

Luminaires —

Part 1: General requirements and tests

The European Standard EN 60598-1:1997, with the incorporation of amendments A1:1998, A12:1998, A13:1999, A14:2000 and A15:2002, has the status of a British Standard

ICS 29.140.40

National foreword

This British Standard is the English language version of EN 60598-1:1997, including amendment A1:1998, corrigendum December 1998 (which included and replaced corrigendum May 1998), amendments A12:1998 and A13:1999, corrigendum June 1999, amendment A14:2000 and amendment A15:2002. It was derived by CENELEC from IEC 60598-1:1996 including amendment 1:1998 and corrigendum September 1998. It supersedes BS EN 60598-1:1993 which is withdrawn.

Corrigendum No. 2 to BS EN 60598-1:1997 was issued to correct the AMD number of corrigendum No. 1 to BS EN 60598-1:1997.

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, a common modification introduced by CENELEC amendment A12 is indicated by [C12] [C12].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [A1]. Tags indicating changes to IEC text carry the number of the IEC amendment; tags indicating changes to text introduced by CENELEC carry the number of the CENELEC amendment. For example, text altered by IEC amendment 1 is indicated by [A1] [A1]; changes to CENELEC Annex ZC made by CENELEC amendment A12 are indicated by [A12] [A12].

Corrigendum December 1998 to the EN foreword to amendment A1 corrected the document number in paragraph 1 and added a date of withdrawal (dow). Corrigendum June 1999 to Annex ZB added “Czech Republic” to the list of countries in the note to 2.2. IEC Corrigendum September 1998 to Section 8 replaced subclause 8.2.3. Corrigendum April 2001 to the EN foreword to amendment A14 replaced the latest date of withdrawal of conflicting national standards.

Attention is drawn to the fact that all parts 2 of EN 60598 and all current parts 102 of BS 4533 relate to the latest edition of part 1.

The UK participation in its preparation was entrusted to Technical Committee CPL/34/4, Luminaires, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Wiring regulations. In the UK the reference to “National Wiring Rules” means BS 7671:1992 *Requirements for Electrical Installation, IEE Wiring Regulation, Sixteenth Edition*. The installation of a luminaire has to conform to those regulations. Particular attention should be paid to the suitability of luminaires for the locations in which they are to be installed. For example, those having exposed basic insulation may necessitate further precautions to be specified by the installation designer. It is important to note that the Regulations do not deal with requirements for the construction of luminaires, which are covered by the appropriate parts of the standard.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

In the case of mains supply flexible cables or cords specified in this standard, the British Standard which implements the relevant parts of HD 21 and HD 22 is BS 6500.

Contract requirements

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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Summary of pages

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13091	June 2001	See national foreword
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14414	16 April 2003	See national foreword

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Descriptors: General requirements, luminaire, rated voltage, extra low-voltage, nominal current, flexible cable, flexible cord, temperature, capacitor, winding, ballast, switch, electric starter, cable, connector, flammable material, fire-resistant material, type test, electric earthing, protection against electric shock, resistance to dust, resistance to moisture, insulation resistance, electric strength, creepage distance, insulation clearance, thermal endurance test, resistance to heat, resistance to fire, resistance to tracking, electrical terminal, marking

English version

Luminaires — Part 1: General requirements and tests

(includes amendments A1:1998, A12:1998, A13:1999, A14:2000 and A15:2002)
(IEC 60598-1:1996, modified, + A1:1998)

Luminaires —

Partie 1: Prescriptions générales et essais
(inclut les amendements A1:1998, A12:1998, A13:1999, A14:2000 et A15:2002)
(CEI 60598-1:1996, modifiée, + A1:1998)

Leuchten —

Teil 1: Allgemeine Anforderungen und Prüfungen
(enthält Änderungen A1:1998, A12:1998, A13:1999, A14:2000 und A15:2002)
(IEC 60598-1:1996, modifiziert, + A1:1998)

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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.

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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Documents

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Foreword

The text of document 34D/382/FDIS, future amendment to IEC 60598-1:1992, prepared by SC 34D, Luminaires, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote. Because this amendment was to be incorporated in a new edition of the IEC standard, CENELEC approved EN 60598-1 on 1996-07-02 incorporating those common modifications from the previous edition of EN 60598-1 which were not covered by the text of 34D/382/FDIS. The common modifications to IEC 60598-1:1996 were prepared by the Technical Committee CENELEC TC 34Z, Luminaires and associated 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) 1997-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1997-12-01

For products which have complied with EN 60598-1:1993 and its amendment A1:1996 before 1997-12-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2002-12-01.

Attention is drawn to the fact that all parts 2 of EN 60598 relate to the latest edition of part 1 (see the reference “Sliding; latest edition” in the normative Annex ZA to all EN 60598-2).

Annexes designated “normative” are part of the body of the standard.

Annexes designated “informative” are given for information only.

In this standard, Annex A, Annex B, Annex C, Annex D, Annex E, Annex F, Annex P, Annex ZA and Annex ZB are normative and Annex J, Annex K, Annex L, Annex M, Annex N, Annex Q and Annex ZC are informative.

Annex ZA, Annex ZB and Annex ZC have been added by CENELEC.

Foreword to amendment A1

The text of document 34D/480/FDIS, future amendment 1 to IEC 60598-1:1996, prepared by SC 34D, Luminaires, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote.

Together with common modifications prepared by the Technical Committee CENELEC TC 34Z, Luminaires and associated equipment, it was approved by CENELEC as amendment A1 to EN 60598-1:1997 on 1998-04-01.

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) 1999-01-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2005-04-01

Foreword to amendment A12

At the request of the Finnish electrotechnical committee, a draft for an amendment to EN 60598-1:1997 was submitted to the CENELEC members for acceptance in October 1998.

The text of the draft was adapted to include additional information received from Norway and was accepted by CENELEC as amendment A12 to EN 60598-1:1997 on 1998-12-16.

The following dates were fixed:

- latest date by which the existence of the amendment has to be announced at national level (doa) 1999-03-16
- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-06-16

Foreword to amendment A13

This amendment was prepared by the Technical Committee CENELEC TC 34Z, Luminaires and associated equipment.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A13 to EN 60598-1:1997 on 1999-06-01.

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- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-12-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1999-12-01

Foreword to amendment A14

This amendment was prepared by the Technical Committee CENELEC TC 34Z, Luminaires and associated equipment.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A14 to EN 60598-1:1997 on 2000-11-01.

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- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2002-09-01

Foreword to amendment A15

This amendment to the European Standard EN 60598-1:1997 was prepared by the Technical Committee CENELEC TC 34Z, Luminaires and associated equipment.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A15 to EN 60598-1:1997 on 2002-06-01.

This amendment A15 supersedes amendment A13:1999 to EN 60598-1:1997.

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- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2002-12-01

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Section 0. General Introduction

0.1 Scope and object

This part 1 of International Standard IEC 598 [A1] specifies general requirements for the classification and marking of luminaires and for their mechanical and electrical construction, together with related tests. [A1] The standard is applicable to luminaires for use with electric light sources on supply voltages not exceeding 1 000 V. Additional sections will be added when a need for them is recognized.

Each section of this part 1 [A1] should be read in conjunction with this Section 0 and with other relevant sections to which reference is made. [A1]

Each section of IEC 598-2 details requirements for a particular type of luminaire or group of luminaires on supply voltages not exceeding 1 000 V. These sections are published separately for ease of revision and additional sections will be added as and when a need for them is recognized.

Attention is drawn to the fact that this part 1 covers all aspects of safety (electrical, thermal and mechanical).

The presentation of photometric data for luminaires is under consideration by the International Commission on Illumination (CIE) and is not, therefore, included in this part 1.

Requirements are included in this part 1 for luminaires incorporating ignitors with nominal peak values of the voltage pulse not exceeding those of Table 11.2. The requirements apply to luminaires with ignitors built into ballasts and to luminaires with ignitors separate from ballasts. For luminaires with ignitors built into lamps, the requirements are under consideration.

Requirements for semi-luminaires are included in this part.

In general this part 1 covers safety requirements for luminaires. The object of this part 1 is to provide a set of requirements and tests which are considered to be generally applicable to most types of luminaires and which can be called up as required by the detail specifications of IEC 598-2. This part 1 is thus not to be regarded as a specification in itself for any type of luminaire, and its provisions apply only to particular types of luminaires to the extent determined by the appropriate section of part 2.

The sections of part 2, in making reference to any of the sections of part 1, specify the extent to which that section is applicable and the order in which the tests are to be performed; they also include additional requirements as necessary.

The order in which the sections of part 1 are numbered has no particular significance as the order in which their provisions apply is determined for each type of luminaire or group of luminaires by the appropriate section of part 2. All sections of part 2 are self-contained and therefore do not contain references to other sections of part 2.

Where the requirements of any of the sections of part 1 are referred to in the sections of part 2 by the phrase “The requirements of section ... of IEC 598-1 apply”, this phrase is to be interpreted as meaning that all the requirements of that section of part 1 apply except those which are clearly inapplicable to the particular type of luminaire covered by that section of part 2.

In accordance with IEC guidelines, new IEC standards are divided into those covering either safety or performance. In the lamp safety standards, “information for luminaire design” is given for the safe operation of lamps; this should be regarded as normative when testing luminaires to this standard.

Attention is drawn to lamp performance standards which contain “information for luminaire design”; this should be followed for proper lamp operation; however, this standard does not require the testing of lamps performance as part of the type test approval for luminaires.

0.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 598. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 598 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 61-2:1969, *Lamp caps and holders together with gauges for the control of interchangeability and safety — Part 2: Lampholders*.

Consolidated edition (1995)

IEC 61-3:1969, *Lamp caps and holders together with gauges for the control of interchangeability and safety — Part 3: Gauges.*

Consolidated edition (1995)

IEC 65:1985, *Safety requirements for mains operated electronic and related apparatus for household and similar general use.*

IEC 68-2-63:1991, *Environmental testing — Part 2: Test methods — Test Eg: Impact, spring hammer.*

IEC 83:1975, *Plugs and socket-outlets for domestic and similar general use — Standards.*

Amendment No. 1 (1979)

IEC 112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions.*

IEC 155:1993, *Glow-starters for fluorescent lamps.*

IEC 227, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V.*

IEC 238:1991, *Edison screw lampholders.*

Amendment 1 (1993), Amendment 2 (1995)

IEC 245, *Rubber insulated cables of rated voltages up to and including 450/750 V.*

IEC 320, *Appliance couplers for household and similar general purposes.*

IEC 357:1982, *Tungsten halogen lamps (non-vehicle).*

Amendments: 1 (1984), 2 (1985), 3 (1987), 4 (1989), 5 (1992), 6 (1993), 7 (1994), 8 (1995)

IEC 360:1987, *Standard method of measurement of lamp cap temperature rise.*

IEC 364-3:1993, *Electrical installations of buildings — Part 3: Assessment of general characteristics.*

Amendment 1 (1993), Amendment 2 (1995)

IEC 364-7-702:1983, *Electrical installations of buildings — Part 7: Requirements for special installations or locations — Section 702: Swimming pools.*

IEC 384-14:1993, *Fixed capacitors for use in electronic equipment — Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains.*

IEC 400:1991, *Lampholders for tubular fluorescent lamps and starter-holders.*

Amendment 1 (1993), Amendment 2 (1994)

IEC 416:1988, *General principles for the creation of graphical symbols for use on equipment.*

IEC 417:1973, *Graphical symbols for use on equipment — Index, survey and compilation of the single sheets.*

IEC 432-1:1993, *Safety specifications for incandescent lamps — Part 1: Tungsten filament lamps for domestic and similar general lighting purposes.*

Amendment 1 (1995)

IEC 432-2:1994, *Safety specifications for incandescent lamps — Part 2: Tungsten halogen lamps for domestic and similar lighting purposes.*

IEC 529:1989, *Degrees of protection provided by enclosures (IP Code).*

IEC 570:1995, *Electrical supply track systems for luminaires.*

IEC 598-2, *Luminaires — Part 2: Particular requirements.*

Amendment 3 (1990)

