
British Standard

Luminaires

Part 101. Specification for general requirements and tests

Luminaires

Partie 101. Règles générales et généralités sur les essais

Leuchten

Teil 101. Allgemeine Anforderungen und Prüfungen

This European Standard EN 60 598-1 : 1989 has the status of a British Standard

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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 60 598-1 'Luminaires Part 1 : General requirements and tests', published by the European Committee for Electrotechnical Standardization (CENELEC). It was derived by that organization from IEC Publication 598-1 (1986) edition 2 and Amendment No 1 (1988) which has a similar title as that of the European Standard. This British Standard supersedes BS 4533 : Part 101 : 1987 'Luminaires Part 101 : Specification for general requirements and tests', which is withdrawn.

The CENELEC Common Modifications have been inserted at the appropriate places in the text of IEC Publication 598-1 (1986) edition 2 into which Amendment No 1 (1988) has been incorporated and are indicated by a side line in the margin. The relevant parts of the original IEC text have been quoted in National appendix NA. Annexes designated 'normative' are part of the body of the standard. Annexes designated 'informative' are given only for information. National appendices are designated 'informative'.

Cross-references. Details of other international publications quoted in this standard are given in annex ZA. Where there are British Standards either identical or technically equivalent to these international standards the relationship is given in national appendix NB.

Additional information

Wherever the expression 'Part 1' appears, referring to this standard, it should be read as 'Part 101'. Wherever the expression 'Part 2' appears, referring to IEC 598-2, it should be read as 'BS 4533 : Part 102'.

Classifications (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 the 'Regulations for Electrical Installations'*, published by the Institution of Electrical Engineers. The installation of a luminaire has to comply with 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.

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. This 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.



Amendment No. 1
published and effective from 15 August 1995
to BS 4533 : Part 101 : 1990

Luminaires
Part 101. Specification for general requirements and tests

NOTE. The English language version of European Standard EN 60598-1 : 1989 was implemented in the United Kingdom by the publication of BS 4533 : Part 101 : 1990. This amendment implements amendment A11 to EN 60598-1 : 1989.

This amendment together with the European Standard EN 60598-1 : 1989 has the status of a British Standard.

Revised text

National foreword

In paragraph 1, line 2, after 'tests', insert 'including amendment A11'.

AMD 8805/August 1995

EN amendment title page and and foreword

After the EN title page, insert the attached EN amendment title page (foreword on reverse).

AMD 8805/August 1995

Text of EN 60598-1

Amend the text of European Standard EN 60598-1 in accordance with the details given on the attached page.

AMD 8805/August 1995

UDC 621.327/328.620.1

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

Amendment A11 to the English version of EN 60598-1

Luminaires Part 1: General requirements and tests

Luminaires

Première partie: Règles générales et
généralités sur les essais

Leuchten

Teil 1: Allgemeine Anforderungen und Prüfungen

This amendment A11 modifies the European Standard EN 60598-1:1989. It was approved by CENELEC on 1994-02-14. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment 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 amendment 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

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

Foreword

At the request of the Danish electrotechnical committee, a draft for an amendment to EN 60598-1 : 1989 was submitted to the CENELEC members for acceptance in December 1993.

The text of the draft was accepted by CENELEC as amendment A11 to EN 60598-1 : 1989 on 1994-02-14.

The following dates were fixed:

- latest date of announcement
of the amendment at national
level (doa) 1994-05-14
- latest date of publication of
an identical national standard (dop) 1994-08-14

Text of amendment A11

In annex ZC, delete the A-deviations for Denmark regarding subclause 12.4.2 (item c) and table XI.

UDC: 621.327/.328 : 620.1

Key words: General requirements; luminaire; rated voltage; extra-low-voltage; nominal current; rated voltage; 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; electrical 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

(IEC 598-1 (1986) ed 2 + Amdt 1 (1988), modified)

Luminaires

Première partie: Règles générales
et généralités sur les essais
(IEC 598-1 (1986) ed 2 +
Amdt 1 (1988), modifiée)

Leuchten

Teil 1: Allgemeine Anforderungen
und Prüfungen
(CEI 598-1 (1986) ed 2 +
Amdt 1 (1988), modifiziert)

This European Standard was ratified by CENELEC on 13 September 1988. CENELEC members are bound to comply with the requirements of the 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 CENELEC Central Secretariat or to any CENELEC member.

