

INTERNATIONAL STANDARD



Luminaires – Part 2-20: Particular requirements – Lighting chains



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IEC 60598-2-20

Edition 5.0 2022-01
REDLINE VERSION

INTERNATIONAL STANDARD



Luminaires – Part 2-20: Particular requirements – Lighting chains

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.140.40

ISBN 978-2-8322-1075-9

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LUMINAIRES –

Part 2-20: Particular requirements – Lighting chains

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60598-2-20:2014. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60598-2-20 has been prepared by subcommittee 34D: Luminaires, of IEC technical committee 34: Lighting. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) specific provisions for temporarily installed protected lighting (TPL) chains have been added;
- b) new terms and definitions have been added.

The text of this International Standard is based on the following documents:

Draft	Report on voting
34D/1646/FDIS	34D/1651/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

This Part 2-20 is to be used in conjunction with the latest edition of IEC 60598-1 and its amendment(s). It was established on the basis of the ninth edition (2020) of that standard.

NOTE 1 When "Part 1" is mentioned in this document, it refers to IEC 60598-1.

NOTE 2 In this document, the following print types are used:

– *compliance statements: in italic type.*

A list of all the parts in the IEC 60598 series, published under the general title *Luminaires* can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This new edition includes the following technical changes:

- a) Inclusion of specific provisions for temporarily installed protected lighting (TPL) chains.

This form of lighting chain was not previously addressed with specific provisions in previous editions of the standard. A temporarily installed protected lighting chain is a physical impact protected rough service lighting chain intended for temporary installation on building sites during the construction or demolition phases of a building project.

- a) Addition of terms and definitions

New terms and definitions have been added to include the expanded typology for lighting chains and to include a connector with breaking capacity (CBC).

- b) Inclusion of graphical depictions of lighting chains

Graphical depictions have been added to clarify and differentiate the construction and installation configurations of the various different types of lighting chains. Word descriptions alone had limitations in clearly and precisely defining the characteristics of the numerous variants in this luminaire sector.

The illustrations show the three main types of lighting chains: permanently installed lighting chains, temporarily installed lighting chains and temporarily installed protected lighting (TPL) chains, as well as further differentiating by installation and/or fixing method where applicable.

LUMINAIRES –

Part 2-20: Particular requirements – Lighting chains

20.1 Scope

This part of IEC 60598 specifies requirements for lighting chains fitted with series, parallel or a combination of series/parallel connected light sources for use either indoors or outdoors on supply voltages not exceeding 250 V.

For combinations where rope lights (also known as sealed lighting chains) are included, see IEC 60598-2-21.

Lighting chains provided with fixed or detachable attachments for example ornamental or decorative, are considered to be covered by this document.

For lighting chains fitted with lampholders of the push-in type, the appropriate requirements of this document applies.

~~NOTE 1 A Christmas tree lighting chain is an example of a lighting chain fitted with series or series/parallel connected lamps. A chain for illuminating ski-tracks or promenades is an example of a lighting chain fitted with parallel connected lamps.~~

This document covers the following lighting chains:

- a) permanently installed lighting chains;
- b) temporarily installed lighting chains;
- c) temporarily installed protected lighting (TPL) chains.

NOTE 1 Festoon lighting chain – a lighting chain that is supported by the supply cable or fixed at the lampholder and is permanently connected to the fixed wiring. Festoon lighting chains are primarily suitable for permanent indoor or outdoor lighting applications.

NOTE 2 Decorative lighting chain – a lighting chain that is supported by the supply cable and is temporarily connected to the fixed wiring. Decorative lighting chains are primarily suitable for domestic, indoor or indoor/outdoor temporary lighting applications, see Figure 1 for examples.

NOTE 3 Temporarily installed protected lighting (TPL) chain – a lighting chain where each lampholder is fixed to the building or structure and the light source is enclosed by a protective enclosure and is temporarily connected to the fixed wiring. Temporarily installed protected lighting chains are primarily suitable for use in rough service lighting applications.

For lighting chains with non-standardized lamps (e.g. lamps of the push-in type) the lamps are regarded as a part of the lighting chain and consequently included in the testing.

NOTE 4 For products where the lighting chain is permanently fixed to a frame or pre-lit Christmas tree the relevant clauses of IEC 60598-2-4 and/or IEC 60598-2-7 can also apply.

NOTE 5 In some countries the term "strings" is used instead of "chains".

NOTE 6 Candlestick luminaires are tested according to IEC 60598-2-4.