IEC 598-2-4:1979, *Portable general purpose luminaires.*

IEC 630:1994, *Maximum lamp outlines for general lighting lamps.*

IEC 634:1993, *Heat test source (H.T.S.) lamps for carrying out heating tests on luminaires.*

IEC 662:1980, *High pressure sodium vapour lamps.*

Amendments: 2 (1987), 3 (1990), 4 (1992), 5 (1993), 6 (1994), 7 and 8 (1995)

IEC 664-1:1992, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests.*

IEC 684, *Specification for flexible insulating sleeving.*

IEC 695-2-2:1991, *Fire hazard testing — Section 2: Needle-flame test.*

- IEC 742:1983, *Isolating transformers and safety isolating transformers — Requirements.*
- IEC 838, *Miscellaneous lampholders.*
- IEC 901:1987, *Single-capped fluorescent lamps — Safety and performance requirements.*
Amendment 1 (1989), Amendment 2 (1992)
- IEC 920:1990, *Ballasts for tubular fluorescent lamps — General and safety requirements.*
Amendment 1 (1989), Amendment 2 (1992)
- IEC 922:1989, *Ballasts for discharge lamps (excluding tubular fluorescent lamps) — General and safety requirements.*
Amendment 2 (1992)
- IEC 924:1990, *D.C. supplied electronic ballasts for tubular fluorescent lamps — General and safety requirements.*
Amendment 1 (1993)
- IEC 972:1989, *Classification and interpretation of new lighting products.*
Amendment 1 (1991)
- IEC 989:1991, *Separating transformers, autotransformers, variable transformers and reactors.*
- Ⓐ IEC 990:1990, *Methods of measurement of touch-current and protective conductor current* Ⓐ.
- IEC 1032:1990, *Test probes to verify protection by enclosures.*
- IEC 1046:1993, *D.C. or a.c. supplied electronic step-down convertors for filament lamps — General and safety requirements.*
Amendment 1 (1995)
- IEC 1058-1:1990, *Switches for appliances — Part 1: General requirements.*
Amendment 1 (1993), Amendment 2 (1994)
- IEC 1167:1992, *Metal halide lamps.*
Amendment 1 (1995)
- IEC 1184:1993, *Bayonet lampholders.*
- IEC 1195:1993, *Double-capped fluorescent lamps — Safety specifications.*
- IEC 1199:1993, *Single-capped fluorescent lamps — Safety specifications.*
- ISO 75-2:1993, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics and ebonite.*
- ISO 1891:1979, *Bolts, screws, nuts and accessories — Terminology and nomenclature.*
- ISO 4046:1978, *Paper, board, pulp and related terms — Vocabulary.*

0.3 General requirements

Luminaires shall be so designed and constructed that in normal use they function safely and cause no danger to persons or surroundings. In general, compliance is checked by carrying out all the tests specified.

0.3.1 A luminaire shall comply with a section of part 2. If, however, an appropriate section of part 2 does not exist for a particular luminaire or group of luminaires, the nearest applicable section of part 2 may be used as a guide to the requirements and tests.

Where the design of a luminaire is such that two or more sections of part 2 are applicable, the luminaire shall comply with both or all of the appropriate sections.

0.3.2 Semi-luminaires should be regarded as luminaires for test purposes.

0.4 General test requirements

0.4.1 Tests according to this standard are type tests. For the definition of a “type test”, see Section 1 of this part 1.

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

0.4.2 Except where otherwise specified in the sections of part 1 or part 2, luminaires shall be tested in an ambient temperature of between 10 °C and 30 °C. Luminaires shall be tested as delivered, and installed as in normal use, having regard to the manufacturer's installation instructions. The lamp (or lamps) is (are) not included except where essential for the test.

Luminaires cannot be regarded as meeting the requirements of this part 1 unless all internal wiring is complete.

In general, the tests are made on a single sample luminaire or, where a range of similar luminaires is involved, on a single luminaire of each rated wattage in the range or on a representative selection from the range as agreed with the manufacturer. This selection shall include the luminaire, together with any attachments, which represents the most unfavourable combination from a testing point of view.

Each sample luminaire shall comply with all the relevant tests. In order to reduce the time of testing and to allow for any tests which may be destructive, the manufacturer may submit additional luminaires or parts of luminaires provided that these are of the same materials and design as the original luminaire and that the results of the test are the same as if carried out on an identical luminaire. Where the test for compliance is shown as being "by inspection" this shall include any necessary handling.

For track-mounted luminaires the manufacturer shall provide, together with the luminaire, a sample of the appropriate track, connector and adaptors for the luminaire to be connected.

Combination luminaires are tested for safety requirements with that assemblage of parts which gives the most unfavourable result.

Certain parts of luminaires, such as joints, raising and lowering devices, may be tested separately provided that the design of these parts is such that their performance is not dependent upon the other parts of the luminaires.

Luminaires intended to be used with non-detachable flexible cables or cords are tested with the flexible cable or cord connected to the luminaire.

For luminaires intended to be used with but not normally supplied with a shade, the luminaire manufacturer shall provide a shade, typical of the type that might be used with the luminaire.

0.5 Components of luminaires

0.5.1 Components, other than integral components, shall comply with the requirements of the relevant IEC standards, if any.

Integral components shall comply as far as is reasonable with the IEC component standards, as part of the luminaire.

NOTE This does not imply that components need to be separately tested before approval of the luminaire.

0.5.2 Components complying with the requirements of their own standard and used in accordance with their intended use, shall only be tested to the requirements of this standard where there are no requirements in the component standard (covering the requirement heading of this standard).

NOTE A valid test report should be considered adequate to show compliance.

Lampholders and starterholders shall additionally comply with the gauging and interchangeability requirements of the appropriate IEC component standard where applicable after building into the luminaire.

0.5.3 Components for which no appropriate IEC standard exists shall satisfy the relevant requirements of this luminaire standard as part of the luminaire. Lampholders and starterholders shall additionally comply with the gauging and interchangeability requirements of the appropriate IEC component standard where applicable.

NOTE Examples of components are lampholders, switches, transformers, ballasts, flexible cables and cords and plugs.

0.5.4 Compliance with this standard can only be assured if protective shields of identical specification are used.

0.6 List of sections of part 2

- 1) Fixed general purpose luminaires.
- 2) Recessed luminaires.
- 3) Luminaires for road and street lighting.
- 4) Portable general purpose luminaires.
- 5) Floodlights.
- 6) Luminaires with built-in transformers for tungsten filament lamps.
- 7) Portable luminaires for garden use.
- 8) Handlamps.
- 9) Photo and film luminaires (non-professional).
- 10) Portable child-appealing luminaires.
- 11) Not used at present.
- 12) Not used at present.
- 13) Not used at present.
- 14) Not used at present.
- 15) Not used at present.
- 16) Not used at present.
- 17) Luminaires for stage lighting, television and film studios (outdoor and indoor).
- 18) Luminaires for swimming pools and similar applications.
- 19) Air-handling luminaires (safety requirements).
- 20) Lighting chains.
- 21) Not used at present.
- 22) Luminaires for emergency lighting.
- 23) Extra-low voltage lighting systems for filament lamps.
- 24) Not used at present.
- 25) Luminaires for use in clinical areas of hospitals and health care buildings.

Section 1. Definitions

1.1 General

A₁ This Section gives general definitions applicable to luminaires. **A₁**

1.2 Definitions

For the purpose of all sections of this part 1, the following definitions apply; other definitions related to lamps are to be found in the relevant lamp standards.

Where the terms “voltage” and “current” are used, they imply the r.m.s. values unless otherwise stated.

1.2.1

luminaire

apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes all the parts necessary for supporting, fixing and protecting the lamps, but not the lamps themselves, and where necessary circuit auxiliaries together with the means for connecting them to the supply

NOTE A luminaire with integral non-replaceable lamps is regarded as a luminaire except that the tests are not applied to the integral lamp or integral self ballasted lamp.

1.2.2

main part (of luminaire)

that which is fixed to the mounting surface or is directly suspended from it or standing on it (it may or may not carry the lamps, lampholders and auxiliary gear)

NOTE In luminaires for tungsten filament lamps, the part carrying the lampholder is normally the main part.

1.2.3

ordinary luminaire

a luminaire providing protection against accidental contact with live parts but without any other special protection against dust, solid objects or moisture

1.2.4

general purpose luminaire

a luminaire which is not designed for a special purpose

NOTE Examples of general purpose luminaires include pendants, some spotlights and certain fixed luminaires for surface or recessed mounting. Examples of special purpose luminaires are those for rough usage, photo and film applications and swimming pools.

1.2.5

adjustable luminaire

a luminaire, the main part of which can be turned or moved by means of joints, raising and lowering devices, telescopic tubes or similar devices

NOTE An adjustable luminaire may be fixed or portable.

1.2.6

basic luminaire

the smallest number of assembled parts that can satisfy the requirements of any of the sections of part 2 of IEC 598

1.2.7

combination luminaire

a luminaire consisting of a basic luminaire in combination with one or more parts which may be replaced by other parts, or used in a different combination with other parts and changed either by hand or with the use of tools

1.2.8

fixed luminaire

a luminaire which cannot easily be moved from one place to another, either because the fixing is such that the luminaire can only be removed with the aid of a tool, or because it is intended for use out of easy reach

NOTE In general, fixed luminaires are designed for permanent connection to the supply, but connection may also be made by means of a plug or similar device.

examples of luminaires intended for use out of easy reach are pendants and luminaires designed for fixing to a ceiling

1.2.9

portable luminaire

a luminaire which, in normal use, can be moved from one place to another while connected to the supply

NOTE Luminaires for wall mounting provided with a non-detachable flexible cable or cord for connection to a plug and luminaires which may be fixed to their support by means of a wing screw, a clip or a hook so that they can easily be removed from their support by hand, are considered to be portable luminaires.

1.2.10

recessed luminaire

a luminaire intended by the manufacturer to be fully or partly recessed into a mounting surface

NOTE The term applies both to luminaires for operation in enclosed cavities and to luminaires for mounting through a surface such as a suspended ceiling.

1.2.11

rated voltage

the supply voltage or voltages assigned to the luminaire by the manufacturer

1.2.12**supply current**

the current at the supply terminals when the luminaire has stabilized in normal use at the rated voltage and frequency

1.2.13**rated wattage**

the number and rated wattage of the lamps for which the luminaire is designed

1.2.14**non-detachable flexible cable or cord**

a flexible cable or cord which can only be removed from the luminaire with the aid of a tool

1.2.15**live part**

a conductive part which may cause an electric shock in normal use

the neutral conductor shall, however, be regarded as a live part

NOTE The test to determine whether or not a conductive part is a live part which may cause an electric shock is given in Annex A.

1.2.16**basic insulation**

insulation applied to live parts to provide basic protection against electric shock

NOTE Basic insulation does not necessarily include insulation used exclusively for functional purposes.

1.2.17**supplementary insulation**

independent insulation applied in addition to basic insulation in order to provide protection against electric shock in the event of a failure of basic insulation

1.2.18**double insulation**

insulation comprising both basic insulation and supplementary insulation

1.2.19**reinforced insulation**

a single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation

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

1.2.20

(Not used at present.)

1.2.21**class 0 luminaire (applicable to ordinary luminaires only)**

a luminaire in which protection against electric shock relies upon basic insulation

this implies that there are no means for the connection of accessible conductive parts, if any, to the protective conductor in the fixed wiring of the installation, reliance in the event of a failure of the basic insulation being placed on the environment

NOTE 1 Class 0 luminaires may have either an enclosure of insulating material which forms a part or the whole of the basic insulation or a metal enclosure which is separated from live parts by at least basic insulation.

NOTE 2 If a luminaire with an enclosure of insulating material has provision for earthing internal parts, it is class I.

NOTE 3 Class 0 luminaires may have parts with double insulation or reinforced insulation.

1.2.22**class I luminaire**

a luminaire 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

NOTE 1 For a luminaire intended for use with a flexible cord or cable, this provision includes a protective conductor as part of the flexible cord or cable.