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

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CENELEC

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

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Brief history

The CENELEC Questionnaire Procedure performed for finding out whether or not IEC 598-1 (1986) edition 2 could be accepted without textual changes, has shown that common modifications were necessary for the acceptance as European Standard (EN). The Reference Document modified by common modifications was submitted to the CENELEC members for formal vote and acceptance by CENELEC.

Technical text

The text of the International Standard IEC 598-1 (second edition (1986)), with agreed common modifications, was approved by CENELEC on 13 September 1988 as a European Standard.

The following dates are applicable:

- latest date of announcement of the EN at national level: (doa) 1989-04-01
- date of latest publication of a new harmonized standard: (dop) 1989-10-01

This European Standard supersedes EN 60 598-1, issued April 1988, which is withdrawn. No date of withdrawal of conflicting national standards (dow) has been fixed because a national standard covering "general requirements for luminaires" may be required for use in conjunction with either:

- national standards based on Parts 2 in the IEC 598 series which are not yet harmonized within CENELEC (i.e. IEC Publication 598-2-20 or 598-2-22);
- national standards not based on Parts 2 of IEC Publication but which are published in the same format.

Attention is drawn to the fact that all Parts 2 to EN 60 598 relate to the latest edition of the Part 1 (see the reference to "Sliding; latest edition" in Normative annexes ZA to all EN 60 598-2 entitled "Other international publications quoted in this standard"). In this EN, annexes ZA and ZB are normative and annex ZC is informative.

This reprint of EN 60 598-1 (October 1989) incorporates Amendment No. 1 (1988) to IEC 598-1. It includes the new necessary common modifications and excludes those no longer required. The text of the special national conditions (snc) and of the deviations has not been changed.

This text supersedes EN 60 598-1 (January 1989).

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LUMINAIRES

Part 1: General requirements and tests

SECTION ZERO — GENERAL INTRODUCTION

0.1 Scope

The sections of Part 1 of this standard specify general requirements for the classification and marking of luminaires and for their mechanical and electrical construction, together with related tests. The standard 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, as and when a need for them is recognized.

Each section of IEC Publication 598-2: Luminaires, Part 2: Particular Requirements, 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 standard 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 standard.

Requirements are included in Part 1 for luminaires incorporating ignitors with nominal peak values of the voltage pulse not exceeding 5 kV. 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.

0.2 Object

In general, this standard covers safety requirements for luminaires. The object of 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 Publication 598-2. Part 1 is thus not to be regarded as a specification by 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, therefore, 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 . . . Publication 598-1 apply", this phrase is to be interpreted as meaning that all the requirements of that section of Part 1 apply except any which are clearly inapplicable to the particular type of luminaire covered by that section of Part 2.

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, the appropriate sections.

The appropriate standard for lamps should be consulted for luminaire design information, maximum lamp outlines and other relevant data.

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.

0.4 General test requirements

0.4.1 Tests according to this standard are type tests. For the definition of a "type test", see Section One of this Part 1.

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.

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 withstand 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 luminaire manufacturer shall provide, together with the luminaire, a sample of the appropriate track, connector and adaptators 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.

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

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 components 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 only be tested to those requirements of this luminaire standard which are not covered by the component standard.

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 use in gardens and the like.
8. Hand lamps.
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 ONE — DEFINITIONS

1.1 Scope

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 Zero 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.

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.

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 without special protection against dust or moisture.

1.2.4 *General purpose luminaire*

A luminaire which is not designed for a special purpose. 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, 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 this standard.

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.

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. 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.

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

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 upon 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.

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.
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 Appendix B 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

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.

Symbol: t_a .