20.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60227-5:2011, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 5: Flexible cables (cords)*

IEC 60238:2016, *Edison screw lampholders*

IEC 60238:2016/AMD1:2017

IEC 60238:2016/AMD2:2020

~~IEC 60245-4:2011, Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables~~

IEC 60309-1, *Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements*

IEC 60320 (all parts), *Appliance couplers for household and similar general purposes*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60598-1, *Luminaires – Part 1: General requirements and tests*

IEC 60906 (all parts), *IEC system of plugs and socket-outlets for household and similar purposes*

IEC 61184:2017, *Bayonet lampholders*

IEC 61184:2017/AMD1:2019

IEC 61347-2-11, *Lamp controlgear – Part 2-11: Particular requirements for miscellaneous electronic circuits used with luminaires*

IEC 61347-2-13, *Lamp controlgear – Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules*

IEC 61984:2008, *Connectors – Safety requirements and tests*

ISO 4046-4:2002/2016, *Paper, board, pulps and related terms – Vocabulary – Part 4: Paper and board grades and converted products*

20.3 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 60598-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

20.3.1

lighting chain

luminaire comprising an assembly of series-connected lamps, parallel-connected lamps or series/parallel-connected lamps and interconnecting insulated conductors

Note 1 to entry: For lighting chains with non-standardized lamps (e.g. lamps of the push-in type) the lamps are regarded as part of the chain.

Note 2 to entry: For lighting chains with non-removable lamps, the lamps are regarded as part of the chain.

Note 3 to entry: A lighting chain may incorporate control devices (e.g. flasher units, see 20.7.8).

Note 4 to entry: Unless otherwise stated, references to lamps within this document also refer to LEDs.

20.3.2

rope light

sealed lighting chain

lighting chain with non-replaceable light sources enclosed in a rigid or flexible insulating translucent pipe or tube, sealed at the ends, with or without joints

Note 1 to entry: Rope lights are covered by IEC 60598-2-21.

20.3.3

connector with breaking capacity

CBC

connector specially designed to be engaged or disengaged in normal use when live or under load

[SOURCE: IEC 60050-581:2008, 581-27-72]

20.3.4

permanently installed lighting chain

lighting chain that is supported by the supply cable or attached at the lampholder and is permanently connected to the fixed wiring

EXAMPLE Lighting chain for illuminating ski-tracks or promenades.

Note 1 to entry: Permanently installed lighting chains are primarily suitable for permanently installed indoor or outdoor lighting applications, see Figure 1 a) for examples.

Note 2 to entry: In some countries permanently installed lighting chains are called festoon lighting chains.

20.3.5

temporarily installed lighting chain

lighting chain that is supported by the supply cable and is temporarily connected to the fixed wiring

EXAMPLE Christmas tree lighting chain.

Note 1 to entry: Temporarily installed lighting chains are suitable for domestic, indoor or indoor/outdoor temporarily installed lighting applications, see Figure 1 b) for examples.

Note 2 to entry: In some countries temporarily installed lighting chains are called decorative lighting chains.

20.3.6

temporarily installed protected lighting (TPL) chain

lighting chain where each lampholder is attached to the building or structure and the light source is enclosed by a protective enclosure and is temporarily connected to the fixed wiring

EXAMPLE Construction site lighting chain.

Note 1 to entry: Temporarily installed protected lighting chains are primarily suitable for use in rough service lighting applications, see Figure 1 c) for example.