NOTE 2 Where a luminaire designed as class I is fitted with a two-core flexible cord or cable with a plug which cannot be introduced into a socket-outlet with earthing contact (formerly class 0I), the protection is then equivalent to that of class 0, but the earthing provisions of the luminaire in all other respects should fully comply with the requirements of class I.

NOTE 3 Class I luminaires may have parts with double insulation or reinforced insulation.

1.2.23**class II luminaire**

a luminaire 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

NOTE 1 Such a luminaire may be of one of the following types:

a) A luminaire having a durable and substantially continuous enclosure of insulating material which envelops all metal parts with the exception of small parts such as nameplates, screws and rivets which are isolated from live parts by insulation at least equivalent to reinforced insulation. Such a luminaire is called an insulation encased class II luminaire.

b) A luminaire having a substantially continuous enclosure of metal, in which double insulation is used throughout, except for those parts where reinforced insulation is used because the application of double insulation is manifestly impracticable. Such a luminaire is called a metal-encased class II luminaire.

c) A luminaire which is a combination of types a) and b) above.

NOTE 2 The enclosure of an insulation-encased class II luminaire may form a part or the whole of the supplementary insulation or the reinforced insulation.

NOTE 3 If earthing is provided to assist starting, but is not connected to an accessible metal part, the luminaire may still be deemed to be of class II. Lamp caps, shells and starting strips on lamps are not regarded as accessible metal parts unless the tests of Annex A show them to be live parts.

NOTE 4 If a luminaire with double insulation and/or reinforced insulation throughout has an earthing terminal or an earthing contact, it is class I construction. However, a fixed class II luminaire intended for looping-in may have an internal terminal for maintaining the electrical continuity of an earthing conductor not terminating in the luminaire, provided that the terminal is insulated from accessible metal parts by class II insulation.

NOTE 5 Class II luminaires may have parts in which protection against electric shock relies on operation at safety extra-low voltage (SELV).

1.2.24**class III luminaire**

a luminaire in which protection against electric shock relies on supply at safety extra-low voltage (SELV) and in which voltages higher than those of SELV are not generated

NOTE A class III luminaire should not be provided with means for protective earthing.

1.2.25**rated maximum ambient temperature (t_a)**

the temperature assigned to a luminaire by the manufacturer to indicate the highest sustained temperature in which the luminaire may be operated under normal conditions

NOTE This does not preclude temporary operation at a temperature not exceeding ($t_a + 10$) °C.

1.2.26**rated maximum operating temperature of the case of a ballast, capacitor or starting device (t_c)**

the highest permissible temperature which may occur on the outer surface (at the indicated place if marked) of the component under normal operating conditions at the rated voltage or maximum of the rated voltage range

1.2.27**rated maximum operating temperature of a winding (t_w)**

the operating temperature of a ballast winding which gives an expectancy of 10 years continuous service (at that temperature)

1.2.28**ballast**

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

it may also include means for transforming from the supply voltage and arrangements which help to provide starting voltage and preheating current, prevent cold starting, reduce stroboscopic effect, correct the power factor and suppress radio interference

A1 1.2.29**independent lamp control gear**

lamp control gear consisting of one or more separate elements so designed that it, or they, can be mounted separately outside a luminaire with protection according to the marking on the lamp control gear and without any additional enclosure

1.2.30**built-in lamp control gear**

lamp control gear designed to be built into a luminaire and not intended to be mounted outside a luminaire without special precautions **A1**

1.2.31**integral lampholder**

a part of a luminaire which supports the lamp and provides electrical contact with it and which is designed as part of the luminaire

1.2.32**ballast compartment**

that part of the luminaire in which the ballast is intended to be mounted

1.2.33**translucent cover**

the light-transmitting parts of the luminaire which may also protect the lamps and other component parts this term includes diffusers, lens panels and similar light-control elements

1.2.34**supply cable**

a cable which is part of the fixed installation to which the luminaire is connected

NOTE Supply cables may be brought into the luminaire and connected to terminals, including terminals of lampholders, switches and the like.

1.2.35**appliance coupler**

a means enabling a flexible cable to be connected at will to the luminaire

it consists of two parts: a connector provided with contact tubes which is the part integral with or designed to be attached to the flexible cable connected to the supply; an appliance inlet, provided with contact pins, which is the part incorporated in or fixed to the luminaire

1.2.36**external wiring**

wiring generally outside the luminaire but delivered with it

NOTE 1 External wiring may be used for connecting the luminaire to the supply, to other luminaires, or to any external ballast.

NOTE 2 External wiring is not necessarily outside the luminaire for its full length.

1.2.37

internal wiring

wiring generally inside the luminaire and delivered with it, which forms the connection between terminals for external wiring or supply cables and terminals of lampholders, switches and similar components

NOTE Internal wiring is not necessarily inside the luminaire for its full length.

1.2.38

normally flammable material

material having an ignition temperature of at least 200 °C and which will not deform or weaken at this temperature

examples: Wood and materials based on wood of more than 2 mm thickness

NOTE The ignition temperature and the resistance of normally flammable materials to deformation or weakening are based on widely accepted values determined during a test period of 15 min.

1.2.39

readily flammable material

material which cannot be classified as either normally flammable or non-combustible

examples: Wood fibre and materials based on wood of up to 2 mm thickness

1.2.40

non-combustible material

material incapable of supporting combustion

NOTE For the purpose of this standard, materials such as metal, plaster and concrete are regarded as non-combustible materials.

1.2.41

flammable material

material which does not comply with the glow-wire test requirements of **13.3.2**

1.2.42

safety extra-low voltage (SELV)

a voltage which does not exceed 50 V a.c. r.m.s. (see note 1) between conductors, or between any conductor and earth, in a circuit which is isolated from the supply mains by means such as a safety isolating transformer or converter with separate windings

NOTE 1 The d.c. value is under consideration.

NOTE 2 The voltage limit should not be exceeded either at full load or no-load, but it is assumed, for the purpose of this definition, that any transformer or converter is operated at its rated supply voltage.

1.2.43

working voltage

the highest r.m.s. voltage which may occur across any insulation at rated supply volts, transients being neglected, in open-circuit conditions or during normal operation

1.2.44

type test

a 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

1.2.45

type test sample

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

1.2.46

by hand

not requiring the use of a tool, a coin or other object

1.2.47**terminal**

that part of a luminaire or component which is necessary to make electrical connection to a conductor
see Section 14 and Section 15

1.2.48**looping-in (feed through)**

a system of mains supply connection to two or more luminaires where each supply conductor is taken into and out of the same terminal

NOTE A supply conductor may be cut to facilitate connections to a terminal. (See Figure 20.)

A1 1.2.49**through wiring**

wiring which passes through the luminaire intended for interconnection of a row of luminaires

NOTE 1 Some countries do not permit joints in through wiring. **A1**

NOTE 2 The luminaire may or may not be electrically connected to the through wiring (see Figure 20).

1.2.50**starting device**

an apparatus that, by itself or in combination with other components in the circuit, provides the appropriate electrical conditions to start a discharge type of lamp

1.2.51**starter**

a starting device, usually for fluorescent lamps, that provides for the necessary preheating of the electrodes and in combination with the series impedance of the ballast, causes a surge in the voltage applied to the lamp

1.2.52**ignitor**

a starting device that generates voltage pulses to start a discharge lamp and that does not provide for preheating of electrodes

1.2.53**terminal block**

an assembly of one or more terminals in or on a housing or body of insulating material to facilitate interconnection between conductors

A1 1.2.54**rough service luminaire**

a luminaire designed to withstand severe mechanical handling

NOTE 1 The luminaire may:

- be permanently fixed; or
- be temporarily fixed on a construction or stand; or
- incorporate an integral stand or handle.

NOTE 2 Such luminaires are for use where normally rough circumstances occur, or where temporary lighting is required, for example on building sites, engineering workshops and similar applications. **A1**

1.2.55**electro-mechanical contact system**

a connection system within a luminaire by which the main part carrying the lampholder is electrically and mechanically connected to the base plate or suspension device

it may or may not incorporate an adjusting device

1.2.56**extra-low voltage d.c. supplied fluorescent luminaire**

a luminaire for operation from a battery voltage not exceeding 48 V d.c. nominal and incorporating a d.c./a.c. inverter using transistors for supplying power to one or more fluorescent lamps

NOTE 1 Extra-low voltage d.c. supplied fluorescent luminaires may generate internal voltages higher than the supply power, and thus not belong to class III. A risk of electric shock should be taken into account and guarded against with such luminaires.

NOTE 2 The value of 48 V is under consideration.

1.2.57

mounting surface

the part of any building, furniture or other structure which a luminaire may in any way be attached to, suspended from, stood on or placed upon in normal use and which will or is intended to support the luminaire

1.2.58

integral component

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

1.2.59

self-ballasted lamps

a unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a light source and any additional elements necessary for starting and stable operation of the light source

NOTE 1 The light source component of a self-ballasted lamp is not replaceable.

NOTE 2 The ballast component is part of the self-ballasted lamp; it is not part of the luminaire. It is discarded at the end of the life of the unit.

NOTE 3 For test purposes, self-ballasted lamp units should be regarded as conventional lamps.

NOTE 4 For examples and further information, see IEC 972.

1.2.60

semi-luminaire

a unit similar to a self-ballasted lamp but designed to utilize a replaceable light source and/or starting device

NOTE 1 The light source component and/or starting device of a semi-luminaire is readily replaceable.

NOTE 2 The ballast component is not replaceable and is not disposed of each time a light source is replaced.

NOTE 3 A lampholder is required for a supply connection.

NOTE 4 For examples and further information, see IEC 972.

1.2.61

plug-ballast/transformer

a ballast or transformer incorporated in an enclosure provided with an integral plug as the means of connection to the electrical supply

1.2.62

mains socket-outlet-mounted luminaire

a luminaire provided with an integral plug as the means of both mounting and connection to the electrical supply

1.2.63

clip-mounted luminaire

an integral assembly of a luminaire and resilient spring clip, securing the luminaire in position on its mounting surface by a single hand action

1.2.64

lamp connectors

a set of contacts specially designed to provide a means of electrical contact but not to support the lamp

1.2.65

mains socket-outlet

an accessory having socket-contacts designed to engage with the pins or blades of a mains plug and having terminals for the connection of cables or cords

1.2.66

rewireable luminaire

a luminaire so constructed that the flexible cable or cord can be replaced using general purpose tools

1.2.67**non-rewireable luminaire**

a luminaire so constructed that the flexible cable or cord cannot be separated from the luminaire using general purpose tools without making the luminaire permanently unusable

NOTE Examples of general purpose tools are screwdrivers, spanners, etc.

1.2.68**lamp control gear**

devices employed for the control of lamps, for example ballasts, transformers and step-down convertors

NOTE The definition does not include devices for the switching of lamps or the control of brightness such as dimmers and daylight sensors.

1.2.69**Safety Extra-Low Voltage (SELV) part**

a current-carrying part supplied from within a luminaire at extra-low voltage (not exceeding 50 V a.c. r.m.s.) with respect to any other parts or earth

1.2.70**dummy lamp**

a device incorporating a cap which is in compliance with the requirements of IEC 61

Section 2. Classification of luminaires**2.1 General**

[A1] This Section describes the classification of luminaires. **[A1]**

Luminaires are classified according to the type of protection against electric shock, the degree of protection against ingress of dust, solid objects and moisture, and the material of the supporting surface.

2.2 Classification according to type of protection against electric shock

Luminaires shall be classified according to the type of protection against electric shock provided, as class 0, class I, class II and class III (see definitions in Section 1). Luminaires with a rated voltage in excess of 250 V shall not be classified as class 0.

Rough service luminaires shall not be classified as class 0.

Luminaires shall have only a single classification. For example, for a luminaire with a built-in extra-low voltage transformer with provision for earthing, the luminaire shall be classified as class I and part of the luminaire shall not be classified as class III even though the lamp compartment is separated by a barrier from the transformer compartment.

Semi-luminaires shall comply with all relevant requirements for class II luminaires without being provided with the class II symbol.

NOTE The class II symbol is omitted in order to avoid the symbol being applied to the complete luminaire in which the semi-luminaire is used.

Track-mounted luminaires shall not be classified as class 0.