Note. — This does not preclude temporary operation at a temperature not exceeding $(t_a + 10)^\circ\text{C}$.

1.2.26 Rated maximum operating temperature (of the case of a ballast, capacitor or starting device).

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.

Symbol: t_c .

1.2.27 Rated maximum operating temperature (of a winding)

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

Symbol: t_w .

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 pre-heating 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 Sub-clause 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 specification.

1.2.44(a) Type test sample

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

1.2.45 By hand

Not requiring the use of a tool, coin or other object.

1.2.46 *Terminal*

That part of a luminaire or component which is necessary to make electrical connection to a conductor. See Sections Fourteen and Fifteen.

1.2.47 *Luminaire track system*

A system, including a track with conductors, for the connection of luminaires to an electrical supply in a range of different positions determined only by the length and location of the track and comprising some or all of the components defined in Sub-clauses 1.2.48 to 1.2.53.

1.2.48 *Track*

A generally linear assembly of conductors within a housing, providing for the mechanical support and electrical connection of luminaires.

Note. — Luminaires may be positioned or repositioned along the length in a simple manner (that is, without the use of tools).

1.2.49 *Coupler*

A component enabling electrical or mechanical connection to be made between tracks.

1.2.50 *Connector*

A component used for the connection of a mains supply to the track or for the electrical connection of a luminaire to the track.

Note. — The functions of a coupler and a connector may be combined. A connector does not provide mechanical connection of a luminaire to the track.

1.2.51 *Adaptor*

A component used for the electrical and mechanical connection of a luminaire to the track.

Note. — An adaptor may incorporate a switch or a fuse.

1.2.52 *Track suspension device*

A component used for the mechanical connection of the track system to the supporting surface.

1.2.53 *Luminaire suspension device*

A component used for the mechanical connection of a luminaire to the track.

1.2.54 *Normal arm's reach*

2.5 m upwards and 1.25 m sideways and downwards from the floor.

Note. — National wiring rules may require different values, and may allow exceptions for special locations.

1.2.55 *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. A supply conductor may be cut to facilitate connections to a terminal (see Figure 20, page 186).

1.2.56 *Through wiring*

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

Note. — Some countries do not permit joints in through wiring.

1.2.57 *Starting devices*

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.

1.2.58 *Starter*

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

1.2.59 *Ignitor*

A starting device that generates voltage pulses to start a discharge lamp and that does not provide for pre-heating of electrodes.

1.2.60 *Terminal block*

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

1.2.61 *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.

1.2.62 *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.

1.2.63 *Low voltage transistorized 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. — Low voltage transistorized 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.

1.2.64 *Mounting surface*

That 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.

1.2.65 *Integral component*

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

SECTION TWO — CLASSIFICATION OF LUMINAIRES

2.1 Scope

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 Zero 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 surfaces.

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 One. 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 an arm from the transformer compartment.

Track-mounted luminaires shall be classified as Class I or Class II.

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 explained in IEC Publication 529: Classification of Degrees of Protection Provided by Enclosures.

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

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

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 only suitable for mounting on non-combustible surfaces as follows:

<i>Classification</i>	<i>Symbol</i>
Luminaires suitable for direct mounting only on non-combustible surfaces	No symbol, but warning notice required—See Section Three.
Luminaires without built-in inductive ballasts or transformers suitable for direct mounting on normally flammable surfaces.	No symbol.
Luminaires with built-in inductive ballasts or transformers suitable for direct mounting on normally flammable surfaces.	Symbol—See Figure 1, page 167.

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 Four and related tests in Section Twelve.

SECTION THREE — MARKING

3.1 Scope

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 Zero and with the other relevant sections to which reference is made.

3.2 Marking, luminaires

The following information shall be distinctly and durably marked on the luminaire in a position where it can be seen during maintenance, if necessary after the removal of covers or similar components. Such information shall not be marked on screws, or on parts likely to be removed when the luminaire is being connected. The information specified in Sub-clauses 3.2.2 and 3.2.8 may be marked on built-in ballasts, where these are provided, instead of on the luminaire itself.