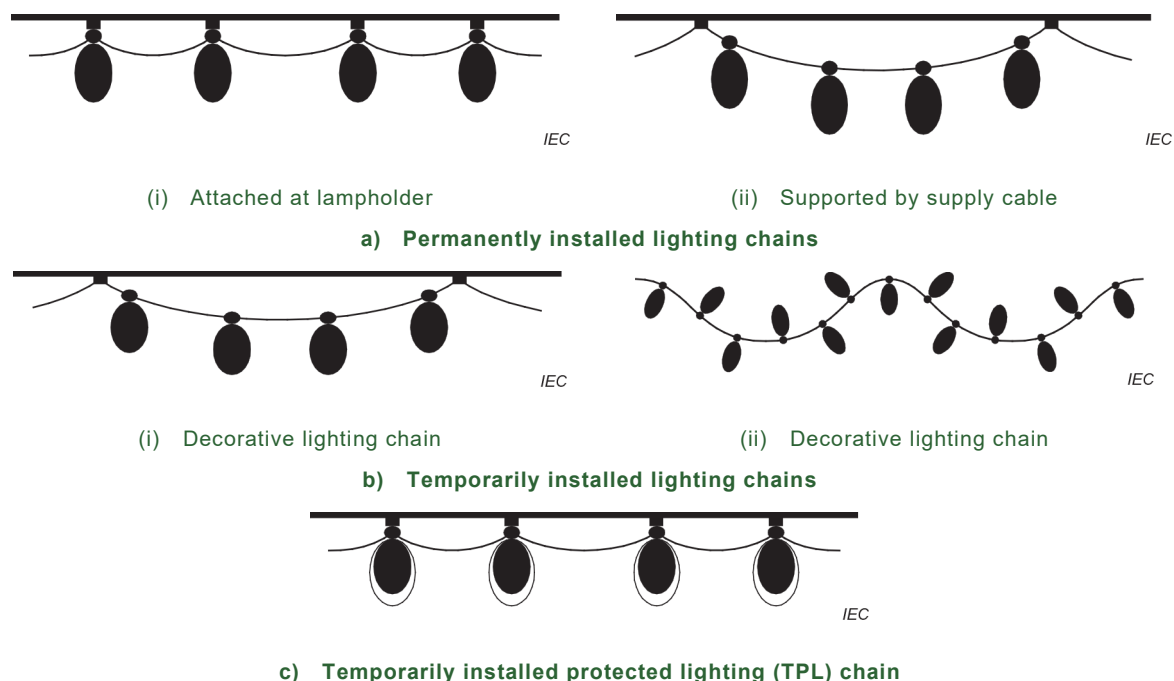


Figure 1 – Examples of different types of lighting chains

20.4 General test requirements

The provisions of Section 0 of Part 1 apply. The tests described in each appropriate section of Part 1 shall be carried out in the order listed in this document.

20.5 Classification of luminaires

20.5.1 General

Lighting chains shall be classified in accordance with the provisions of Section 2 of Part 1 together with the requirements of 20.5.2 and 20.5.3.

20.5.2 Protection against electric shock

Lighting chains shall be classified as Class II or Class III.

20.5.3 Protection against dust, solid objects and moisture

Lighting chains for outdoor use shall have a protective index IP 44 or higher.

20.6 Marking

20.6.1 General

The provisions of Section 3 of Part 1 apply together with the requirements of 20.6.2 to 20.6.4.

20.6.2 Lighting chain marking

The following information shall be marked on the lighting chain:

- rated voltage of the complete chain;
- rated wattage of the complete chain.

Where the information is on the cable, it shall be marked on a durable non-removable sleeve or label.

20.6.3 Lighting chain and ~~packing~~ packaging marking

The following marking shall be placed on the lighting chain and on the accompanying ~~packing~~ packaging of lighting chains for indoor use only.

- "FOR INDOOR USE ONLY".
- As an alternative to the text, the lighting chain can be marked with the symbol IEC 60417-5957 (2004-12). The symbol shall be explained in the instructions.

NOTE In some countries (UK and Australia) national requirements are such that a plug must be fitted to a portable appliance. In situations where this plug does not provide the same ingress protection of the lighting chain, information concerning the location of the plug/transformer may be given e.g. "Plug/transformer for indoor use only".

20.6.4 ~~Packing~~ Packaging or instructions marking

The following or similar marking shall be placed on the accompanying ~~packing~~ packaging or instructions.

- a) For all lighting chains where the ~~packing~~ packaging has not been adapted for display purposes:
 - "Do not connect the chain to the supply while it is in the ~~packing~~ packaging".
- b) For lighting chains with replaceable lamps:
 - voltage and wattage or manufacturer's article number of replacement lamps;
 - "Do not remove or insert lamps while the chain is connected to the supply";
 - "Ensure that all lampholders are fitted with a lamp".
- c) Lighting chains designed to be used without a lamp in every lampholder:
 - adequate information about required blanking plug(s).
- d) For chains with replaceable series-connected lamps:
 - "Replace failed lamps immediately by lamps of the same type as delivered or of a type specified by the manufacturer".
- e) For lighting chains with 'fuse' lamp(s):
 - "Do not replace a 'fuse' lamp with a non-'fuse' lamp"; in order to indicate the difference from 'ordinary' lamps, 'fuse' lamps shall be partly coloured white;
 - information indicating that the chain is provided with 'fuse' lamps and explanation of their function.
- f) For lighting chains with non-replaceable lamps:
 - "The lamps are not replaceable".
- g) For class II lighting chains with non-replaceable lamps, the substance of the following:
 - where breakage or damage to lamps occurs the chain must not be used or energized but disposed of safely.
- h) For lighting chains which rely on gaskets to provide the specified degree of protection against dust, solid objects and moisture:
 - "WARNING – THIS LIGHTING CHAIN MUST NOT BE USED WITHOUT ALL GASKETS BEING IN PLACE."