NOTE Some national wiring rules may not allow portable luminaires to be class 0. Other national wiring rules may not allow any luminaires to be class 0.

2.3 Classification according to degree of protection against ingress of dust, solid objects and moisture

Luminaires shall be classified in accordance with the "IP number" system of classification described in IEC 529.

Symbols for the degrees of protection are given in Section 3.

Tests for the degrees of protection are given in Section 9.

NOTE 1 Luminaires classified as watertight are not necessarily suitable for operation under water; pressure watertight luminaires should be used for such applications.

NOTE 2 The IP numbers are the principal marking on luminaires but symbols may be used in addition to IP numbers if desired.

2.4 Classification according to material of supporting surface for which the luminaire is designed

Luminaires shall be classified according to whether they are suitable for direct mounting on normally flammable surfaces in all cases, or are primarily intended for that application or are only suitable for mounting on non-combustible surfaces as follows:

<i>Classification</i>	<i>Symbol</i>
— Portable and handheld luminaires.	Symbol not required.
— Other fixed luminaires suitable for mounting on normally flammable surfaces.	Symbol required — see Figure 1, page 81.
— Other fixed luminaires suitable for mounting on non-combustible materials only.	No symbol, but warning notice may be required — see Section 3.

NOTE Readily flammable surfaces are not suitable for the direct mounting of luminaires. Requirements for luminaires classified as primarily intended for direct mounting on normally flammable surfaces are given in Section 4 and related tests in Section 12.

2.5 Classification according to the circumstances of use

Luminaires shall be classified according to whether they are intended for normal use or for rough service.

<i>Classification</i>	<i>Symbol</i>
— Luminaires for normal use.	No symbol.
— Luminaires for rough service.	Symbol — see Figure 1, page 81. 

Section 3. Marking

3.1 General

 This Section specifies the information to be marked on luminaires. 

3.2 Marking on luminaires

The following information shall be distinctly and durably marked on the luminaire (see Table 3.1).

- Marking to be observed when replacing lamps shall be visible on the outside of the luminaire (except the mounting side) or behind a cover which is removed during lamp replacement and with the lamp removed.
- Marking to be observed during installation shall be visible during installation on the outside of the luminaire or behind a cover or part which is removed during installation.
- Marking to be observed after installation shall be visible with the luminaire assembled and installed as for normal use and with the lamp in place.

Marking may be on ballasts provided the conditions under a) or b) above, as appropriate, are fulfilled.

The earthing symbol referred to in 3.2.12 may be marked on the ballast, instead of the luminaire, if the ballast is a non-replaceable type. The height of graphical symbols shall not be less than 5 mm except that the symbols for class II and class III luminaires and for the F mark may be reduced to a minimum of 3 mm where the space available for marking is restricted. The height of letters and numerals either shown separately or with or as part of symbols shall not be less than 2 mm.

For combination luminaires where the type references or the rated inputs are different for different combinations, the main part and the alternative parts may be marked with a type reference or a rated input, as appropriate, provided that the type can be identified and the rated input of the complete unit may be established from a catalogue or a similar document.

For luminaires with electro-mechanical contact systems the base plate shall be marked with the rated current of the electrical connection.

3.2.1 Mark of origin (this may take the form of a trade mark, the manufacturer's identification mark or the name of the responsible vendor)

3.2.2 Rated voltage(s) in volts. Luminaires for tungsten filament lamps shall be marked only if the rated voltage is different from 250 V.

Portable class III luminaires shall be marked with the rated voltage on the outside of the luminaire.

3.2.3 The rated maximum ambient temperature t_a , if other than 25 °C (see Figure 1).

NOTE Exceptions to this general requirement may be specified in particular sections of IEC 598-2.

3.2.4 Symbol for class II luminaires where applicable (see Figure 1).

For portable luminaires provided with a non-detachable flexible cable or cord, the symbol for class II construction, if applicable, shall be on the outside of the luminaire.

The class II symbol shall not be applied to semi-luminaires.

3.2.5 Symbol for class III luminaires where applicable (see Figure 1).

3.2.6 Marking (if applicable) with IP numbers for degree of protection against ingress of dust, solid objects and moisture and, if desired, additional symbols (see Figure 1 and Annex J). Where X is used in an IP number in Figure 1, it indicates a missing numeral in the example, but both of the appropriate numerals shall be marked on the luminaire.

Table 3.1

Markings belonging to a)	Markings belonging to b)	Markings belonging to c)
3.2.8^a Rated wattage	3.2.1 – 3.2.2^b	3.2.3 Ambient temperature
3.2.10 Special lamps	3.2.4 – 3.2.5	3.2.6 IP number
3.2.11 Cool beam	3.2.7 Type reference	3.2.13 Lighted objects
3.2.15 Bowl mirror	3.2.9 Symbols   	3.2.14 Rough service
3.2.16 Protective shield	3.2.12 Termination	
3.2.18 Ignition warning		
^a 3.2.8 Rated wattage. For luminaires for discharge lamps with remote control gear, the marking may be replaced by the instruction: "For lamp designation, see control gear". ^b 3.2.2 Rated voltage. For luminaires for discharge lamps, if the ballast is not built into the luminaire, the luminaire shall be marked with the working voltage instead of the mains voltage. For luminaires with built-in transformers for filament lamps, see IEC 598-2-6.		

In cases where different IP numbers apply to distinct parts of the luminaire, the lower number shall be marked on the type label on the luminaire whereas the higher number shall be marked separately on the part concerned. The instruction sheet supplied with the luminaire shall include details of the IP numbers applying to the various parts of the luminaire. The use of different IP numbers on different parts of a luminaire is only applicable to fixed luminaires.

Marking of IP20 on ordinary luminaires is not required.

3.2.7 Maker's model number or type reference.

3.2.8 Rated wattage or the designation as indicated on the lamp data sheet of the type or types of lamp for which the luminaire is designed. Where the lamp wattage alone is insufficient, the number of lamps and the type shall also be given.

Luminaires for tungsten filament lamps shall be marked with the maximum rated wattage and number of lamps.

Marking of maximum rated wattage for luminaires for tungsten filament lamps with more than one lampholder may be in the form:

" $n \times \text{MAX... W}$ ", n being the number of lampholders.

3.2.9 Where applicable, the relevant symbol (see Figure 1) for suitability or non-suitability for direct mounting on normally flammable surfaces or suitability for mounting in/on normally flammable surfaces when thermally insulating material may cover the luminaire.

NOTE A warning notice is not required when it is obvious that either a luminaire will never be mounted on normally flammable surfaces, for example portable luminaires for garden use or a luminaire will always be mounted on normally flammable surfaces, for example portable general purpose luminaires, portable child-appealing luminaires and luminaires for emergency lighting.

3.2.10 Information concerning special lamps, if applicable.

In particular this applies to the symbols (see Figure 1) for luminaires for use with high-pressure sodium lamps having either an internal starting device or requiring an external ignitor where the lamp is required to be marked with the same symbol according to IEC 662.

3.2.11 Symbol (see Figure 1), if applicable, for luminaires for lamps of similar shape to “cool beam” lamps but where the use of a dichroic reflectorized “cool beam” lamp might impair safety.

3.2.12 Terminations shall be clearly marked or otherwise identified to give a clear indication as to which termination should be connected to the live side of the supply, where necessary for safety, or to ensure satisfactory operation. Earthing terminations shall be clearly indicated by the appropriate symbol shown in IEC 417.

For luminaires with non-detachable flexible cables or cords which are not fitted with a plug, a label giving information for proper connection shall be attached where it is easily seen during connection.



Extra-low voltage d.c. supplied fluorescent luminaires shall have positive supply terminations marked + or coloured red and negative supply terminations marked – or coloured black.

3.2.13 Symbol (see Figure 1) for minimum distance from lighted objects, if applicable, for luminaires which might otherwise overheat the lighted objects due to for example the applied lamp type, the shape of the reflector, the adjustability of the mounting means or the location of mounting as indicated in the installation instructions.

The minimum distance marked shall be determined by the temperature test described in item j) of 12.4.1.

The distance is measured on the optical axis of the luminaire from that part of the luminaire or lamp which is nearest to the lighted object.

The symbol for minimum distance and explanation of its meaning shall also be given either on the luminaire or in the instructions with the luminaire.

3.2.14 Symbol (see Figure 1), if applicable, for rough service luminaires.

3.2.15 Symbol (see Figure 1), if applicable, for luminaires which are designed for use with bowl mirror lamps.

NOTE Separate bowls for attachment to GLS lamps without reference to luminaire testing are not within the scope of this standard.

3.2.16 Luminaires incorporating a glass protective shield shall be marked as follows:

“Replace any cracked protective shield”

or

with the symbol (see Figure 1).

3.2.17 The maximum number of luminaires that may be interconnected or the maximum total current that may be drawn by means of couplers provided for looping-in connection to the mains supply.

3.2.18 A warning symbol or notice for luminaires with ignitors intended for use with double-ended high pressure discharge lamps if the voltage measured according to Figure 26 exceeds 34 V peak.

- a) Warning symbol in accordance with Sheet 5036 IEC 417 visible during replacement of the lamp. The symbol shall be explained on the luminaire or in the manufacturer's instructions provided with the luminaire, or
- b) A warning notice near to the holder of a replaceable ignitor or replaceable switching element, if any: "Attention, remove replaceable device before replacement of lamp. After lamp-replacement reinsert replaceable device".

3.3 Additional information

In addition to the above marking, all details which are necessary to ensure proper installation, use and maintenance shall be given either on the luminaire or on built-in ballasts or in the manufacturer's instructions provided with the luminaire, for instance:

Written instructions related to safety shall be in a language which is acceptable in the country in which the equipment is to be installed.

3.3.1 For combination luminaires, the permissible ambient temperature, the class of protection or the protection against ingress of dust, solid objects and moisture of an alternative part if not at least equal to that of the basic luminaire.

3.3.2 Nominal frequency in hertz.

3.3.3 Operating temperatures:

- a) The rated maximum operating temperature (of a winding) t_w in degrees Celsius;
- b) The rated maximum operating temperature (of a capacitor) t_c in degrees Celsius;
- c)  The maximum temperature to which the insulation of supply cables and interconnecting cables will be subjected within the luminaire under the most unfavourable conditions of normal operation, if in excess of 90 °C (see footnote c to Table 12.2 relating to unsleeved fixed wiring). The symbol to indicate this requirement is given in Figure 1. 
- d) Spacing requirements to be observed during installation.

3.3.4 A symbol or a warning notice that the luminaire is not suitable for mounting on a normally flammable surface (see Figure 1).

3.3.5 A wiring diagram, except where the luminaire is suitable for direct connection to the mains supply.

3.3.6 Special conditions for which the luminaire, including the ballast, is suitable; for instance, whether or not the luminaire is intended for looping-in.

3.3.7 Luminaires provided with metal halide lamps shall, if applicable, be provided with the following warning notice:

"The luminaire shall only be used complete with its protective shield".

3.3.8 The limitations of use or application for semi-luminaires.

3.3.9 In addition, the manufacturer shall be prepared to supply information on the power factor and the supply current.

For connections suitable for both resistive and inductive loads, the rated current for the inductive load shall be indicated between brackets and shall immediately follow the rated current for the resistive load. The marking may accordingly be as follows:

3(1)A 250 V or 3(1)/250 or $\frac{3(1)}{250}$

NOTE 1 This marking is in accordance with IEC 1058-1.

NOTE 2 The rated current values do not apply to circuits in general but only to the rating of the luminaire as a whole.

3.3.10 Suitability for use "indoors" including the related ambient temperature.

3.3.11 For luminaires using remote control gear, the range of lamps for which the luminaire is designed.

3.3.12 For clip-mounted luminaires a warning when the luminaire is not suitable for mounting on tubular material.

3.3.13 The manufacturer shall provide the specifications of all protective shields.

3.3.14 Where necessary for correct operation, the luminaire shall be marked with the symbol for nature of supply (see Figure 1).

3.3.15 The rated current at rated voltage shall be declared by the manufacturer for any socket outlet incorporated in the luminaire, if less than the rated value.