The earthing symbol referred to in Sub-clause 3.2.12 may be marked on the ballast, instead of the luminaire, if the ballast is a non-replaceable type. Details of symbols are shown in Figure 1, page 167. The height of graphical symbols shall be not less than 5 mm, and for letters and numerals, not 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, 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 Publication 598-2.

3.2.4 Symbol for Class II luminaire 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.

3.2.5 Symbol for Class III luminaire 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 Appendix A). Where X is used in an IP number in Figure 1, it indicates a missing numeral in the example, but both the appropriate numerals shall be marked on 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 of the lamp(s) in watts. 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 is not required if luminaires for tungsten filament lamps having E14 or B15 lampholders comply with all the tests when fitted with lamps of 60 W.

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

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

- 3.2.9 Symbol (see Figure 1, page 167), if applicable, for luminaires with built-in ballasts or transformers, 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 Publication 662.

- 3.2.11 Symbol (see Figure 1), if applicable, for luminaires for lamps or 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 Publication 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.

Low voltage transistorized 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 spot lights and the like. The minimum distance marked shall be determined by the temperature test described in Sub-clause 12.4.1 item j).

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 supplied with the luminaire.

3.2.14 Symbol (see Figure 1, page 167), 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 safety shield shall be marked as follows:

“Replace any cracked safety shield”

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:

- 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.
- 2) Nominal frequency in hertz.
- 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.
- 4) A warning notice that the luminaire is not suitable for mounting on a normally flammable surface.
- 5) A wiring diagram, except where the luminaire is suitable for direct connection to the mains supply.
- 6) Special conditions for which the luminaire, including the ballast, is suitable; for instance, whether or not the luminaire is intended for looping-in.
- 7) A recommendation that Class II luminaires shall 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.

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 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 resistive load.

The marking shall 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 Publication 328 and CEE Publication 24: Switches for Appliances.

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

3.4 Test for marking

The durability of the marking shall be 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 hexane, and by inspection after the tests detailed in Section Twelve have been completed. After the test, the marking shall be legible, marking labels shall not be easily removable and they shall show no curling.

SECTION FOUR — CONSTRUCTION

4.1 Scope

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 Zero and with the other relevant sections to which reference is made. See also Appendix H.

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.

Scaled-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 shall be 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 lampholder and lamp in position fully assembled, as for normal use. In addition, integral lampholders shall, when mounted in the luminaire, comply with the "safety during insertion of the lamp" requirements of the appropriate lampholder standard.

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

4.4.3 Luminaires for double-ended 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 double-ended lamps, the changing of any one lamp shall not impair the security of the other lamps.

Compliance shall be 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 Publication 61 or (if IEC Publication 61 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 shall be checked by inspection, measuring and, if applicable, by the following mechanical test:

Lampholders for a fluorescent lamp, with a test-cap in position, shall be subjected, for one minute, to a pressure applied to the centre of the cap in the direction of its axis of:

15N for G5 lampholders

30N for G13 lampholders

Value under consideration for other lampholders.

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

— 7006-47C for lampholder G5

— 7006-60C for lampholders G13

Test-caps for other lampholders are 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 for all 250 V rated lampholders

4.6 U_R for other lampholders of rated voltage U_R

Compliance shall be checked by measurement of the voltage occurring across the lampholder during the test to Sub-clause 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.
- 4.4.7 The insulating parts of lampholders and plugs incorporated in rough service luminaires shall be of a material resistant to tracking.

4.5 Starter holders

Starter holders in luminaires other than Class II shall accept starters which comply with IEC Publication 155: Starters for Fluorescent Lamps.

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 Publication 155: Starters for Tubular Fluorescent Lamps.

4.6 Terminal blocks

- 4.6.1 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.

Test: Compliance shall be 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, page 170, 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.

- 4.6.2 Unsecured terminal blocks are permitted when they are so designed and insulated that creepage distances and clearances in accordance with Section Eleven 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, Class I and Class II and in fixed luminaires of Class 0, Class I and Class 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. The requirement may be met by securing the wires adjacent to their entry to the terminals, by suitably dimensioning 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.

