

Luminaires

Part 1. General requirements and tests

The European Standard EN 60598-1 : 1993, together with amendment A1 : 1996 and the corrigendum 1996, has the status of a British Standard

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Cooperating organizations

The European Committee for Electrotechnical Standardization (CENELEC), under whose supervision this European Standard was prepared, comprises the national committees of the following countries:

Austria	Italy
Belgium	Luxembourg
Denmark	Netherlands
Finland	Norway
France	Portugal
Germany	Spain
Greece	Sweden
Iceland	Switzerland
Ireland	United Kingdom

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Summary of pages

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National foreword

This British Standard has been prepared under the direction of the Electrical Illumination Standards Policy Committee and is the English language version of EN 60598-1 : 1993 *Luminaires Part 1 : General requirements and tests*, including amendment A1 : 1996 and the corrigendum : 1996, published by the European Committee for Electrotechnical Standardization (CENELEC). It was derived by CENELEC from IEC Publication 598-1 : 1992, edition 3 and its amendment 1 : 1993 published by the International Electrotechnical Commission (IEC). This British Standard supersedes BS 4533 : Part 101 : 1990 (EN 60598-1 : 1989) *Luminaires Part 101. Specification for general requirements and tests*, which is withdrawn. Certification and marks in respect of in BS 4533 : Part 101 : 1990 are no longer awarded; however, certificates and marks already awarded may continue to apply for production until 1 January 2001.

The CENELEC common modifications have been inserted at the appropriate places in the text and are indicated by a side line in the margin. Parts of the original IEC text that have been modified by CENELEC have been quoted in national annex NA.

Additional information

In BS 4533 : Part 102 and BS EN 60598-2-20 : 1992, where the words 'Publication 598-1' appear, they should be read as 'BS EN 60598-1 : 1993'.

Classification (2.2). Class 0 (defined in 1.2.21) is not permitted in the UK by reason of the Electrical Equipment (Safety) Regulations and the Electricity (Factories Acts) Special Regulations 1908 and 1944.

Wiring regulations. In the UK the reference to 'National Wiring Rules' means BS 7671 : 1992 *Requirements for Electrical Installations*¹⁾, published by the Institution of Electrical Engineers. 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.

Additional marking (3.3). Attention is drawn to Statutory Instrument (SI) No. 310 of 1969 as amended by SI 811 of 1970 and SI 931 of 1977 for luminaires to which flexible cords are attached.

Safety regulations. The European Standard is a harmonized standard in the terms of the Low Voltage Electrical Equipment (Safety) Regulations 1989.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

¹⁾ Available from the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London WQR 0BL.

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-resisting 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, electric terminal, marking

English version

Luminaires

Part 1: General requirements and tests (includes amendment A1 : 1996)

(IEC 598-1 : 1992, modified + amendment 1 : 1993, modified)

Luminaires

Partie 1: Prescriptions générales et essais (inclut l'amendement A1 : 1996)

(CEI 598-1 : 1992, modifiée + amendement 1 : 1993, modifiée)

Leuchten

Teil 1: Allgemeine Anforderungen und Prüfungen (enthält Änderung A1 : 1996)

(IEC 598-1 : 1992, modifiziert + Änderung 1 : 1993, modifiziert)

This European Standard was approved by CENELEC on 1993-03-09, amendment A1 was approved by CENELEC on 1995-03-06. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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

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

CENELEC

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

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Foreword

At the request of the CENELEC Technical Committee TC 34Z, Luminaires and associated equipment, the International Standard IEC 598-1 : 1992 was submitted to the CENELEC members for formal vote.

The text of the reference document, with agreed common modifications prepared by CLC/TC 34Z, was approved by CENELEC as EN 60598-1 on 9 March 1993.

- latest date of publication of an identical national standard (dop) 1993-12-01
- latest date of withdrawal of conflicting national standards (dow) 1996-01-01

The following dates were fixed:

- latest date by which the amendment EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-06-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) —

Annexes designated 'normative' are part of the body of the standard. Annexes designated 'informative' are given for information only. In this standard, annexes ZA and ZB are normative and annex ZC is informative. They replace or modify the corresponding annexes of EN 60598-1 : 1993.

This European Standard supersedes EN 60598-1 : 1989 and HD 77 : 1982. For products which have complied with EN 60598-1 : 1989 + A11 : 1994 before 1996-01-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2001-01-01.

Attention is drawn to the fact that all Parts 2 of EN 60598 relate to the latest edition of Part 1 (see the reference to 'Sliding; latest edition' in the normative annexes ZA to all EN 60598-2 entitled 'Other international publications quoted in this standard with the references of the European publications').

In this European Standard, annexes ZA and ZB are normative and annex ZC is informative.