[A]

3.3.16 The information about rough service luminaires concerning:

- the connection to IPX4 rated socket outlets;
- the correct mounting taking into account the temporary installation;
- the correct fixing to a stand, and also where the stand is not supplied with the luminaire, the maximum height of a possible stand, and its required stability by the indication of the number and minimum length of the legs. **[A]**

[C]

3.3.101 Where the terminal block is not supplied with the luminaire, the packaging needs to contain the following wording:

“Terminal block not included. Installation may require advice from a qualified person.” **[C]**

3.4 Test of marking

Compliance with the requirements of **3.2** and **3.3** is checked by inspection and by the following test:

The durability of the marking is checked by trying to remove it by rubbing lightly for 15 s with a piece of cloth soaked with water and, after drying, for a further 15 s with a piece of cloth soaked with petroleum spirit and by inspection after the tests detailed in Section 12 have been completed.

After the test, the marking shall be legible, marking labels shall not be easily removable and they shall show no curling.

NOTE The petroleum spirit used should consist of a solvent hexane with a content of aromatics of maximum 0,1 % by volume, a value of 29 % for kauri-butanol, an initial boiling-point of approximately 65 °C, a dry-point of approximately 69 °C and a density of approximately 0,68 g/cm³.

Section 4. Construction

4.1 General

[A] This Section specifies general constructional requirements for luminaires. See also Annex L. **[A]**

4.2 Replaceable components

Luminaires incorporating components or parts intended to be replaceable shall be so designed that there is sufficient space to permit replacement of such components or parts without difficulty and without impairing safety.

NOTE Sealed-in components and riveted parts are not replaceable components.

4.3 Wireways

Wireways shall be smooth and free from sharp edges, burrs, flashes and the like, which might cause abrasion of the insulation of the wiring. Parts such as metal set screws shall not protrude into wireways.

Compliance is checked by inspection and, if necessary, by dismantling and reassembling the luminaire.

4.4 Lampholders

4.4.1 The requirements for electrical safety of integral lampholders shall be those applicable to the luminaire as a whole with the lampholder and lamp in fully assembled position, as for normal use.

In addition, integral lampholders shall, when mounted in the luminaire, comply with the requirements concerning safety during insertion of the lamp as specified in the appropriate lampholder standard.

4.4.2 Connection of wiring to integral lampholder contacts may be made by any method giving reliable electrical contact over the service life of the lampholder.

4.4.3 Luminaires for tubular fluorescent lamps designed for end-to-end mounting shall be so designed that the lamp may be changed in the middle luminaire of a row without adjusting any other luminaire. In multi-lamp luminaires for tubular fluorescent lamps, the changing of any one lamp shall not impair the security of the other lamps.

Compliance with the requirements of 4.4.1, 4.4.2 and 4.4.3 is checked by inspection.

4.4.4 Lampholders which are put into position by the user shall be capable of easy and correct positioning.

The distance between the pair of fixed lampholders for a fluorescent lamp intended to be set in a fixed position shall comply with the relevant Standard Sheet of IEC 61-2 or (if IEC 61-2 does not apply) the lampholder manufacturer's mounting instructions. The fixing device of lampholders shall have adequate mechanical strength so as to withstand such rough handling as may be expected in normal use. These requirements apply both to lampholders put in position by the user and to lampholders put in position by the luminaire manufacturer.

Compliance is checked by inspection, measuring and, if applicable, by the following mechanical tests:

i) *Lampholders for a fluorescent lamp, with a test-cap in position, are subjected, for 1 min, to a pressure applied to the centre of the cap in the direction of its axis of:*

- 15 N for G5 lampholders;
- 30 N for G13 lampholders;
- 30 N for lampholders for single-capped fluorescent lamps (G23, G10q GR8 etc.).

Values for other lampholders are under consideration.

After the test, the distance between the holders shall comply with the relevant Standard Sheet of IEC 61-2 and the lampholder shall show no damage. The test-cap for this test shall comply with the following Standard Sheets in IEC 61-3:

7006-47C for G5 lampholders;

7006-60C for G13 lampholders;

test-caps for other lampholders are under consideration.

After the test on lampholders for single-capped fluorescent lamps the lampholder shall not have moved from its position and the fixing device shall show no permanent deformation, so that the lamp, when reinserted, will come into its intended position.

ii) Mounting brackets for Edison screw or bayonet-capped lampholders are subjected to testing for 1 min, to the following bending moments:

for E14 and B15 lampholders	1,0 Nm;
for E26, E27 and B22 lampholders	2,0 Nm;
for E39 and E40 lampholders	Value under consideration.

4.4.5 For luminaires with ignitors, the peak pulse voltage occurring across contacts in lampholders which are part of the pulse voltage circuit shall not be greater than the pulse voltage marked on the lampholder or, in the absence of such marking, shall not be greater than:

- for 250 V rated lampholders 2,5 kV;
- for 500 V rated ES lampholders 4 kV;
- for 750 V rated ES lampholders 5 kV.

Compliance is checked by measurement of the voltage occurring across the lampholder contacts during the pulse test of 10.2.2 for luminaires with ignitors.

4.4.6 For luminaires with ignitors incorporating Edison screw lampholders, the centre contact of the lampholder shall be connected to the lead which supplies the pulse voltage.

Compliance is checked by inspection.

4.4.7 The insulating parts of lampholders and plugs incorporated in rough service luminaires shall be of a material resistant to tracking.

Compliance is checked by the test of Clause 13.4.

4.4.8 Lamp connectors shall comply with all the requirements for lamp holders other than those related to retaining the lamp in position. Means for retaining the lamp have to be provided by other parts of the luminaire.

Compliance is checked by inspection and test as required by 4.4.1, 4.4.2, 4.4.3, 4.4.4, 4.4.5, 4.4.6 and 4.4.7.

NOTE The difference between lamp connectors and lampholders is clearly identified on the relevant data sheets of IEC 61.

4.5 Starter holders

Starter holders in luminaires other than class II shall accept starters which comply with IEC 155.

Class II luminaires may require starters of class II construction.

For class II luminaires where the starter can be touched with the standard test finger when the luminaire is fully assembled for use or open for the replacement of lamps or starters, the starter holder shall be one accepting only starters complying with the requirements for starters for class II luminaires given in IEC 155.

Compliance is checked by inspection.

4.6 Terminal blocks

If luminaires are provided with connecting leads (tails) requiring a separate terminal block for the connection to the supply cables, adequate space for this terminal block shall be provided within the luminaire, or within a box delivered with the luminaire, or specified by the manufacturer.

This requirement applies to terminal blocks for connecting leads (tails) with conductor nominal cross-sectional areas not exceeding 2,5 mm².

Compliance is checked by measurement and by an installation test, using one terminal block for each two conductors to be connected together, as shown in Figure 2, and supply cables having a length of approximately 80 mm. The dimensions of the terminal blocks are those specified by the manufacturer or, in the absence of such a specification, 10 mm × 20 mm × 25 mm.

NOTE Unsecured terminal blocks are permitted when they are so designed and insulated that creepage distances and clearances in accordance with Section 11 are always maintained for any position of the terminal block, and that damage to internal wiring is prevented.

4.7 Terminals and supply connections

4.7.1 In portable luminaires of class 0, I and II and in fixed luminaires of class 0, I and II that are frequently adjusted, adequate precautions shall be taken to prevent metal parts from becoming live due to a detached wire or screw. This requirement applies to all terminals (including supply terminals).

NOTE The requirement may be met by securing the wires adjacent to their entry to the terminals, by suitable dimensioning of the enclosure for the terminals, by the use of an enclosure of insulating material or by the provision of an insulating lining in the enclosure.

Examples of methods deemed efficient to prevent a wire from becoming detached are:

- a) wires are retained by a cord anchorage adjacent to the terminals;
- b) conductor is clamped by a spring type screwless terminal;
- c) the wire conductor is anchored to the tag before soldering, unless breakage close to the soldering place is likely to occur as a result of vibration;
- d) wires are twisted together in a reliable manner;
- e) wires are fastened together by insulation tape, sleeves, or the like;
- f) the wire conductor is inserted into a hole in a printed board, bent and soldered, the hole having a diameter slightly greater than the conductor;
- g) the wire conductor is securely wrapped around the terminal by means of a special tool (see Figure 19);
- h) the wire conductor is crimped to the terminal by means of a special tool (see Figure 19).

The methods under a) to h) apply to internal wiring and the methods under a) and b) to rewirable external flexible cords.

Compliance is checked by inspection and based upon the assumption that only one conductor can become detached at the same time.

4.7.2 Supply terminals shall be located or shielded in such a way that, if a wire of a stranded conductor escapes from a terminal when the conductors are fitted, there is no risk of contact between live parts and metal parts which can be touched with the standard test finger when the luminaire is fully assembled for use or open for the replacement of lamps or starters.

Compliance is checked by inspection and by the following test:

An 8 mm length of insulation is removed from the end of a flexible conductor having the largest cross-sectional area specified in Section 5. One wire of the stranded conductor is left free and the remainder are fully inserted and clamped in the terminal. The free wire is bent, without tearing the insulation back, in every possible direction, but without making sharp bends around barriers.

The free wire of a conductor connected to a live terminal shall not touch any metal part which is accessible or connected to an accessible metal part, and the free wire of a conductor connected to an earthing terminal shall not touch any live part.

This test does not apply to lampholders which have been separately approved to an appropriate IEC standard and to terminals of components where the construction method justifies a shorter length of free wire.

4.7.3 Terminals for supply conductors, including those for non-detachable flexible cables and cords, shall be suitable for connection to be made by means of screws, nuts or equally effective devices.

Connecting leads (tails) shall comply with the requirements of Section 5.

NOTE 1 For luminaires designed to be connected by means of rigid (solid or stranded) conductors, screwless terminals of the spring type are effective devices, including the earth connection. No requirements are specified at present for using such terminals for the connection of non-detachable flexible cables and cords.

NOTE 2 For luminaires designed to be connected by means of a non-detachable flexible cable or cord and having a rated current not exceeding 3 A, soldered, welded, crimped and similar connections, including snap-on connectors, are effective devices, including an earth connection.

NOTE 3 For luminaires having a rated current exceeding 3 A, snap-on connectors are suitable if the connection can also be made without making use of the receptacle, for example, by means of a screwed connection for which a threaded hole is provided in the tab.

4.7.4 Terminals, other than those for supply connection, which are not covered by separate standards for components, shall comply with the requirements of Section 14 or Section 15.

Terminals of lampholders, switches and similar parts used for multiple connection of internal wiring shall have dimensions adequate for the purpose and shall not be used for the connection of external wiring.

Compliance is checked by inspection and by the tests of Section 14 and Section 15.

4.7.5 If the external wiring or supply cable is unsuitable for the temperatures reached inside the luminaire, either a connection shall be provided at the point of entry of the external wiring into the luminaire for the use of heat-resistant wiring after this point, or heat-resisting parts shall be supplied with the luminaire to cover the part of the wiring placed inside it, which exceeds the wiring temperature limit.

Compliance is checked by inspection.

4.7.6 If during the installation or maintenance of a luminaire electrical connections are made by a multi-pole plug and socket, unsafe connections shall be prevented.

Compliance is checked by inspection and by trying to make unsafe connections e.g. by shifting the plug positions and the like.

4.8 Switches

Switches shall be adequately rated and so fixed that they are secured against rotation and cannot be removed by hand.

Switches in flexible cables or cords and switched lampholders shall not be used in luminaires other than ordinary, unless the degree of protection against dust, solid objects or moisture of the switch is in accordance with the classification of the luminaire.

For luminaires intended for use on a polarized supply and where the luminaire has a single-pole on/off switch, the switch shall be wired into the live side of the supply or the side other than that identified as the neutral side.

Compliance is checked by inspection.

4.9 Insulating linings and sleeves

4.9.1 Insulating linings and sleeves shall be so designed that they are reliably retained in position when switches, lampholders, terminals, wires or similar parts have been mounted.

NOTE Self-hardening resins, such as epoxy resins, may be used to fix linings.

Compliance is checked by inspection and by manual test.