- i) For lighting chains intended for interconnection:
 - "Do not interconnect parts of this lighting chain with parts of another manufacturer's lighting chain";
 - "Interconnection shall be made only by the use of the supplied connectors. Any open ends must be sealed-off before use";
 - maximum system length that may be interconnected;
 - maximum number of lamps or maximum system wattage that may be interconnected.
- j) For lighting chains incorporating lamp bridging device(s):
 - information stating that the chain is fitted with a bridging device(s).
- k) For class III lighting chains delivered without a supply source:
 - relevant information concerning the required supply source.
- l) For mains voltage lighting chains with series connected lamps:
 - "WARNING – RISK OF ELECTRIC SHOCK IF LAMPS ARE BROKEN OR MISSING. DO NOT USE."

20.7 Construction

20.7.1 General

The provisions of Section 4 of Part 1 apply together with the requirements of 20.7.21 to 20.7.412.

Temporarily installed protected lighting (TPL) chains shall comply with the requirements for rough service luminaires as defined in Part 1.

20.7.2 Lampholders

In lighting chains where non-standardized lampholders (e.g. of the push-in type) are used, the lampholders are regarded as parts of the lighting chain and tested accordingly.

Edison screw lampholders E5, E10, E14 and E27 shall meet the requirements of IEC 60238.

Bayonet lampholders shall meet the requirements of IEC 61184.

Insulation piercing terminals on lampholders are acceptable only if used in the SELV circuit of lighting chains or as permanent, non-rewireable connections in class II chains.

E5 and E10 lampholders and similar small lampholders of the push-in type shall be used only if the rated voltage of each lamp does not exceed:

- for E5 and similar small lampholders 25 V
- for series connected E10 lampholders 60 V
- for parallel connected E10 lampholders 250 V

Compliance is checked by inspection.

Lampholders shall have a body of insulating material.

Compliance is checked by inspection.

20.7.3 Terminal blocks

Clause 4.6 of Part 1 referring to terminal blocks does not apply.

20.7.4 Terminals and supply connections

Clause 4.7 of Part 1 referring to terminals and supply connections applies together with the following requirement.

Interconnecting connectors for lighting chains shall, in addition, comply with the requirements and modifications given in Annex A.

Plugs and socket-outlets used with temporarily installed protected lighting (TPL) chains shall conform to IEC 60309-1.

Compliance is checked by inspection and by carrying out the tests of this document.

20.7.5 Gaskets

Gaskets used to provide the specified degree of protection against dust, solid objects and moisture of lighting chains for outdoor use shall be weather resistant. Such gaskets shall remain in place on the chain when the lamp is removed and shall fit tightly round the inserted lamp.

Compliance is checked by inspection and by manual test.

NOTE A test to verify the weather resistance of gaskets is under consideration.

20.7.6 Mechanical strength

~~Compliance with~~ The mechanical strength requirements of Clause 4.13 of Part 1 for Edison screw lampholders and small lampholders of the push-in type shall be checked by the tests given in Clause ~~15~~ 16 of IEC 60238:2016. The free fall test specified for E5 and E10 lampholders shall also apply for push-in lampholders.

For bayonet lampholders, the tests in Clause ~~15~~ 16 of IEC 61184:2017 apply.

The tests are made on three samples of the lampholder without the lamp inserted. After the test, the relevant compliance requirements of Clause 4.13 of Part 1 shall be met.

Accessories, for example plugs, interconnecting connectors, ~~etc.~~ incorporated in a lighting chain, shall comply with the mechanical requirements of 4.13.6 of Part 1.

20.7.7 Lamp bridging devices

Protection against electric shock and fire shall not be impaired when devices for bridging lamp filaments in series connected chains are functioning.

Compliance is checked by inspection and, where appropriate, by the test of 20.13.3.

20.7.8 Control units and controlgear

Control units and similar devices forming an integral part of the lighting chain shall be enclosed in non-flammable insulating material. In addition they shall be securely fixed to the cable of the chain.

Compliance is checked by inspection and, for the non-flammability of the insulating material, by the tests of Clause 20.16.

Any electronic control ~~device~~ unit (e.g. flasher units) shall, in addition to the requirements of this document, comply with the requirements of IEC 61347-2-11.

LED ~~drivers~~ controlgear shall comply with the requirements of IEC 61347-2-13

Compliance is checked by carrying out the relevant tests.

The enclosure of electronic control units shall meet the mechanical impact requirements of Part 1 using an impact energy of 0,7 Nm unless marked for indoor use only, where an impact energy of 0,5 Nm is applied.

