

Ballasts for tubular fluorescent lamps — General and safety requirements

The European Standard EN 60920:1991, with the incorporation of amendments A1:1993, A2:1996 and A11:2000, has the status of a British Standard

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Cooperating organizations

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National foreword

This British Standard has been prepared by Technical Committee CPL/34/3 (formerly LGL/21) and is the English language version of EN 60920:1991, *Ballasts for tubular fluorescent lamps — General and safety requirements*, including amendments A1:1993, A2:1996 and A11:2000, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 60920:1990, *Ballasts for tubular fluorescent lamps — General and safety requirements*, including amendments 1:1993 and 2:1995, published by the International Electrotechnical Commission (IEC). This Standard, together with BS EN 60921:1991 supersedes BS 2818-1:1985 which is withdrawn.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags **[C]** **[C]**. Where a common modification has been introduced by amendment, the tags carry the number of the amendment. For example, the common modifications introduced by CENELEC amendment A11 are indicated by **[C11]** **[C11]**.

The foreword and preface of IEC 920:1990, which do not form part of the text of EN 60920, have been quoted in National appendix NA.

Annexes designated “normative” are part of the body of the Standard. Annexes designated “informative” are given for information only. National appendices are designated “informative”.

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

Cross-references. Details of international standards quoted in this British Standard for which there is an identical or technically equivalent British Standard are given in National appendix NC.

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Summary of pages

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English version

Ballasts for tubular fluorescent lamps — General and safety requirements

(includes amendments A1:1993, A2:1996 and A11:2000)
(IEC 60920:1990 + A1:1993 + A2:1995, modified)

Ballasts pour lampes tubulaires à fluorescence —
Prescriptions générales et prescriptions de sécurité
(inclut les amendements A1:1993, A2:1996 et
A11:2000)
(CEI 60920:1990 + A1:1993 + A2:1995, modifiée)

Vorschaltgeräte für röhrenförmige
Leuchtstofflampen
Allgemeine und Sicherheitsanforderungen
(enthält Änderungen A1:1993, A2:1996 und
A11:2000)
(IEC 60920:1990 + A1:1993 + A2:1995, modifiziert)

This European Standard was approved by CENELEC on 15 March 1991, amendment A1 was approved by CENELEC on 1993-09-22, amendment A2 was approved by CENELEC on 1995-11-28 and amendment A11 was approved by CENELEC on 2000-02-03. 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

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Foreword

Following a decision taken by CENELEC Technical Committee TC 34Z at their meeting in Brussels in February 1989, the International Standard IEC 920:1990 was submitted to the CENELEC Unique Acceptance Procedure (UAP) in August 1990 for acceptance as a European Standard.

The text of the reference document was approved by CENELEC as EN 60920 on 15 March 1991.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1992-03-01
- latest date of withdrawal of conflicting national standards (dow) 1992-03-01

For products which have complied with the relevant national standard before 1992-03-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1997-03-01.

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given only for information. In this Standard, Annex ZA is normative and Annex ZB is informative.

Endorsement notice

The text of the International Standard IEC 920:1990 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

At the request of the CENELEC Technical Committee TC 34Z, Luminaires and associated equipment, amendment 1:1993 to the International Standard IEC 920:1990 was submitted to the CENELEC Unique Acceptance Procedure (UAP).

The text of the reference document was approved by CENELEC as amendment A1 to EN 60920 on 22 September 1993.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-12-01
- latest date of withdrawal of conflicting national standards (dow) 1994-12-01

For products which have complied with EN 60920:1991 before 1994-12-01, as shown by the manufacturer or by a certification body, this

previous standard may continue to apply for production until 1999-12-01.

Annexes designated “normative” are part of the body of the standard. In this Standard, Annex ZA is normative.

Foreword to amendment A2

The text of document 43C/313/FDIS, future amendment 2 to IEC 920:1990, prepared by SC 34C, Auxiliaries for lamps, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60920:1991 on 1995-11-28.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-09-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1996-09-01

For products which have complied with EN 60920:1991 and its amendment A1:1993 before 1996-09-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2001-09-01.

Foreword to amendment A11

At the request of the Swedish electrotechnical committee, a draft for an amendment to EN 60920:1991 was submitted to the CENELEC members for acceptance in December 1999.