4.9.2 Insulated linings, sleeves and similar parts shall have adequate mechanical, electrical and thermal strength.

Compliance is checked by inspection, by manual test and by the electric strength test in accordance with Section 10. The thermal properties of wire and sleeve are checked in accordance with Section 12. Heat resistant sleeves used as covering for wires attaining a temperature exceeding the values given in Table 12.2 of Section 12 shall comply with the requirements of IEC 684, taking into account the temperature measured on the wire in question. The sleeve shall be resistant to a temperature exceeding the temperature measured on the wire by 20 °C or withstand the following test:

- a) *Three test specimens of the sleeve, about 15 cm in length, are subjected to the humidity test Clause 9.3 and subsequently to the insulation resistance and electric strength tests according to Section 10. A suitable uninsulated copper conductor or metal rod is passed through the specimens, and the outside is covered by a metal foil in such a way that no flashover at the ends of the samples can occur. The measurement of the insulation resistance and the electric strength test is then made between the copper conductor/metal rod and the metal foil.*
- b) *After the copper conductors/metal rods and metal foils have been removed, the specimens are placed in a heating cabinet for 240 h at a temperature of $T + 20$ °C, T being the measured temperature of the wire.*
- c) *The specimens are allowed to cool to room temperature and are then prepared as indicated under item a) above.*

Measurement of the insulation resistance and electric strength is then made between the copper conductor/metal rod and the metal foil.

Compliance is checked by the insulation resistance values and test voltages specified in 10.1 and 10.2 in Section 10.

4.10 Double and reinforced insulation

4.10.1 For metal encased class II luminaires, contact between mounting surfaces, accessible metal parts and wiring with basic insulation only shall be effectively prevented.

NOTE This requirement does not exclude the use of bare conductors if adequate protection is provided.

This wiring includes internal and external wiring of the luminaire, and fixed wiring of the installation.

Class II fixed luminaires shall be so designed that the required degree of protection against electric shock is not impaired as a result of the installation of the luminaire, for example by contact with metal conduits or metal sheaths of cables.

Capacitors shall not be connected between live parts and the body of metal encased class II luminaires, with the exception of interference suppression capacitors.

The interference suppression capacitors shall comply with the requirements of IEC 384-14 and the method of their connection is under consideration in line with 9.3.4 of IEC 65.

NOTE Contact between accessible metal parts and the basic insulation of internal wiring may be prevented by sleeves or similar parts which comply with the requirements for supplementary insulation.

Compliance is checked by inspection.

4.10.2 Any assembly gap with a width greater than 0,3 mm in supplementary insulation shall not be coincidental with any such gap in basic insulation, nor shall any such gap in reinforced insulation give straight access to live parts.

Openings in double or in reinforced insulation shall not give straight access to live parts, so that the live parts can be touched with the conical pin of test probe 13 shown in Figure 8 of IEC 1032.

In addition, compliance shall be ensured with the required degree of protection against electric shock in accordance with the IP classification of the luminaire.

Compliance is checked by inspection and measurement using the relevant probe(s) in accordance with the required degree of protection against electric shock.

4.10.3 For parts of class II luminaires which serve as supplementary insulation or reinforced insulation:

- either they shall be fixed so that they cannot be removed without being seriously damaged;
- or they shall be unable to be replaced in an incorrect position.

Where sleeving is used as supplementary insulation on internal wiring, and where insulated linings are used in lampholders as supplementary insulation on external or internal wiring, the sleeving and lining shall be retained in position by positive means.

Compliance is checked by inspection and by manual test.

NOTE Lining metal enclosures with a coating of lacquer or with any other material in the form of a coating which can be easily removed by scraping is not considered to meet this requirement. A sleeve is considered to be fixed by positive means if it can only be removed by breaking or cutting or if it is clamped at both ends or its movement on internal wiring is restricted by neighbouring components. A lining is considered to be fixed by positive means if it can only be removed by breaking or cutting or by dismantling the lampholder.

Parts, such as a tube of insulating material provided with a shoulder and used as a liner inside the nipple of a lampholder, are considered to provide supplementary insulation on external or internal wiring if they can be removed only by dismantling the lampholder.

4.11 Electrical connections and current-carrying parts

4.11.1 Electrical connections shall be so designed that contact pressure is not transmitted through insulating material other than ceramic, pure mica or other material with characteristics at least equivalent, unless there is sufficient resilience in the metallic parts to compensate for any possible shrinkage of the insulating material.

Compliance is checked by inspection.

4.11.2 Self-tapping screws shall not be used for the connection of current-carrying parts, unless they clamp these parts directly in contact with each other, and are provided with a suitable means of locking.

Thread-cutting screws shall not be used for the interconnection of current-carrying parts of metal which is soft or liable to creep, such as zinc or aluminium.

Self-tapping screws may be used to provide earth continuity, if it is not necessary to disturb the connection in normal use, and at least two screws are used for each connection.

Compliance is checked by inspection.

NOTE See Figure 22 for some examples of screws.

4.11.3 Screws and rivets which serve as electrical as well as mechanical connections shall be locked against loosening. Spring washers may provide satisfactory locking. For rivets, a non-circular shank or an appropriate notch may be sufficient.

Sealing compound which softens on heating provides satisfactory locking only for screw connections not subject to torsion in normal use.

Compliance is checked by inspection and manual test.

4.11.4 Current-carrying parts shall be of copper, an alloy containing at least 50 % copper, or a material having at least equivalent characteristics.

NOTE Aluminium conductors can be accepted as having at least equivalent characteristics subject to an assessment of suitability being made in each individual case.

This requirement does not apply to screws which do not essentially carry current, such as terminal screws. Current-carrying parts shall be resistant to, or adequately protected against, corrosion.

NOTE Copper and copper alloys containing at least 50 % copper are considered to meet this requirement.

Compliance is checked by inspection and, if necessary, by chemical analysis.

4.11.5 Current-carrying parts shall not be in direct contact with wood.

Compliance is checked by inspection.

4.11.6 Electro-mechanical contact systems shall withstand the electrical stresses occurring in normal use.

Compliance is checked by subjecting the electro-mechanical contact systems to 100 operations at a speed which corresponds to practical usage (an operation is either making or breaking the contact). The test is made with a.c. at rated voltage, and the test current shall be 1,25 times the rated current of the electrical contact system. The power factor of the load shall be approximately 0,6, unless a different rated current is marked for resistive loads, in which case the load power factor shall be unity.

Where a luminaire is marked for both resistive and inductive loads, it shall be subjected to tests at power factors of both unity and 0,6.

Before and after the tests, the electro-mechanical contact systems shall be loaded with 1,5 times rated current, and the voltage drop across each contact shall not exceed 50 mV.

Following completion of these tests the electro-mechanical contact system shall withstand [C] an electric strength test made in accordance with 10.2 [the test voltage however being reduced to 1 500 V]. [C]

After the test the samples shall show:

- no wear impairing their further use;
- no deterioration of enclosures or barriers;
- no loosening of electrical or mechanical connections.

For electro-mechanical contact systems the mechanical test of 4.14.3 is made simultaneously with this electrical test.

4.12 Screws and connections (mechanical) and glands

4.12.1 Screws and mechanical connections, the failure of which might cause the luminaire to become unsafe, shall withstand the mechanical stresses occurring in normal use.

Screws shall not be of a metal which is soft or liable to creep, such as zinc and some grades of aluminium.

Screws which are operated for maintenance purposes shall not be of insulating material if their replacement by a metal screw could impair supplementary or reinforced insulation.

Compliance is checked by inspection and screwed connections shall be tightened and loosened five times. During the test, no damage impairing the further use of the screwed connection shall occur.

The test is made by means of a suitable test screwdriver or spanner, applying a torque as shown in Table 4.1 except that for screws of insulating material used in cord anchorage and bearing directly on the cable or cord the torque is 0,5 Nm.

Table 4.1 — Torque tests on screws

Nominal diameter of screw mm	Torque	
	1 Nm	2 Nm
Up to and including 2,8	0,20	0,4
Over 2,8 up to and including 3,0	0,25	0,5
Over 3,0 up to and including 3,2	0,30	0,6
Over 3,2 up to and including 3,6	0,40	0,8
Over 3,6 up to and including 4,1	0,70	1,2
Over 4,1 up to and including 4,7	0,80	1,8
Over 4,7 up to and including 5,3	0,80	2,0
Over 5,3 up to and including 6,0	—	2,5
Over 6,0 up to and including 8,0	—	8,0
Over 8,0 up to and including 10,0	—	17,0
Over 10,0 up to and including 12,0	—	29,0
Over 12,0 up to and including 14,0	—	48,0
Over 14,0 up to and including 16,0	—	114,0

The shape of the blade of the screwdriver shall suit the head of the screw to be tested. The screws shall not be tightened in jerks. Damage to covers is neglected.

Column 1 of Table 4.1 applies to screws without heads if the screw, when tightened, does not protrude from the hole. Column 2 applies to other screws and to nuts.

The values given in Table 4.1 for screws over 6,0 mm diameter apply to steel screws and the like, which are used mainly in the mounting of the luminaire.

The values given in Table 4.1 for screws over 6,0 mm diameter do not apply to nipple threads of lampholders, the requirements for which are specified in Clause 15 of IEC 238.

4.12.2 Screws transmitting contact pressure, screws which are operated when mounting or connecting the luminaires and having nominal diameter less than 3 mm, shall screw into metal.

Screws or nuts which are operated when mounting the luminaire or replacing lamps include screws or nuts for fixing covers, lids, etc. Connections for screwed conduits, screws for mounting the luminaire to its mounting surface, hand-operated fixing screws or nuts of glass covers and screwed lids are excluded.

Compliance is checked by inspection and for screws which are operated when mounting the luminaire or when replacing the lamps, by the test described in 4.12.1.

4.12.3 Screws or nuts that engage with a thread of insulating material shall have a length engagement of at least 3 mm plus one-third of the nominal screw diameter, except that this length need not exceed 8 mm.

This requirement does not apply to screws of insulating material used in cord anchorage and bearing directly on the cable or cord.

Compliance is checked by inspection, by measurement and by completely removing and replacing the screw or nut 10 times.

The requirements of this subclause do not apply to components complying with their relevant standard.

NOTE Examples of components are push-button switches, lampholders, controlgear, etc.

4.12.4 Screwed and other fixed connections between different parts of luminaires shall be made in such a way that they do not work loose through such torsion, bending stresses, vibration, etc., as may occur in normal use. Fixed arms and suspension tubes shall be securely attached.

NOTE Examples of means of preventing the loosening of connections are soldering, welding, lock nuts and set screws.

Compliance is checked by inspection and by attempting to loosen locked connections with a torque not exceeding:

- 2,5 Nm for thread size up to and including M 10 or corresponding diameters;
- 5,0 Nm for thread sizes above M 10 or corresponding diameters.

For lampholders which are exposed to a rotary action during lamp replacement, compliance shall be checked by inspection and by attempting to loosen locked screwed mechanical connections for 1 min with a torque not exceeding:

- 4,0 Nm for E40 lampholders;
- 2,0 Nm for E26, E27 and B22 lampholders;
- 1,2 Nm for E14 and B15 lampholders (except candle type);
- 0,5 Nm for E14 and B15 candle lampholders;
- 0,5 Nm for E10 lampholders.

For push-button switches, the means of fixing are subjected to a torque not exceeding 0,8 Nm.

During the test, such screwed connections shall not loosen.

4.12.5 Screwed glands shall comply with the following test:

Screwed glands shall be fitted with a cylindrical metal rod having a diameter equal to the nearest whole number of millimetres below the internal diameter of the packing. The glands shall then be tightened by means of a suitable spanner, the force shown in Table 4.2 being applied to the spanner for 1 min at a point 250 mm from the axis of the gland.

Table 4.2 — Torque tests on glands

Diameter of test rod mm	Force	
	Metal glands N	Glands of moulded material N
Up to and including 14	25	15
Over 14 up to and including 20	30	20
Over 20	40	30

After the test, the luminaire and the glands shall show no damage.

4.13 Mechanical strength

4.13.1 Luminaires shall have adequate mechanical strength and be so constructed as to be safe after such rough handling as may be expected in normal use.