20.7.9 Lamp rotation

The lamp (bulb) glass of push-in lamps shall not rotate in relation to the lamp cap, if any, and the lamp cap, if any, shall not rotate in relation to the lampholder.

Compliance is checked by applying a torque of 0,025 Nm for 1 min between the glass envelope and the lampholder. No displacement shall occur between the parts during the test.

20.7.10 Lamp insertion~~!~~ and withdrawal force

Replaceable push-in type lamps shall remain in the seated position when the lamp is subjected to a pull force of up to 3 N. Replaceable push-in type lamps shall make electrical contact with the lampholder contacts by applying a push-in force of up to 3 N. Withdrawal of the lamp from the holder shall be effected when subjected to a pull force of between 3 N and 10 N.

Non-replaceable lamps shall withstand a pull force of $10\text{ N} \pm 1\text{ N}$ during which the lamp shall remain seated and shall not have become unsafe.

During each application of the specified forces no damage shall occur impairing safety and in particular no breakage or separation of the lamp glass envelope from the lamp cap shall take place.

Compliance is checked on three new samples, by manual test, by measurement of the forces and by inspection.

The samples are then placed in an oven at a temperature of $120\text{ °C} \pm 5\text{ °C}$ K for 2 h, following which it is allowed to cool down to room temperature. During this test, lampholders for replaceable lamps are left empty.

The same three samples are then re-submitted to the same tests, requirements and compliance criteria as those specified for the sample before the heating treatment. For lampholders for replaceable lamps, the lamps are reintroduced by a push-in force of $5\text{ N} \pm 1\text{ N}$.

20.7.11 Lamp mechanical requirements

Other than lamps supplied by SELV, the lamps of ~~Class II~~ lighting chains shall be resistant to typical handling forces.

The bulb (envelope) of the following lamps shall be ~~tested~~ included in the mechanical test:

- non-removable lamps,
- non-standardized lamps.

Compliance is checked by the test of 4.13.1 of Part 1 using an impact energy of 0,2 Nm and with the lamp held against a suitable rigid wooden board.

20.7.12 Temporarily installed protected lighting (TPL) chains

Temporarily installed protected lighting (TPL) chains shall comply with constructional requirements for rough service luminaires given in Part 1.

20.8 Creepage distances and clearances

The provisions of Section 11 of Part 1 apply.

20.9 Provisions for earthing

The provisions of Section 7 of Part 1 do not apply.

20.10 Terminals

The provisions of Sections 14 and 15 of Part 1 apply.

20.11 External and internal wiring

20.11.1 General

The provisions of Section 5 of Part 1 apply together with the requirements of 20.11.2 to 20.11.4.

20.11.2 Cables for lighting chains

Subclause 5.2.2 of Part 1 is replaced by the following.

Internal and external cables for lighting chains shall not be lighter than those given in Table 1 and below.

Table 1 – Cables or cord types for lighting chains

Type of lighting chain	Required cable or cord type
Class II ordinary lighting chains	60227 IEC 52 ^a or 60227 IEC 43
Class II lighting chains other than ordinary	60245 IEC 57 ^a
Class III lighting chains and parts of chains supplied by SELV	Insulation according to 5.3.1 of Part 1 ^b
Temporarily installed protected lighting (TPL) chains	Elastomer or thermoplastic sheathed flexible conductors or flexible cables (or cords) conforming to IEC 60227-5
^a The cable may consist of a single core cable provided with a two-layer insulation corresponding to the specified standard sheet. ^b The insulation may consist of rubber or PVC.	

Compliance is checked by inspection and measurement.

The nominal cross-sectional area of the conductors for lighting chains shall provide adequate current-carrying capacity and mechanical properties but shall not be less than the following values in Table 2:

- ~~a) 0,5 mm² for class II lighting chains;~~
- ~~b) 1,5 mm² for class II lighting chains with E14, E27, B15 or B22 lampholders and fitted with parallel-connected lamps;~~
- ~~c) 0,15 mm² for class III lighting chains and parts of chains supplied by SELV;~~
- ~~d) 1 mm² for separate supply cables and extension cables for interconnection between different parts of extendable class II lighting chains.~~

Table 2 – Conductor size for lighting chains

Type of lighting chain	Nominal cross-sectional area
Class II lighting chains	0,5 mm ²
Class II lighting chains with E14, E27, B15 or B22 lampholders and fitted with parallel-connected lamps	1,5 mm ²
Class III lighting chains and parts of chains supplied by SELV	0,15 mm ²
Temporarily installed protected lighting (TPL) chains	2,5 mm ²
Separate supply cables and extension cables for interconnection between different parts of extendable class II lighting chains	1,0 mm ²

Compliance is checked by inspection and measurement.