The text of the draft was accepted by CENELEC as amendment A11 to EN 60920:1991 on 2000-02-03.

The following dates were fixed:

- latest date by which the existence of the amendment has to be announced at national level (doa) 2000-05-03
- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2000-08-03

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Section 1. General requirements

Introduction

This Standard covers general and safety requirements for ballasts for tubular fluorescent lamps; Section 1 describes general requirements and Section 2 gives safety requirements.

Performance requirements for these ballasts are the subject of IEC Publication 921.

NOTE Safety requirements ensure that electrical equipment constructed in accordance with these requirements does not endanger the safety of persons, domestic animals or property when properly installed and maintained and used in applications for which it was intended.

Relevant clauses of this Standard, for example those dealing with thermal endurance tests for windings, apply also to ballasts which form an integral part of a luminaire and which cannot be tested separately.

The thermal characteristics of ballasts are specified by the rated maximum operating temperature of the winding (symbol t_w) which shall not be exceeded in order to ensure a sufficient length of life for the ballast when it is built into a luminaire. In addition, for ballasts which are subjected to abnormal conditions, the limiting temperature is given which shall not be exceeded when the ballast is built into a luminaire.

Moreover, an indication of the rated temperature rise of a winding (symbol Δt) may be added as an optional requirement.

For checking the rated maximum operating temperature t_w , this Standard specifies an endurance test period of 30 days as the standard method. At the manufacturer's choice, optional endurance test periods of 60, 90 or 120 days may be used.

This Standard permits the use of constants S other than 4 500 in t_w tests. If a claim is not made to the contrary, the endurance testing of ballasts is based on the constant S , given in Appendix A, having a value of 4 500. A manufacturer may claim the use of other values if this can be justified by either of the tests specified.

Tests in this Standard are type tests. Requirements for testing individual ballasts during production are not included.

1 Scope

This Standard covers ballasts, excluding resistance types, for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz, associated with tubular fluorescent lamps with or without pre-heated cathodes operated with or without a starter or starting device and having rated wattages, dimensions and characteristics as specified in IEC Publication 81.

It applies to complete ballasts and to their component parts such as reactors, transformers and capacitors. Particular requirements for thermally protected ballasts are given in Appendix B.

This Standard also specifies ballasts for lamps which are not yet fully standardized.

Ballasts for conventional operation of lamps at mains frequency are covered. A.C. supplied electronic ballasts for high frequency operation are excluded. These are specified in IEC Publication 928.

Capacitors having a capacitance greater than 0.1 μF are covered by IEC Publication 566. Capacitors having a capacitance less than or equal to 0.1 μF are specified in IEC Publication 384-14.

2 Definitions

For the purposes of this Standard, the following definitions apply.

2.1

ballast

unit inserted between the supply and one or more discharge lamps which by means of inductance, capacitance, or a combination of inductance and capacitance serves mainly to limit the current of the lamp(s) to the required value

the ballast may consist of one or more separate components

it may also include means for transforming the supply voltage and arrangements which help to provide starting voltage and pre-heating current, prevent cold starting, reduce stroboscopic effects, correct the power-factor and/or suppress radio interference

2.1.1**independent ballast**

ballast which can be mounted separately outside a luminaire without any additional enclosure

this may consist of a built-in ballast housed in a suitable enclosure which provides all the necessary protection according to its markings

2.1.2**built-in ballast**

ballast exclusively designed to be built into a luminaire, a box, an enclosure or the like

the control gear compartment in the base of a road lighting column is considered to be an enclosure

2.1.3**integral ballast**

ballast which forms a non-replaceable part of a luminaire and which cannot be tested separately from the luminaire

2.2**reference ballast**

special inductive ballast designed for the purpose of providing comparison standards for use in testing ballasts and for the selection of reference lamps

it is essentially characterized by a stable voltage-to-current ratio, which is relatively uninfluenced by variations in current, temperature and magnetic surroundings, as outlined in Appendix C of IEC Publication 921

2.3**reference lamp**

lamp selected for testing ballasts which, when associated with a reference ballast, has electrical characteristics which are close to the nominal values as stated in the relevant lamp standard

2.4**calibration current of a reference ballast**

value of the current on which are based the calibration and control of the ballast

NOTE Such a current should preferably be approximately equal to the nominal running current of the lamps for which the reference ballast is suitable.