Compliance is checked by applying blows to the sample by means of the spring-operated impact test apparatus specified in IEC 68-2-63 or by other suitable means giving equivalent results.

NOTE Equivalent impact energies obtained by different methods do not necessarily give the same test result.

The hammer spring shall be such that the product of the compression, in millimetres, and the force exerted, in newtons, equals 1 000, the compression being approximately 20 mm. The spring shall be adjustable so as to cause the hammer to strike with an impact energy and spring compression as shown in Table 4.3.

Table 4.3 — Impact energy and spring compression

Type of luminaire	Impact energy Nm		Compression mm	
	Fragile parts	Other parts	Fragile parts	Other parts
Recessed luminaires, fixed general purpose luminaires and portable luminaires for wall mounting	0,2	0,35	13	17
Portable floor and table luminaires, photo and film luminaires	0,35	0,50	17	20
Floodlights, road and street lighting luminaires, swimming pool luminaires, portable garden luminaires and child-appealing luminaires	0,5	0,70	20	24
Rough service luminaires, handlamps and lighting chains	Other testing methods			
NOTE Lampholders and other components are retested only in so far they protrude beyond the projection of the outline of the luminaire. The front of the lampholders is never retested since in normal operation this part is covered by the lamp.				
Fragile parts are parts such as glass and translucent covers providing only protection against dust, solid objects and moisture, and ceramic and small parts protruding from the enclosure by less than 26 mm, or if their surface area does not exceed 4 cm².				
Protective shields required on account of 4.24 are regarded as fragile parts.				

Translucent covers, neither providing protection against electric shock and/or UV, nor forming part of the protection against dust, solid objects, moisture and lamps, are not tested.

The sample is mounted or supported as in normal use on a rigid wooden board, cable entries being left open, knockouts opened, and cover-fixing and similar screws tightened with a torque equal to two-thirds of that specified in Table 4.1.

Three blows shall be applied to the point which is likely to be the weakest, paying special attention to insulating material enclosing live parts and to bushings of insulating material, if any. Additional samples may be necessary to find the weakest point; in case of doubt, the test shall be repeated on a fresh sample to which three blows only are applied.

After the test, the sample shall show no damage, in particular:

- 1) *live parts shall not have become accessible;*
- 2) *the effectiveness of insulating linings and barriers shall not have been impaired;*

3) the sample shall continue to afford the degree of protection against ingress of dust, solid objects and moisture, in accordance with its classification;

4) it shall be possible to remove and to replace external covers without these covers or their insulating linings breaking.

Breakage of an enclosure is, however, allowed if its removal does not impair safety.

In case of doubt, supplementary insulation or reinforced insulation is subjected to an electric strength test as specified in Section 10.

Damage to the finish, small dents which do not reduce creepage distances or clearances below the value specified in Section 11, and small chips which do not adversely affect the protection against electric shock, dust or moisture, are neglected.

4.13.2 Metal parts enclosing live parts shall have adequate mechanical strength.

Compliance is checked by the appropriate tests of **4.13.3**, **4.13.4** and **4.13.5**.

4.13.3 A straight unjointed test finger is used, with the same dimensions as the standard test finger specified in IEC 529. The finger is pressed against the surface with a force of 30 N.

During the test, metal parts shall not touch live parts.

After the test, covers shall not be excessively deformed and the luminaire shall continue to meet the requirements of Section 11.

4.13.4 Rough service luminaires

A1) Rough service luminaires shall have protection against ingress of solid objects and moisture of at least IP54.

Rough service luminaires shall not be of class 0 construction.

Compliance is checked by inspection and the appropriate test of **9.2.0**.

Rough service luminaires shall have adequate mechanical strength and shall not overturn under circumstances that may be expected during normal use. In addition the fixation means of the stand to which the luminaire is connected shall have adequate mechanical strength.

Compliance is checked by the tests of a) to d) below.

a) Fixed rough service luminaires and portable rough service luminaires (not hand-held)

Each of three samples of the luminaire shall be subjected to three single impacts, at points likely to be the weakest, on any surface normally exposed. The sample without lamp (or lamps) is mounted as in normal use on a rigid supporting surface.

The impacts are produced by dropping a steel sphere 50 mm diameter weighing 0,51 kg from a height H (1,3 m) as shown in Figure 21, to produce an impact energy of 6,5 Nm.

Each of the three samples of a luminaire intended for outdoor use shall additionally be cooled to a temperature of $5\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and maintained at that temperature for 3 h.

Whilst the samples are at this temperature they shall be subjected to the impact test specified above.

b) Hand-held luminaires

The luminaire is caused to fall four times from a height of 1 m on to a concrete floor. The falls are made from four different horizontal starting positions, the luminaire being turned through 90° around its axis between each fall. Lamps are removed but protective glasses, if any, are not removed for this test.

After the test of **4.13.4a)** or **4.13.4b)** the luminaire shall show no damage impairing safety and its further use. The parts protecting the lamp against damage shall not have loosened.

NOTE These parts may have become deformed. Breakage of a protective glass or translucent cover is ignored if the glass or cover is not the sole means of protecting the lamp against damage.

c) Luminaires delivered with a stand

Any lamp(s) are removed before the tests.

The luminaire and stand shall not overturn at an angle of 6° from the vertical.

The luminaire shall withstand the impacts resulting from overturning four times from an angle up to 15° from the vertical.

The fixation means of the stand shall withstand a force of four times the weight of the luminaire in the most onerous direction.

If the luminaire overturns during the test on the plane inclined at an angle of 15° from the vertical, the test of 12.5.1 is made with the luminaire on a horizontal surface, in the most unfavourable of the overturned positions that may reasonably be expected in practice.

d) Luminaires for temporary installations and suitable for mounting on a stand

The luminaire shall withstand four impacts resulting from the following test.

Any lamp(s) are removed before the test.

The luminaire is suspended by an aluminium rod along a concrete or brick wall. The length of the rod is that of the stand as indicated for a possible stand in the mounting instruction.

The luminaire is lifted until the rod is in the horizontal plane and then allowed to fall freely against the wall.

After the test there shall be no impairing of the safety. 

4.13.5 Not used

4.13.6 Plug-ballast/transformers and mains socket-outlet-mounted luminaires shall have adequate mechanical strength.

Compliance is checked by the following test, which is made in a tumbling barrel as shown in Figure 25.

The barrel is turned at a rate of five revolutions per minute, 10 falls per minute thus taking place.

The sample falls from a height of 50 cm on to a steel plate 3 mm thick, the number of falls being:

- 50 if the mass of the sample does not exceed 250 g;
- 25 if the mass of the sample exceeds 250 g.

After the test, the sample shall show no damage within the meaning of this standard, but it need not be operative and any damage to the glass bulb shall be ignored. Provided that the protection against electric shock is not affected, small pieces which may have broken off the sample are ignored.

Distortion of pins and damage to the finish and small dents which do not reduce the creepage distances or clearances below the values specified in Section 11 are ignored.

4.14 Suspensions and adjusting devices

4.14.1 Mechanical suspensions shall have adequate factors of safety.

Compliance is checked by the appropriate following tests.

Test A, for all suspended luminaires: A constant evenly distributed load equal to four times the weight of the luminaire shall be added to the luminaire in the normal direction of the load for a period of 1 h. There shall be no appreciable deformation of the components of the suspension system at the end of this period. Where alternative means of fixing or suspension are provided, each shall be tested separately.

For adjustable suspension, the load shall be applied with the supporting cable fully extended.

Test B, for rigid suspension luminaires: A torque of 2,5 Nm is applied to the luminaires for a period of 1 min, first in a clockwise and then in an anticlockwise direction. For this test, it shall not be possible to rotate the luminaire relative to the fixed part by more than one revolution in either direction.

Test C, for rigid suspension brackets: Details of the test for rigid suspension brackets are as follows:

- a) *For heavy-duty brackets (for example workshop brackets), a force of 40 N shall be applied for 1 min, in various directions at the free end, with the bracket arm fixed as in normal use. The bending moment resulting from this test shall be not less than 2,5 Nm. When the test force has been removed, the bracket arm shall not be permanently displaced or deformed so as to endanger safety.*
- b) *For light-duty brackets (for example domestic brackets), a similar test to item a) shall be applied for 1 min, but with a force of 10 N, and the bending moment resulting from this test shall be not less than 1,0 Nm.*

Test D, for track-mounted luminaires: The mass of the luminaire shall not exceed the value, recommended by the track manufacturer, of the maximum loading for which the luminaire suspension devices are suitable.

Test E, for clip-mounted luminaires: A pull is applied on the cable without jerk for 1 min in the most unfavourable direction in normal use. During the test the clip is mounted on standard test “shelves” made of ordinary window glass, one with a nominal thickness of 10 mm and one with the maximum thickness onto which the clip can be mounted. For this test the thickness of the test shelf is increased by multiples of 10 mm. The clip shall not start moving on the glass at a pull of 20 N.

Clip-mounted luminaires shall, in addition, be tested on the metal rod having a polished chromium plated finish and a nominal diameter of 20 mm. The luminaire shall not rotate under its own weight and shall not fall off the rod when a pull of 20 N is applied on the cable. The test on a polished metal rod is not applied to luminaires marked “not suitable for mounting on tubular material”.

NOTE 1 The increase in the thickness of the test sheet by 10 mm steps for the maximum thickness, limits the possibility of forcing the clip onto the test shelf.

NOTE 2 The test shelf for a maximum thickness test may comprise layers of glass and wood, provided that the surfaces that are gripped by the clip of the luminaire are of glass.

4.14.2 The mass of the luminaire suspended by flexible cables or cords shall not exceed 5 kg. The total nominal cross-sectional area of the conductors of flexible cables or cords suspending pendants shall be such that the stress in the conductors does not exceed 15 N/mm².

For the calculation of the stress, only the conductors are considered.

Where a luminaire of mass greater than 5 kg is intended to be suspended, the design of the luminaire or of the flexible cable or cord shall be such as to prevent any tension being applied to the conductors.

NOTE This requirement can be met by using a cable which incorporates suitable load-carrying cores.

For the semi-luminaires intended for connection to Edison screw or bayonet lampholders the mass and effective bending moment shall not exceed the maximum value given in Table 4.4. The bending moment is relative to the point of contact, in the fully inserted position, of the semi-luminaire contact(s) with the centre contact of an Edison screw lampholder or the plungers of a bayonet lampholder.

Table 4.4 — Test on semi-luminaires

Lampholders	Luminaires	
	Maximum mass	Maximum bending moment
E14 and B15	1,8 kg	0,9 Nm
E27 and B22	2,0 kg	1,8 Nm

NOTE These values are lower than those to which a lampholder would normally be tested to provide a safety margin.

Compliance is checked by inspection, by measurements and by calculation.

4.14.3 Adjusting devices, for example joints, hoisting devices, adjusting brackets or telescopic tubes, shall be so constructed that cords or cables are not pressed, clamped, damaged or twisted along the longitudinal axis by more than 360° during operation.

NOTE If a luminaire has more than one joint the 360° limit applies to each joint if they are not too close together. Each case needs to be judged on its own merits.

Compliance is checked by the following test:

The adjusting device, equipped with the appropriate cable or cord shall be operated in accordance with Table 4.5. A cycle of operation is a movement from one extreme of the range to the other and back to the starting position. The rate of movement shall not cause the device to heat appreciably and shall not exceed 600 cycles per hour.

For electro-mechanical contact systems this test is conducted simultaneously with the electrical connection test of 4.11.6.

Compliance is checked by inspection.

After the test, not more than 50 % of the strands in a conductor shall be broken nor shall there be any serious damage to the insulation, if any, of the flexible cord. The cord or cable shall be subjected to, and shall satisfy, the insulation resistance and high-voltage tests specified in Section 10.

Ball-joints and the like, where the clamping means can be adjusted, are tested with the joints only lightly clamped to avoid excessive friction. If necessary, the clamping areas are readjusted during the test.

For adjusting devices that consist of a flexible tube the range of adjustment for this test is normally 135° in both directions from the vertical. However where this adjustment cannot be achieved without using unreasonable force the flexible tube is bent only to the positions where it will remain by itself.