For the mechanical properties the relevant requirements given in 4.14.1 and 4.14.2 of Part 1 apply.

20.11.3 Cord anchorage test

For lighting chains incorporating a single-core cable, the test described in 5.2.10.4³ of Part 1 is made in the following way.

The cable is subjected 25 times to a pull of 30 N. The torque test is not made.

For lighting chains fitted with screwless type terminals, the electrical connections are disconnected without adversely affecting the efficiency of the cord anchorage function.

20.11.4 Plugs and cable length

Lighting chains for outdoor use shall either be provided with a splash-proof plug or be suitable for permanent connection to fixed wiring by means of a junction box.

The length of the cable between the plug and the first lamp or lampholder shall be not less than 1,5 m.

Compliance is checked by measurement.

NOTE 1 National rules in some countries do not permit plugs in accordance with IEC TR 60083.

NOTE 2 In some countries (UK and Australia) national requirements are such that a plug must be fitted to a portable appliance. In situations where this plug does not provide the same ingress protection of the lighting chain, information concerning the location of the plug/transformer may be given e.g. "Plug/transformer for indoor use only".

20.11.5 Maximum length of extendable class II lighting chains

Extendable class II lighting chains shall be limited to a maximum length of:

- 100 m for systems using a 0,5 mm² cable;
- 150 m for systems using a 0,75 mm² cable.

Compliance is checked by inspection and measurement.

20.12 Protection against electric shock

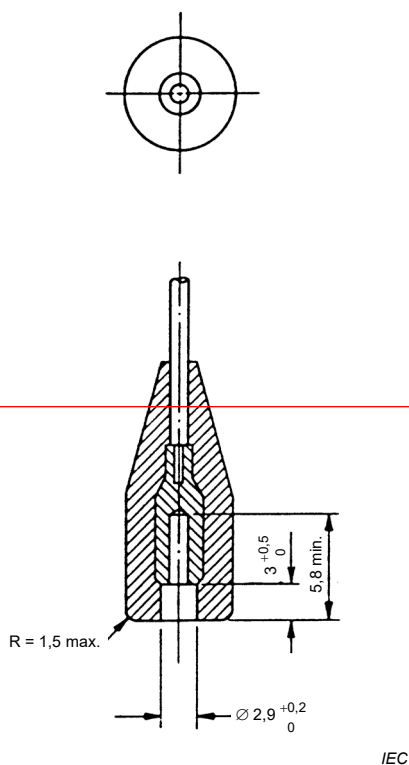
20.12.1 General

The provisions of Section 8 of Part 1 apply together with the requirements of 20.12.2 to 20.12.4.

20.12.2 Divisible plug

If the plug of a lighting chain incorporates a means for disconnecting one end of the chain to facilitate installation, the connector fitted at the end of the cable shall have an entry such that the diameter of the opening and the distance from the front to live parts are equal to the corresponding dimensions specified in Figure 2. The two parts of the connector shall not separate when subjected to a pull force of 10 N.

Dimensions in millimetres



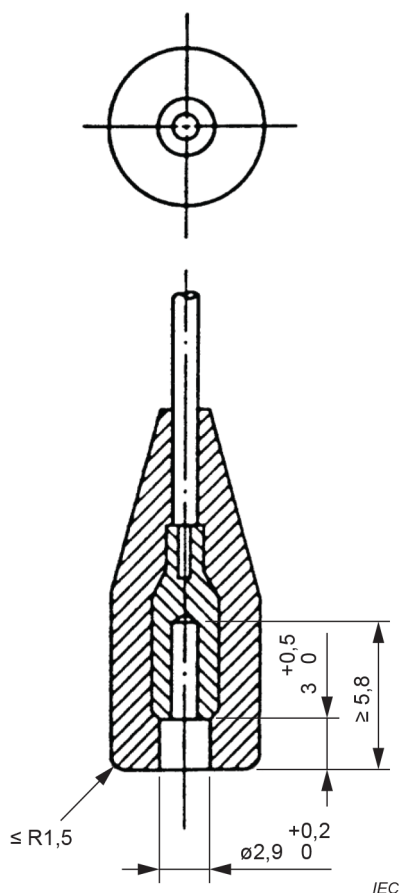


Figure 2 – Example of a connector to a divisible plug for lighting chains

Compliance is checked by a test with the standard test finger specified in IEC 60529.