Compliance shall be checked by inspection.

- 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 replacement of lamps or starters.

Test: Compliance shall be checked, for luminaires intended to be connected to the supply by means other than a non-detachable flexible cable or cord, by inspection, and for luminaires intended to be connected to the supply by means of a non-detachable flexible cable or cord, 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 Five. One wire of the stranded conductor is left free and the remainder is 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 is 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 Five.

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.

For luminaires designed to be connected by means of 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 the earth connection.

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 Sections Fourteen or Fifteen.

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.

- 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.

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 switch-lampholders shall not be used in luminaires other than ordinary, unless the degree of protection against ingress of 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 shall be 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.

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

Test: Compliance shall be checked by inspection and by manual test.

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

Test: Compliance shall be checked by inspection, by manual test and by an electric strength test in accordance with Section Ten.

4.10 Insulation of Class II luminaires

- 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 internal and external wiring of the luminaire and fixed wiring of the installation. The sheath of a flexible cable or cord is not supplementary insulation if it is subject to undue mechanical or thermal stress. 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.

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 shall be checked by inspection.

- 4.10.2 Assembly joints in basic insulation and in supplementary insulation shall not be coincidental, neither shall any assembly joint in reinforced insulation give straight access to live parts.

Compliance shall be checked by inspection.

- 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 shall be 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 shall be 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 shall be checked by inspection.

Note. — See Figure 22 for some examples of self-tapping, thread-cutting and thread-forming 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 shall be 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.

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 shall be checked by inspection and, if necessary, by chemical analysis.

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

Compliance shall be checked by inspection.

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

Test: The electro-mechanical contact systems shall be operated 100 times 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 an electric strength test made in accordance with Clause 10.2 (the test voltage however being reduced to 1500 V).

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 Sub-clause 4.14.3 shall be 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.

Test: Compliance shall be 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 I, except that for screws of insulating material used in cord anchorages and bearing directly on the cable or cord the torque is 0.5 Nm.

TABLE I
Torque tests on screws

Nominal diameter of screw (mm)	Torque	
	1 (Nm)	2 (Nm)
Up to and including 2.8	0.2	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 I 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 I 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 I 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 Publication 298.

- 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.

Test: Compliance shall be checked by inspection and for screws which are operated when mounting the luminaire or when replacing the lamps, by the test described in Sub-clause 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 anchorages and bearing directly on the cable or cord.

Test: Compliance shall be checked by inspection, by measurement and by completely removing and replacing the screw or nut, ten times.

- 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.

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

- 2.5 Nm for thread sizes 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 one minute 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
- 0.5 Nm for E10 lampholders

During the test, such screwed connections shall not loosen.

- 4.12.5 Screwed glands shall comply with the following test.

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 II being applied to the spanner for 1 min at a point 250 mm from the axis of the gland.

TABLE II
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.

Test: Blows shall be applied to the sample by means of the spring-operated impact test apparatus specified in IEC Publication 817 or by some other suitable means giving equivalent results.

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

The apparatus consists of three main parts, the body, the striking element and the spring-loaded release cone.

The body comprises the housing, the striking element guide, the release mechanism and all parts rigidly fixed thereto. The mass of this assembly shall be 1.25 ± 0.01 kg.

The striking element comprises the hammer head, the hammer shaft and the cocking knob. The mass of this assembly shall be 0.250 ± 0.001 kg.

The hammer head shall have a hemispherical face of polyamide having a Rockwell hardness of R100, with a radius of 10 mm; it shall be fixed to the hammer shaft in such a way that the distance from its tip to the plane of the front of the cone when the striking element is on the point of release is equal to the value shown for the compression in Table III.

The cone shall have a mass of 0.06 kg and the cone spring shall be such that it exerts a force of 20 N when the release jaws are on the point of releasing the striking element.

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 III.