Foreword to amendment A1

The text of amendment 1 : 1993 to the International Standard IEC 598-1 : 1992, prepared by SC 34D, Luminaires, of IEC TC 34, Lamps and related equipment, together with common modifications prepared by the Technical Committee CENELEC TC 34Z, Luminaires and associated equipment, was submitted to the formal vote and was approved by CENELEC as amendment A1 to EN 60598-1 : 1993 on 1995-03-06.

NOTE. Finland, Norway and Sweden have no obligation to implement this European Standard.

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LUMINAIRES

Part 1: General requirements and tests

SECTION 0: GENERAL INTRODUCTION

0.1 Scope and object

This part 1 of International Standard IEC 598 specifies general requirements for the classification and marking of luminaires and for their mechanical and electrical construction, together with related tests. The part is applicable to luminaires for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 1 000 V. Additional sections will be added when a need for them is recognized.

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.

For "luminaire design information", IEC 630 and the appropriate standards for different lamps concerning maximum lamp outlines and other relevant data should be consulted. Checking of compliance with the maximum lamp outline conditions is not part of the type approval test 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.*

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

IEC 68-2-63: 1991, *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: 1983, *Starters for tubular fluorescent lamps. Amendments No. 1 (1987) and 2 (1991).*

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

IEC 238: 1991, *Edison screw lampholders.*

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

IEC 249: *Base materials for printed circuits.*

IEC 320: 1981, *Appliance couplers for household and similar general purposes. Amendment 3 (1987).*

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



- IEC 360: 1987, *Standard method of measurement of lamp cap temperature rise.*
- IEC 364-3: 1977, *Electrical installations of buildings - Part 3: Assessment of general characteristics.* Amendment 1 (1980).
- IEC 400: 1991, *Lampholders for tubular fluorescent lamps and starterholders.*
- 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.*
- IEC 432-2: 199X, *Tungsten halogen lamps for domestic and similar lighting purposes. Part 2: Safety specification for incandescent lamps.*
- IEC 529: 1989, *Degrees of protection provided by enclosures (IP Code).*
- IEC 570: 1985, *Electrical supply track systems for luminaires.* Amendment 1 (1990).
- IEC 598-2: *Luminaires - Part 2: Particular requirements.*
- IEC 598-2-4: 1979, *Portable general purpose luminaires.* Amendment 3 (1990).
- IEC 630: 1979, *Maximum lamp outlines for general lighting lamps.*
- IEC 634: 1978, *Heat test source (H.T.S.) lamps for carrying out heating tests on luminaires.* Amendment 1 (1983).
- IEC 662: 1980, *High pressure sodium vapour lamps.* Amendment 2 (1987) and Amendment 3 (1990).
- IEC 664-1: 1992, *Insulation co-ordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests.*
- IEC 684: *Specification for flexible insulating sleeving.*
- IEC 695-2-1: 1980, *Fire hazard testing - Glow-wire test and guidance.*
- IEC 695-2-2: 1991, *Fire hazard testing - Needle-flame test.*
- IEC 750: 1983, *Item designation in electrotechnology.*
- IEC 901: 1987, *Single-capped fluorescent lamps - Safety and performance requirements.*
- IEC 922: 1989, *Ballasts for discharge lamps (excluding tubular fluorescent lamps). Performance requirements.*
- IEC 924: 1990, *D.C. supplied electronic ballasts for tubular fluorescent lamps - General and safety requirements.*
- IEC 972: 1989, *Classification and interpretation of new lighting products.*
- IEC 1032: 1990, *Test probes to verify protection by enclosures.*
- IEC 1058-1: 1990, *Switches for appliances - Part 1: General requirements.*
- ISO 75: 1987, *Plastics and ebonite - Determination of temperature deflection under load.*
- 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 that have been shown to comply with the requirements of the relevant IEC standard for those components shall be tested only to the requirements of this luminaire standard which are not covered by the component standard.

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.

0.6 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 and the like.

List of sections of part 2 (continued)

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 the like.
19. Air-handling luminaires (safety requirements).
20. Lighting chains.
21. Not used at present.
22. Luminaires for emergency lighting.

SECTION 1: DEFINITIONS

1.1 General

This section gives general definitions applicable to luminaires for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 1 000 V. It is to be read in conjunction with section 0 and with the other relevant sections to which reference is made.

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.

NOTES

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

NOTES

- 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.
- 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.
- 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.

NOTES

- 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 envelopes 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.

NOTES (*continued*)

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.

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 stripes on lamps are not regarded as accessible metal parts unless the tests of annex A show them to be live parts.

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.

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, single 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.

1.2.29 *Independent ballast*

A ballast 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 of the ballast and without any additional enclosure.