2.5**supply voltage**

voltage applied to the complete circuit of lamp(s) and ballast

2.6**supply current**

current supplied to the complete circuit of lamp(s) and ballast

2.7**working voltage**

highest r.m.s. voltage which may occur across any insulation, transients being neglected, in open-circuit conditions or during lamp operation when the ballast is operated at its rated voltage

2.8**circuit power factor, λ**

power factor of the combination of a ballast and the lamp or lamps for which the ballast is designed

2.9**high power factor ballast**

ballast having a circuit power factor of at least 0.85 (leading or lagging)

NOTE The value 0.85 takes into account the distortion of the current waveform.

NOTE For North America high power factor is defined as a power factor of at least 0.9.

2.10**high audio frequency impedance ballast**

ballast of which the impedance in the frequency range 250 Hz to 2 000 Hz exceeds the values specified in IEC Publication 921, to avoid interference with power line signals

2.11**low distortion ballast**

ballast of which the harmonic content complies with the more severe requirements specified in IEC Publication 921

2.12**rated maximum operating temperature of a capacitor case, t_c**

highest permissible temperature which may occur at any place on the outer surface under normal operating conditions

NOTE The internal losses in a capacitor, though small, will result in the surface temperature being above ambient air temperature and due allowance for this should be made. The temperature difference will depend upon the material of the case.

2.13**rated maximum operating temperature of a ballast winding, t_w**

winding temperature assigned by the manufacturer as the highest temperature at which the ballast may be expected to have a service life of at least 10 years continuous operation

2.14**rated temperature rise of a ballast winding, Δt**

temperature rise assigned by the manufacturer under the conditions specified in this Standard

NOTE The specifications for the supply and mounting conditions of the ballast are given in Clause A.4.

2.15**parallel cathode heating (or pre-heating)**

type of heating (or pre-heating) supplied by a low tension winding of the ballast directly connected to the cathode terminations of the lamp

NOTE This type of heating circuit is used in practice only with lamps operated without starter.

2.16**series cathode heating (or pre-heating)**

type of heating (or pre-heating) in which a cathode is connected in series in the main circuit before the lamp has started

2.17**rectifying effect**

effect which may occur at the end of lamp life when one cathode is either broken or has insufficient electron emission, resulting in the arc current being constantly unequal in consecutive half-cycles

2.18**short-circuit power**

short-circuit power of a voltage source is the quotient of the square of the voltage produced at its output terminals (in open circuit conditions) and the internal impedance of the source (as seen from the same terminals)

2.19**type test**

test or 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

2.20**type test sample**

sample consisting of one or more similar units submitted by the manufacturer or the responsible vendor for the purpose of a type test

3 General requirements

Ballasts shall be so designed and constructed that in normal use they operate without danger to the user or surroundings. Capacitors and other components incorporated in ballasts shall comply with the requirements of the appropriate IEC standard. Thermally protected ballasts shall comply with the requirements of Appendix B.

In general, compliance for ballasts and other elements is checked by carrying out all the tests specified. In addition, the enclosure of independent ballasts shall comply with the requirements of IEC Publication 598-1, including the classification and marking requirements of that standard.

4 General notes on tests

4.1 Tests in this Standard are type tests.

NOTE The requirements and tolerances permitted by this Standard are related to testing of a type test sample submitted for that purpose. Compliance of the type test sample does not ensure compliance of the whole production of a manufacturer with this safety Standard.

Conformity of production is the responsibility of the manufacturer and may include routine tests and quality assurance in addition to type testing.

4.2 The tests are carried out in the order of the clauses unless otherwise specified.

4.3 *The type test is carried out on one sample consisting of eight ballasts submitted for the purpose of the type test, see Definition 2.20. Seven ballasts are for the endurance test and one for all other tests. For conditions of compliance for the endurance test, see Clause 12.*

With the exception of the endurance test, certain countries require three ballasts to be tested and, therefore, ten ballasts are required, of which seven are for the endurance test and three for all other tests. If more than one ballast fails, then the type shall be rejected. If one ballast fails, the test shall be repeated using three ballasts and all of these shall comply with the test requirements.