TABLE III
Impact energy and spring compression

Part to be tested	Impact energy (Nm)	Compression (mm)
Class II luminaires:		
Translucent covers forming part of the protection against dust and moisture, but not providing protection against electric shock	0.35	17
Ceramic lampholders	0.20	13
Ceramic covers providing protection against electric shock	0.35	17
Other translucent covers providing protection against electric shock	0.50	20
Other parts	0.70	24
Other luminaires:		
Translucent covers forming part of the protection against dust and moisture, but not providing protection against electric shock, parts of ceramic material and parts of ceramic lamp-holders integral with the luminaire	0.20	13
Translucent covers providing protection against electric shock and other parts, with the exception of parts of ceramic material	0.35	17
Translucent covers neither providing protection against electric shock nor forming part of the protection against dust and moisture are not subjected to the test.		
Fixed rough service luminaires	(See the test of Sub-clause 4.13.3)	
Portable rough service luminaires (hand-held)	(See the test of Sub-clause 4.13.4)	

The release mechanism springs shall be adjusted so that they exert just sufficient pressure to keep the release jaws in the engaged position.

The apparatus is cocked by pulling the cocking knob back until the release jaws engage with the groove in the hammer shaft.

The blows shall be applied by pushing the release cone against the sample in a direction perpendicular to the surface at the point to be tested.

The pressure shall be slowly increased so that the cone moves back until it is in contact with the release bars, which then move to operate the release mechanism and allow the hammer to strike.

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 I.

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.

If a translucent cover of a Class II luminaire that forms part of the protection against electric shock fails the impact energy test at 0.50 Nm, a further three samples shall be subjected to an impact energy test at 0.50 Nm and two of these samples shall pass the second test.

Damage to the finish, small dents which do not reduce creepage distances or clearances below the value specified in Section Eleven, 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 shall be checked by the following test:

Test: A straight unjointed test finger is used, with the same dimensions as the standard test finger specified in IEC Publication 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 Eleven.

4.13.3 *Test. 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, to 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) to produce an impact energy of 6.5 Nm, as shown in Figure 21, page 186.

Each of the three samples of a luminaire intended for outside use shall additionally be cooled to a temperature of -5 ± 2 °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.

4.13.4 *Test. Portable rough service luminaires (hand-held)*

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 Sub-clauses 4.13.3 or 4.13.4 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 neglected if the glass or cover is not the sole means of protecting the lamp against damage.

In addition, the compliance requirements of Sub-clauses 4.13.1 and 4.13.2 apply

4.14 Suspensions and adjusting devices

4.14.1 Mechanical suspensions shall have adequate factors of safety. Compliance shall be checked by the appropriate following tests.

Test: 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: 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: For rigid suspension brackets. Details of the test for rigid suspension brackets are as follows:

- 1) 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.
- 2) For light-duty brackets (for example domestic brackets), a similar test to Item 1) 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: 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.

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.

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 by more than 360° during operation.

Test: The adjusting device, equipped with the appropriate cable or cord shall be operated in accordance with the details of Table IV. 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 Sub-clause 4.11.6.

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. Compliance shall be checked by inspection. The cord or cable shall also be subjected to and shall satisfy the insulation resistance and high-voltage tests specified in Section Ten.

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 IV
Tests on adjusting devices

Type of luminaire	Number of cycles of operation
Luminaires intended to be frequently adjusted, for example drawing board luminaires	1500
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 shall be 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 shall be checked by inspection.

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 Sub-clause 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 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 Sub-clause 13.3.1, shall have no holes and shall have a height and length at least equal to the corresponding dimensions of the heated parts. A screen is not required in those 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 %.

Compliance shall be checked by inspection and by measurement.

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.

Compliance shall be checked 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 Appendix B is made.

4.16 Luminaires marked with symbol

4.16.1 Not used.

4.16.2 For luminaires with an symbol, the excessive ballast/transformer temperatures which may arise due to ballast/transformer failure shall not cause a fire hazard.