1.2.30 Built-in ballast

A ballast generally designed to be built into a luminaire and not intended to be mounted outside a luminaire without special precautions.

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.

NOTES

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

NOTES

1 The d.c. value is under consideration.

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 sections 14 and 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.)

1.2.49 *Through wiring*

Wiring which passes through the luminaire but without electrical connection to the luminaire.

NOTE - Some countries do not permit joints in through wiring.

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.

1.2.54 *Rough service luminaire*

A luminaire designed for arduous service.

NOTE - Such luminaires are:

- luminaires for use in rough environmental situations, for example, heavy engineering workshops;
- luminaires for use on building sites and similar locations.

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.

NOTES

1 Extra low voltage d.c. supplied fluorescent luminaires may generate internal voltages higher than the supply voltage and thus might not be class III. A possible electric shock hazard should therefore be taken into account and guarded against with such luminaires.

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.

NOTES

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

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.

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

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.

NOTES

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

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

3 A lampholder is required for a supply connection.

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.

SECTION 2: CLASSIFICATION OF LUMINAIRES**2.1 General**

This section describes the classification of luminaires for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 1 000 V. It is to be read in conjunction with section 0 and with the other relevant sections to which reference is made.

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.

NOTES

- 1 Luminaires classified as watertight are not necessarily suitable for operation under water; pressure watertight luminaires should be used for such applications.
- 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 primarily intended for direct mounting on normally flammable surfaces or are suitable only for mounting on non-combustible surfaces as follows:

<i>Classification</i>	<i>Symbol</i>
– Luminaires suitable for direct mounting on non-combustible surfaces only.	No symbol, but warning notice may be required - see section 3.
– Luminaires suitable for direct mounting on normally flammable surfaces.	Symbol - see figure 1, page 203

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.

SECTION 3: MARKING

3.1 General

This section specifies the information to be marked on luminaires for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 1 000 V. It is to be read in conjunction with section 0 and with the other relevant sections to which reference is made.

3.2 Marking on luminaires

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

- a) 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.
- b) 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.
- c) 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.

1

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

Table 3.1

Markings belonging to a)	Markings belonging to b)	Markings belonging to c)
3.2.8* Rated wattage 3.2.10 Special lamps 3.2.11 Cool beam 3.2.15 Bowl mirror 3.2.16 Protective shield 3.2.18 Ignition warning	3.2.1 - 3.2.2** 3.2.4 - 3.2.5 3.2.7 Type reference 3.2.9 Symbol  3.2.12 Termination	3.2.3 Ambient temperature 3.2.6 IP number 3.2.13 Lighted objects 3.2.14 Rough service
* 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". ** 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.		

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  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.

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.

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 Symbol (see figure 1) if applicable, for luminaires suitable for direct mounting on normally flammable surfaces.

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 spotlights and the like.

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"

3.2.17 The maximum number of luminaires that may be interconnected 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. The symbol to indicate this requirement is given in figure 1.

3.3.4 A warning notice that the luminaire is not suitable for mounting on a normally flammable surface.

NOTE - A warning notice is not required when it is obvious that luminaire will never be mounted on normally flammable surfaces, for example portable luminaires for garden use.

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 A recommendation that class II luminaires should be installed so that any exposed metal work is not in electrical contact with any part of the electrical installation connected to a protective conductor.

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 $\frac{3(1)}{250}$

NOTES

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

3.4 Test of marking

Compliance with the requirements of clauses 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

This section specifies general constructional requirements for luminaires for use with tungsten filament, tubular fluorescent and other discharge lamps on supply voltages not exceeding 1 000 V. It is to be read in conjunction with section 0 and with the other relevant sections to which reference is made. See also annex L.

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 to 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 in 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 lampholders which are part of the pulse voltage circuit shall not be greater than:

- 5 000 V for 750 V rated ES lampholders
- 3 500 V for 500 V rated ES lampholders
- 2 500 V for all 250 V rated lampholders
- $4,6 \times U_R$ V for other lampholders of rated voltage U_R

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 to 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 x 20 mm x 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, 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, becoming live by reason of a detached wire or screw. This requirement applies to all terminals (including supply terminals) for wires that may be subjected to stress during normal use.

Compliance is checked by inspection.

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.

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.

NOTES

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.

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.

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 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 sections 14 and 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 table 10.1 and 10.2 in section 10.

4.10 Double and reinforced insulation

4.10.1 For class II luminaires contact between accessible metal parts and wiring with basic insulation only shall be effectively prevented. This wiring includes the internal and external wiring of the luminaire and the 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 luminaires, for example by contact with conduits or metal sheaths of cables. Capacitors shall not be connected between live parts and the body of class II luminaires.

NOTE - Contact between accessible metal parts and 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.

Compliance is checked by inspection and measurement.

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.