In addition, six ballasts are required for the high-voltage impulse testing according to Clause 11 below, of ballasts intended for circuits in which high-voltage impulse occur within the ballast. There shall be no failure during the test.

4.4 *The tests are made under the conditions specified in Appendix A. In general all tests are made for each type of ballast or, where a range of similar ballasts is involved, for each rated wattage in the range or on a representative selection from the range as agreed with the manufacturer. A reduction of the number of samples for the endurance test according to Clause 12 including the use of constants S other than 4 500 according to Appendix C, or even the omission of these tests is allowed when ballasts of the same construction but with different characteristics are submitted together for approval, or when test reports from the manufacturer or other authority are accepted by the testing station.*

5 Classification

Ballasts are classified according to the method of installation:

- independent ballasts;
- ballasts for building-in (built-in ballasts);
- integral ballasts.

6 Marking

Ballasts which form an integral part of the luminaire need not be marked.

6.1 Mandatory markings

Ballasts, other than integral ballasts, shall be clearly and durably marked with the following mandatory markings:

- a) Mark of origin, which may take the form of a trade mark, or the manufacturer's name or the name of the responsible vendor;
- b) Model number or type reference of the manufacturer;
- c) Marking to show the peak value of the voltage produced if the peak value exceeds 1 500 V.

Connections subjected to this voltage shall be marked as such;

Pulse generated by a glow starter and ballast combination are exempt from this requirement.

d) When a ballast has more than two terminals or leads, other than earthing terminals, they shall be identified clearly and their rated voltage indicated. This may be implemented by numbering and/or lettering, and/or colouring of the terminal leads. The protective earth terminal (if any) shall be identified by the symbol $\oplus$ 417C-IEC-5019. This symbol shall not be placed on screws or other easily removable parts.

Unless connections are self-evident, the position of terminals shall be clearly indicated by a wiring diagram.

e) Rated supply voltage (or voltages, if there are several), supply frequency and supply current(s); the supply current(s) may be given in the manufacturer's literature;

f) The claimed value of the rated maximum operating temperature of the winding following the symbol t_w , values increasing in multiples of 5 °C.

6.2 Information to be provided, if applicable

In addition to the above mandatory markings, the following information, if applicable, shall be given either on the ballast, or be made available in the manufacturer's catalogue or the like.

a) Rated wattage or the designation as indicated on the lamp data sheet of the type or types of lamp for which the ballast is designed. If the ballast is to be used with more than one lamp, the number and their wattage shall be indicated.

b) In the case of a ballast consisting of more than one separate unit, the current controlling inductive element(s) shall be marked with the essential details of the other unit(s) and/or essential capacitors.

In the case of an inductive ballast used with a separate series capacitor other than a radio interference suppression capacitor, the marking of rated voltage, capacitance and tolerance shall be repeated.

c) The limiting temperature of the winding under abnormal conditions which shall be respected when the ballast is built into a luminaire, as information for luminaire design.

NOTE In the case of a ballast intended for circuits which do not produce abnormal conditions or are for use only with starting devices which exempt the ballasts from the abnormal conditions of Sub-clause 13.2, then the winding temperature under abnormal conditions is not indicated.

d) The test period for the endurance test for ballasts which, at the manufacturer's choice, have to be tested for a longer period than 30 days.

This information may be indicated with the symbol D, followed by the appropriate number of days, 60, 90 or 120 in tens, and the whole being placed between brackets immediately after the t_w -indication. For example (D6) for ballasts to be tested for a test period of 60 days.

NOTE The standard endurance test period of 30 days need not be indicated.

e) For ballasts for which a constant S other than 4 500 is claimed by the manufacturer, the symbol S together with its appropriate value in thousands, for example "S6", if S has a value of 6 000.

NOTE Preferred values of S are: 4 500 – 5 000 – 6 000 – 8 000 – 11 000 – 16 000.

f) A declaration of the cross-section of conductors for which the terminals, if any, are suitable. Symbol: relevant value(s) in mm² followed by a small square . . . □.

g) A declaration if the ballast does not rely upon the luminaire enclosure for protection against accidental contact with live parts.

h) Symbol for independent ballasts, .

6.3 Other information

Manufacturers may provide the following non-mandatory information, if available:

The rated temperature rise of the winding following the symbol Δt , values increasing in multiples of 5 K.