This requirement shall be met by spacing the ballast/transformer from the mounting surface in accordance with Sub-clause 4.16.2.1, by the use of thermal cut-outs in accordance with Sub-clause 4.16.2.2, or by compliance with Sub-clause 4.16.2.3.

4.16.2.1 The ballast/transformer case shall be spaced from the mounting surface by a distance, including the thickness of the luminaire case material, of either:

- a) 35 mm, or
- b) 10 mm, when the spacing shall include 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 ballast/transformer, and a minimum of 3 mm air space between the ballast/transformer case and the inner surface of the luminaire case.

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

Compliance shall be checked by inspection and by measurement.

Note. — The spacing of 35 mm in Item a) is primarily to take account of stirrup-mounted luminaires where the ballast/transformer case to mounting surface distance is often very much greater than 10 mm.

- 4.16.2.2 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 ballast/transformer or be part of a thermally protected ballast in accordance with Appendix F of IEC Publication 82. Temperature-sensing controls shall not be of the plug-in type or otherwise easily replaceable type.

Temperature-sensing controls external to the ballast/transformer shall be kept in a fixed position with regard to the ballast/transformer.

Note. — The use of cement or the like as a means of attaching the temperature-sensing control to the ballast is not permitted.

Compliance shall be checked by inspection and by the test Clause 12.6 of Section Twelve.

- 4.16.2.3 If the luminaire does not comply with the spacing requirements of Sub-clause 4.16.2.1, and does not incorporate thermal cut-outs in accordance with Sub-clause 4.16.2.2, it shall be so designed that it satisfies the test of Clause 12.6 of Section Twelve.

Note. — The 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 the temperature of the mounting surface will not exceed 180 °C for a duration of more than 15 min.

- 4.16.3 The requirements of Sub-clause 4.16.2 do not apply in the case of luminaires incorporating electronic ballasts, provided the maximum temperature of the ballast case complies with the requirements specified in Appendix F of IEC Publication 82, for  and  thermally protected ballasts.

In the case of electronic ballasts incorporating a filter coil the requirements of Sub-clause 4.16.2 shall apply in addition. In that case specially prepared ballasts may be necessary for the purpose of the measurements specified in Sub-clause 4.16.2.3.

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. Watertight luminaires shall have no provision for draining.

Test: Compliance shall be checked by inspection and by the tests of Section Nine.

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

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

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

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 season cracking.

Compliance shall be checked by the test given in Appendix J which shall be made on the samples not subjected to any other test.

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

Test under consideration.

4.19 Ignitors

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

4.20 Rough service luminaires — vibration requirement

Note. — In the design of fixed rough service luminaires particular attention should be paid to resistance to damage owing to vibration. It is hoped that a test for assessing resistance to vibration will be agreed but there is no requirement for a test at present.

4.21 Safety shield (tungsten halogen lamps)

- 4.21.1 Luminaires for indoor use incorporating double-ended halogen lamps shall be fitted with a safety shield to provide protection against the effects of shattering lamps. This shield may, for example, be in the form of a glass screen.

- 4.21.2 All openings in the luminaire shall be such that no part of a shattered lamp can leave the luminaire by a direct path.

- 4.21.3 The safety shield shall withstand the impact from a shattering lamp.

Compliance shall be checked by operating the luminaire, at the rated voltage of the lamp, in a position of normal use for 30 s, and then causing the lamp to shatter, for example by abruptly increasing the voltage applied to the lamp by about 30%.

After the shattering of this lamp, the shield shall show no damage. This test is repeated and, after the shattering of the second lamp, the shield (if of glass) may be cracked but no high velocity particles shall escape.

Note. — Safety shield requirements for indoor luminaires incorporating single-ended halogen lamps are under consideration.

4.22 Attachments to lamps

Luminaires shall not incorporate attachments to lamps which might cause overheating or damage of the lamp, lamp cap or lampholder.

Note. — Examples of attachments to lamps which might not comply with these requirements are bowl mirror reflectors, reflectors around lamps, etc. Examples which might be permitted are springs for attachment of lightweight shades to candle lamps and similar devices.