Table 4.5 — Test on adjusting devices

Type of luminaire	Number of cycles of operation
Luminaires intended to be frequently adjusted, for example drawing board luminaires	1 500
Luminaires intended to be occasionally adjusted, for example shop window spotlights	150
Luminaires intended to be adjusted during installation only, for example floodlighting luminaires	45

4.14.4 Cords or cables passing through telescopic tubes shall not be fixed to the outer tube. Means shall be provided for avoiding strain on the conductors at the terminals.

Compliance is checked by inspection.

4.14.5 Guide pulleys for flexible cords shall be dimensioned to prevent damage to the cords by excessive bending. Grooves in the pulleys shall be well rounded, the diameter of the pulley at the bottom of the groove being at least three times the diameter of the cord. Accessible metal pulleys shall be earthed.

Compliance is checked by inspection.

4.14.6 Plug-ballast/transformers and mains socket-outlet-mounted luminaires shall not impose undue strain on socket-outlets.

Compliance is checked by the following test. The plug-ballast/transformer or mains socket-outlet-mounted luminaire is inserted, as in normal use, into a fixed socket-outlet pivoted about a horizontal axis through the centre lines of the contact tubes at a distance of 8 mm behind the engagement face of the socket-outlet.

The additional torque which has to be applied to the socket-outlet to maintain the engagement face in the vertical plane shall not exceed 0,25 Nm.

For adjustable mains socket-outlet-mounted luminaires the total torque transmitted to the socket-outlet during adjustment shall not exceed 0,5 Nm.

The socket-outlet used for the test shall have the earth contact (if any) removed unless the socket has shuttered pin receptacles that are uncovered by the action of inserting the earth pin.

4.15 Flammable materials

Covers, shades and similar parts not having an insulation function, and which do not withstand the 650 °C glow-wire test of **13.3.2**, shall be adequately spaced from any heated part of the luminaire which could raise the material to its ignition temperature. These parts made of flammable material shall have suitable fastenings or supporting devices to maintain this spacing.

The spacing from heated parts mentioned above shall be at least 30 mm, unless the material is protected by a screen spaced at least 3 mm from the heated parts. This screen shall comply with the needle-flame test of **13.3.1**, shall have no holes, and shall have a height and a length at least equal to the corresponding dimensions of the heated parts. A screen is not required in cases where the luminaire provides an effective barrier to burning drops.

NOTE The requirements of this clause are illustrated in Figure 4.

Materials which burn fiercely, such as celluloid, shall not be used.

The requirements of this clause do not apply to small parts such as wiring clips and resin-bonded paper parts used inside the luminaire.

Spacing is not required from electronic circuits if under abnormal conditions the operating current does not exceed normal conditions current by more than 10 %.

Spacing is not required from parts of luminaires incorporating a temperature sensing control which provides protection against overheating of the covers, shades or similar parts.

The requirements of this clause do not apply to a transformer supplied within an enclosure of its own, that is IP20 or higher, complying with IEC 742 or IEC 989.

Compliance is checked by inspection, by measurement and by operating the luminaire in the abnormal condition with a slowly and steadily increasing current through the windings of the ballast or transformer, until the temperature sensing control operates. During and after this test, covers, shades and similar parts shall not catch fire and accessible parts shall not become live.

To check whether accessible parts have become live a test in accordance with Annex A is made.

4.15.2 Luminaires made of thermoplastic materials shall withstand temperature rises due to fault conditions in ballasts/transformers and electronic devices, so that no danger occurs when mounted as in normal use.

This requirement shall be met by one of the following measures:

a) Constructive measures ensuring that:

- during failure conditions, the components are kept in place, for example by temperature-independent supports;
- luminaire parts cannot be overheated in such a way that live parts can become accessible.

Compliance is checked by inspection and/or the test of 12.7.1.

b) The use of a temperature sensing control to limit the temperature of the ballast/transformer and electronic device fixation points and exposed parts of the luminaire to a safe value. The temperature sensing control may be either an auto-reset thermal cut-out, a manual-reset thermal cut-out, or a thermal link.

Compliance is checked by the test of 12.7.2.

c) The thermoplastic materials used for the luminaires shall be suitable for the maximum surface temperature permitted by the use of thermally protected ballasts complying with the relevant auxiliary standard.

Compliance shall be checked by the test of 12.7.2.

4.16 Luminaires marked with symbol

For luminaires with an  symbol, the excessive temperatures which may arise due to the failure of a component shall not overheat the mounting surface.

The requirements of this Clause 4.16 are not applicable to a transformer supplied within an enclosure of its own, i.e. IP20 or higher complying with IEC 742 or IEC 989. For shaver transformers or shaver supply units incorporated in a luminaire and complying with IEC 742, the requirements of 4.16.1 apply.

For luminaires incorporating lamp control gear, compliance with this requirement shall be met by spacing the lamp control gear from the mounting surface in accordance with 4.16.1, or by the use of thermal protection in accordance with 4.16.2, or by compliance with 4.16.3.

For luminaires that do not contain lamp control gear, the requirements are met by compliance with Section 12.

4.16.1 The lamp control gear shall be spaced from the mounting surface by a minimum distance of either:

a) 10 mm, including the thickness of the luminaire case material when the spacing includes a minimum of 3 mm air space between the outer surface of the luminaire case and the mounting surface of the luminaire in the region of the lamp control gear, and a minimum of 3 mm air space between the lamp control gear case and the inner surface of the luminaire case. If there is no control gear case, the distance of 10 mm shall apply from the active part, for example windings of the lamp controlgear.

NOTE The luminaire case should be substantially continuous in the projected area of the lamp control gear so that a direct path of at least 35 mm is provided between the active part of the lamp controlgear and the mounting surface; otherwise, the requirement of item b) applies.

or

b) 35 mm.

NOTE The spacing of 35 mm is primarily to take account of stirrup-mounted luminaires where the lamp controlgear to mounting surface distance is often much greater than 10 mm.

In both instances the luminaire shall be so designed that any necessary air space is automatically obtained when it is mounted as in normal use.

Compliance is checked by inspection and by measurements.

4.16.2 The luminaire shall incorporate a temperature sensing control to limit the temperature of the mounting surface of the luminaire to a safe value. This temperature sensing control may be either external to the lamp controlgear or be part of a thermally protected lamp controlgear in accordance with the relevant auxiliary standard.

The temperature sensing control may be either a self-resetting thermal cut-out, a manual reset thermal cut-out or a thermal link (a thermal cut-out which operates only once and then requires replacement).

A temperature sensing control external to the lamp controlgear shall not be of the plug-in type or an otherwise easily replaceable type. It shall be kept in a fixed position with regard to the ballast/transformer.

NOTE Cementing or the like to the ballast/transformer is not permitted.

Compliance is checked by inspection and by the test of 12.6.2.

The requirements of this subclause are deemed to be complied with for luminaires incorporating “class P” thermally protected ballast/transformer(s), marked with the symbol , and temperature declared thermally protected ballast/transformer(s), symbol  with a marked value equal to or below 130 °C, in accordance with the relevant auxiliary standard, without any further tests

Luminaires incorporating ballast/transformer(s) without the symbol for thermally protected ballasts or with a marked value above 130 °C shall comply with the requirements of 4.16.1 or 4.16.3.

4.16.3 If the luminaire does not comply with the spacing requirements of 4.16.1, and does not incorporate thermal cut-outs in accordance with 4.16.2, it shall be so designed that it satisfies the test of 12.6.

NOTE This requirement and its test are based on the assumption that, during failure of the ballast/transformer, for instance owing to short-circuited windings or a short-circuit to the case, the ballast/transformer winding will not exceed 350 °C for a duration of more than 15 min and therefore that the temperature of the mounting surface will not exceed 180 °C for a duration of more than 15 min.

— For an explanation of  marking of luminaires, see Annex N.

4.17 Drain holes

Drip-proof, rain-proof, splash-proof and jet-proof luminaires shall be so designed that if water accumulates in the luminaire it can drain out effectively, for example by opening one or more drain holes. Watertight luminaires shall have no provision for draining.

Compliance is checked by inspection and by the tests of Section 9.

NOTE A drain hole in the back of a luminaire for surface mounting is effective only if the design ensures a clearance of at least 5 mm from the mounting surface, for example, by means of projections from the back.

4.18 Resistance to corrosion

NOTE Since the tests of Clause 4.18 and Annex F may be destructive, they may be carried out on separate samples in accordance with 0.4.2.

4.18.1 Ferrous parts of drip-proof, rain-proof, splash-proof, jet-proof, watertight and pressure-watertight luminaires, the rusting of which might cause the luminaire to become unsafe, shall be adequately protected against rusting.

Compliance is to be checked by the following test:

All grease is removed from the parts to be tested. The parts are then immersed for 10 min in a 10 % solution of ammonium chloride in water at a temperature of 20 °C ± 5 °C. Without drying, but after shaking off any drops, the parts are placed for 10 min in a box containing air saturated with moisture at a temperature of 20 °C ± 5 °C.

After the parts have been dried for 10 min in a heating cabinet at a temperature of 100 °C ± 5 °C, their surfaces shall show no signs of rust.

NOTE Traces of rust on sharp edges and any yellowish film removable by rubbing are ignored.

For small helical springs and the like, and for inaccessible parts exposed to abrasion, a layer of grease may provide sufficient protection against rusting. Such parts are subjected to the test only if there is doubt about the effectiveness of the grease film, and the test is then made without previous removal of the grease.

4.18.2 Contacts and other parts made of rolled copper or copper alloy sheet, the failure of which might cause the luminaire to become unsafe, shall be free from stress corrosion.

Compliance is checked by the test given in Annex F which shall be made on samples not subjected to any other test.

4.18.3 Parts of aluminium or aluminium alloy in drip-proof, rain-proof, splash-proof, jet-proof, watertight and pressure-watertight luminaires, shall be resistant to corrosion, if otherwise the luminaire might become unsafe.

NOTE Guidance on resistance to corrosion is given in Annex L.

4.19 Ignitors

Ignitors used in luminaires shall be electrically compatible with the associated ballast in the luminaire.

Compliance is checked by inspection.

A1 4.20 Rough service luminaires — Vibration requirements

Rough service luminaires shall have adequate resistance to vibrations.

Compliance is checked by the following vibration test.

The luminaire is fastened in its most onerous but normal position of installation to a vibration generator.

The direction of vibration is in the most onerous direction and the severity is:

Duration: 30 min

Amplitude: 0,35 mm

Frequency range: 10 Hz, 55 Hz, 10 Hz

Sweep rate: approximately one octave per minute.

*After the test the luminaire shall have no loosened parts which could impair the safety. **A1***

4.21 Protective shield (tungsten halogen lamps)

4.21.1 Luminaires incorporating tungsten halogen lamps, without an integral outer envelope, shall be fitted with a protective shield except when the lamp is:

- a mains voltage (general lighting source) replacement lamp;¹⁾ or
- a low pressure tungsten halogen lamp as specified in **9.1** of IEC 357.

4.21.2 Parts of the lamp compartment shall so be designed that particles from a shattering lamp cannot impair safety.

4.21.3 All openings in the luminaire shall be such that no parts of a shattered lamp can leave the luminaire by a direct path, including the rear of recessed luminaires.

4.21.4 *Compliance with 4.21.1, 4.21.2 and 4.21.3 is checked by inspection and by the following tests:*

- the protective shield shall comply with the impact test of 4.13.1 with the impact energy of Table 4.3 for fragile parts;*
- parts of the lamp compartment, if of insulating material, shall comply with the resistance to flame and ignition test of 13.3.2.*

4.22 Attachments to lamps

Luminaires shall not incorporate attachments to lamps which might cause overheating or damage to the lamps, lamp caps or holders, luminaires or attachments.

Attachments to fluorescent lamps are only allowed if supplied or approved by the luminaire manufacturer. The total weight of the lamp plus attachment shall not exceed:

- 100 g for lamps with cap G5; and
- 500 g for lamps with cap G13.

Compliance is checked by inspection, by weighing and by thermal measurements if appropriate.

¹⁾ The lamp will be one which conforms to IEC 432-2.