6.4 Marking shall be durable and legible

Compliance is checked by inspection and by trying to remove the marking by rubbing lightly, for 15 s each, with two pieces of cloth, one soaked with water and the other with petroleum spirit.

The marking shall be legible after the test.

NOTE The petroleum spirit used should consist of a solvent hexane with a content of aromatics of maximum 0.1 volume percentage, a kauri-butanol value of 29, an initial boiling point of approximately 65 °C, a dry-point of approximately 69 °C and a density of approximately 0.68 g/cm³.

The table below illustrates a typical example of ballast-marking:

Brand	Model number 220 V ~50 Hz	Mandatory markings
	$1 \times 65 \text{ W} - 0.67 \text{ A } \lambda 0.50$ $C = 5.7 \mu\text{F} \pm 4 \% 420 \text{ V} - 0.68 \text{ A } \lambda 0.50 \text{ C}$ $t_w 120$ (D6) S6 $\Delta t 55$	Information to be given either on the ballast or in the manufacturer's literature
NOTE The typical marking above indicates that the ballast may be used to supply a lamp of 65 W either in an inductive circuit (0.67 A λ 0.50) or, in series with a capacitor (5.7 $\mu\text{F} \pm 4 \% 420 \text{ V}$), in a capacitive circuit (0.68 A λ 0.50 C).		

Section 2. Safety requirements

7 Protection against accidental contact with live parts

7.1 Ballasts which do not rely upon the luminaire enclosure for protection against electric shock shall be sufficiently protected against accidental contact with live parts when installed as in normal use.

Lacquer or enamel is not deemed to be adequate protection or insulation for the purpose of this requirement.

Parts providing protection against accidental contact shall have adequate mechanical strength and shall not work loose in normal use. It shall not be possible to remove them without the use of a tool.

Compliance is checked by Inspection, and with regard to protection against accidental contact, by means of the test finger shown in Figure 1 of IEC Publication 529, using an electrical indicator to show contact.

This finger is applied in all possible positions with, if necessary, a force of 10 N on electrical indicator being used to show contact with live parts.

It is recommended that a lamp be used for the indication of contact and that the voltage be not less than 40 V.

7.2 Ballasts incorporating capacitors of total capacitance exceeding 0.5 μF shall be provided with a discharge device so that the voltage at the ballast terminations does not exceed 50 V, 1 min after disconnection of the ballast from a source of supply at rated voltage.

8 Terminals

Screw terminals shall comply with Section Fourteen of IEC Publication 598-1.

Screwless terminals shall comply with Section Fifteen of IEC Publication 598-1.

9 Provision for earthing

9.1 Any earthing terminal shall comply with the requirements of Clause 8. The electrical connection shall be adequately locked against loosening and it shall not be possible to loosen the electrical connection without the use of a tool. For screwless terminals, it shall not be possible to loosen the clamping means unintentionally.

Earthing of ballasts via the means of fixing the ballasts to earthed metal is permitted. However, if a ballast has an earthing terminal, this terminal shall only be used for earthing the ballast.

Compliance is checked by inspection, by a manual test and by the requirements of Clause 8.

9.2 All parts of an earth terminal shall be such as to minimize the danger of electrolytic corrosion resulting from contact with the earth conductors or any other metal in contact with them.

The screw and the other parts of the earthing terminal shall be made of brass or other metal no less resistant to corrosion, or a material with a non-rusting surface. At least one of the contact surfaces shall be bare metal.

Compliance is checked by inspection.

10 Moisture resistance and insulation

Ballasts shall be moisture resistant and have adequate insulation.

Compliance is checked by the tests of Sub-clauses 10.1 and 10.2.

10.1 *The ballast shall not show any appreciable damage after being subjected to the moisture treatment in Clause A.2 of Appendix A.*

10.2 *Insulation is checked as follows:*

- *between poles;*
- *between live parts and external parts including fixing screws.*

The insulation resistance is measured immediately after the humidity conditioning under the conditions specified in Sub-clause A.2.1 of Appendix A. It shall be not less than 2 M Ω .

Immediately after the insulation test, the ballast shall, in addition, withstand a voltage test for 1 min under the conditions specified in Sub-clause A.2.2 of Appendix A, the test voltage corresponding to the values of Table I.