20.12.3 Electrification of decorations

Lighting chains shall not electrify tinsel or other metallic decorations with which they are used.

Compliance shall be checked by means of a flat probe, 0,5 mm thick and 8 mm wide, with a rounded tip having a radius of 4 mm. It shall not be possible to touch live parts with this probe, when it is applied in any position with a force not exceeding 0,5 N, the chain being fitted with the lamps with which it is delivered.

20.12.4 Contacts of push-in lampholders

Lampholder contacts in push-in lampholders shall be reliably secured in the lampholder body by means other than friction to avoid a displacement of the lampholder contacts such that live parts of the chain become accessible either through the bottom or top of the lampholder.

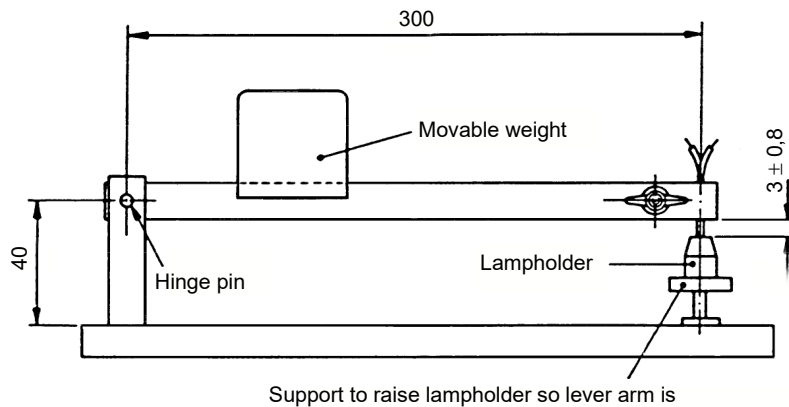
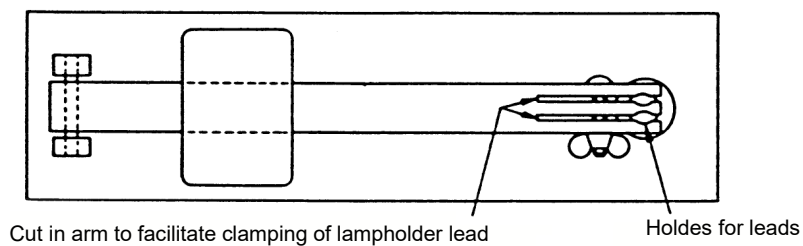
NOTE An example of an adequate securing method is by the provision of ears on the contacts of the lampholder.

Compliance is checked by inspection and by the following test.

Six lampholders are heated for 7 h according to the requirements of Clause 12.3 of Part 1 in an orientation to reach the highest temperature. After the lampholders have cooled down to room temperature, the lamps are removed and a force of 15 N is applied for 1 min to each of the conductors connected. Following this, a force of 30 N is applied for 1 min to the two conductors together. The forces are applied at a distance of 3 mm ± 0,8 mm from the insertion points in the lampholder so as to try to move the contacts from the lampholders.

During the test the contacts shall not move more than 0,8 mm. An example of a device suitable for this test is shown in Figure 3.

