currents are carried out with instruments which do not appreciably affect the values to be measured.

4.1.5 Test requirements are based on the use of fully charged rechargeable batteries or dry batteries in a fresh condition.

4.2 Normal operating conditions

Normal operating conditions are considered to consist of the most unfavourable combination of the following conditions:

4.2.1 Any position of normal use of the apparatus.

4.2.2 A supply voltage of 0.9 times or 1.1 times any rated supply voltage for which the apparatus is set.

For apparatus having a rated supply voltage range not requiring the adjustment of a voltage setting device, a supply voltage of 0.9 times the lower limit or 1.1 times the upper limit of the rated supply voltage range; if considered necessary, a supply voltage of 0.9 times or 1.1 times a nominal supply voltage within the range marked on the apparatus.

Any rated frequency of the supply voltage.

For battery-operated apparatus, the specified battery in a fully charged state or in fresh condition.

The apparatus operated on each type of supply for which it is designed.

4.2.3 Any position of controls which are accessible to the user for adjustments by hand, except voltage setting devices complying with Sub-clause 13.6.

4.2.4 Connection or not of flash heads, capacitors and other accessories.

4.2.5 Apparatus which can be used either while connected to the mains or with its own supply connected to the mains or not.

4.2.6 Any protective earth terminal being connected to earth or not, and either pole of the isolated supply source, used during the test, being earthed.

4.3 Fault conditions

Operation under fault conditions denotes that, in addition to the normal operating conditions mentioned in Sub-clause 4.2, each of the following conditions is applied in turn and, associated with it, those other fault conditions which are a logical consequence.

Examination of the apparatus and its circuit diagram will generally show the fault conditions which should be applied. These are applied in sequence in the order which is most convenient.

4.3.1 Short-circuit across creepage distances and clearances if they are less than the values indicated by curve A in Table I.

If an insulating part contains a groove of less than 1 mm width, the creepage distance is not measured over the surface of the groove but only across its width.

If a clearance consists of two or more air gaps in series separated by conductive parts, any gap of less than 1 mm width is ignored in computing the total distance unless the total distance as required in Table I is less than 1 mm. However, individual gaps of less than 0.5 mm are ignored.

This does not imply that dimensional requirements of insulations specified in Sub-clauses 8.3.7 and 8.3.8 can be ignored.

If an insulating barrier consists of two parts separated by a capillary slit, the path along the slit should be taken into account when measuring creepage distances and clearances.

The specified creepage distances and clearances are the minimum actual separations taken into account tolerances in assemblies and piece parts.

Guidance for the determination of creepage distances and clearances involving enamelled wires is given in Sub-clause 4.3.3.

In the determination of creepage distances and clearances between accessible parts and live parts, when using the standard test finger, any accessible zone of a non-conductive part is considered as being covered with a conductive layer (see Figure 1, page 90, as an example).

The voltages mentioned in Table I are determined with the apparatus connected to the rated supply voltage after the steady state has been reached.

Creepage distances and clearances are measured with conductors and plugs in their normal positions.

Between conductors, one of which may be directly or conductively connected to one pole of the supply mains, which are on a printed board complying with the pull-off and peel strength requirements specified in IEC Publication 249-1: Base Materials for Printed Circuits, Part 1: Test methods and IEC Publication 249-2: Part 2: Specifications, the requirements for creepage distances and clearances are modified.

The dimensions of Table I are replaced by the values calculated from the formula:

$$\log d = 0.78 \log \frac{\hat{U}}{300} \text{ with a minimum of 0.5 mm,}$$

where d is the distance in millimetres and \hat{U} the peak value of the voltage in volts. These distances can be determined by reference to Figure 7, page 97.

This reduction in creepage distances and clearances is permitted only as far as overheating is concerned (see Sub-clause 10.2).

The reduced values above apply to the conductors themselves, but not to mounted components or associated soldering terminals.

Coverings of lacquer or the like on printed boards are ignored when calculating the distances.