Dimensions in millimetres



IEC

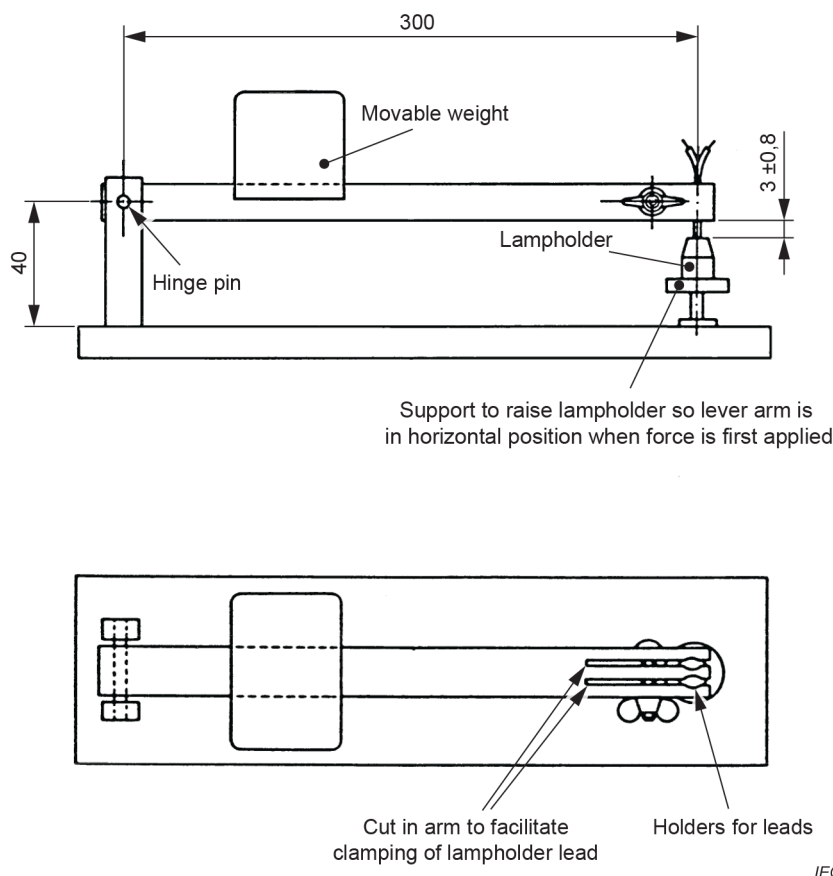


Figure 3 – Example of test device suitable for checking security of lampholder contacts

20.12.5 Blanking plugs

Where a lighting chain is designed to be used without a lamp in every lampholder, suitable blanking plug(s) shall be provided to prevent access to live parts.

20.13 Endurance tests and thermal tests

20.13.1 General

The provisions of Section 12 of Part 1 apply together with the requirements of 20.13.2 to 20.13.3.

Lighting chains with an IP classification greater than IPX0 shall be subjected to the relevant tests of Clauses 12.4, 12.5 and 12.6 of Part 1 after the test(s) of Clause 9.2 but before the test(s) of Clause 9.3 of Part 1 specified in Clause 20.14 of this document.

20.13.2 Test voltage

The provisions of 12.3.1 d) of Part 1 together with the following apply.

For class III chains supplied from an associated transformer/convertor, the test is carried out at 1,10 times the rated voltage of the transformer/convertor.

The provisions of 12.4.1 d) of Part 1 together with the following apply.

For class III chains supplied from an associated transformer/convertor, the test is carried out at 1,06 times the rated voltage of the transformer/convertor.

20.13.3 Lamp bridging devices

The operation of devices for bridging the lamp filament, where fitted in accordance with 20.7.7, shall not cause any part of the lighting chain to attain a temperature which would impair safety.

Compliance is checked by causing the bridging device to operate successively on each lamp until the complete set falls or until half the chain is bridged, whichever occurs first. The lamps are not replaced during the test. The temperature of the component parts of the lighting chain shall be allowed to stabilize before each bridging device is made to operate. The temperature of lampholders and cables shall not exceed the appropriate values given in Tables 12.1 and 12.2 of Part 1 and eventual deformation shall not give access to live parts.

If a protective device (e.g. a 'fuse' lamp) operates during the test, the highest temperatures reached shall be taken as the final temperatures.

20.13.4 Short-circuit test of rectifier

A class II or class III LED lighting chain incorporating a rectifier unit shall be subjected to the following test.

The lighting chain is supplied with a voltage between 0,9 and 1,1 times the rated supply voltage. The output of the rectifier is short-circuited. During this test there shall be no emission of flames or molten material or production of flammable gases. Live parts shall not become accessible.

Compliance: To check whether emission of flames or molten material might present a safety hazard, the test specimen is wrapped with a tissue paper, as specified in 4.187 of ISO 4046-4:20022016, and shall not ignite.

20.14 Resistance to dust, solid objects and moisture

The provisions of Section 9 of Part 1 apply together with the following requirement. For lighting chains with an IP classification greater than IP20, the order of the tests specified in Section ~~9~~ 12 of Part 1 shall be as specified in Clause 20.13 of this document.

During the test the lighting chains are completely assembled ready for use, appropriate lamps are inserted and the lampholders are positioned at random.

20.15 Insulation resistance and electric strength

The provisions of Section ~~10~~ 9 of Part 1 apply together with the following.

During the measurement of the insulation resistance and the electric strength test the following procedure applies:

- for lighting chains for outdoor use, the metal foil shall be completely wrapped over the lampholder and the lamp;
- for lighting chains for indoor use with Edison screw lampholders tested according to IEC 60238, or bayonet lampholders tested according to IEC 61184, the metal foil is only wrapped on the lampholder near to the rim of the lampholder, but the lamp is not wrapped with metal foil;
- for lighting chains with push-in lampholders, the metal foil shall be completely wrapped over the lampholder and the lamp.

20.16 Resistance to heat, fire and tracking

The provisions of Section 13 of Part 1 apply, except that: