

NORME
INTERNATIONALE
INTERNATIONAL
STANDARD

CEI
IEC

60598-2-20

Edition 2.2

2002-05

Edition 2:1996 consolidée par les amendements 1:1998 et 2:2002
Edition 2:1996 consolidated with amendments 1:1998 and 2:2002

Luminaire –

Partie 2-20:
Règles particulières –
Guirlandes lumineuses

Luminaire –

Part 2-20:
Particular requirements –
Lighting chains

© IEC 2002 Droits de reproduction réservés — Copyright - all rights reserved

Aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'éditeur.

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission
Telefax: +41 22 919 0300

e-mail: inmail@iec.ch

3, rue de Varembe Genève, Switzerland
IEC web site <http://www.iec.ch>



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE

Q

For price, see current catalogue
Pour prix, voir catalogue en vigueur

CONTENTS

FOREWORD	5
20.1 Scope	7
20.1.1 Normative references	7
20.2 General test requirements	7
20.3 Definitions	9
20.4 Classification of luminaires	9
20.5 Marking	9
20.6 Construction	11
20.7 Creepage distances and clearances	17
20.8 Provisions for earthing	17
20.9 Terminals	17
20.10 External and internal wiring	19
20.11 Protection against electric shock	21
20.12 Endurance tests and thermal tests	23
20.13 Resistance to dust and moisture	23
20.14 Insulation resistance and electric strength	25
20.15 Resistance to heat, fire and tracking	25
Annex A (informative) Tumbling barrel test	31
Bibliography	33
Figure 1 – An example of a suitable connection for lighting chains	25
Figure 2 – Example of test device suitable for checking security of lampholder contacts	27
Figure 3 – Example of test device suitable for winding a flexible pipe	29

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LUMINAIRES –

Part 2-20: Particular requirements – Lighting chains

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60598-2-20 has been prepared by subcommittee 34D: Luminaires, of IEC technical committee 34: Lamps and related equipment.

This consolidated version of IEC 60598-2-20 is based on the second edition (1996) [documents 34D/381/FDIS and 34D/398/RVD], the interpretation sheet of March 2001, its amendment 1 (1998) [documents 34D/477/FDIS and 34D/488/RVD] and its amendment 2 (2002) [documents 34D/706/FDIS and 34D/747/RVD].

It bears the edition number 2.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2 and the interpretation sheet.

Annex A is for information only.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until July 2005. At this date, the publication will be

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

LUMINAIRES –

Part 2-20: Particular requirements – Lighting chains

20.1 Scope

This section of IEC 60598-2 specifies requirements for lighting chains fitted with series- or parallel- or a combination of series/parallel-connected incandescent lamps for use either indoors or outdoors on supply voltages not exceeding 250 V.

NOTE 1 A Christmas tree 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.

NOTE 2 For lighting chains fitted with lampholders of the push-in type, the appropriate requirements of this section apply.

NOTE 3 In some countries the term "strings" is used instead of "chains".

NOTE 4 For lighting chains with non-standardised 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 (and thereby in the certificate, if any).

20.1.1 Normative references

The following referenced documents are indispensable for the application 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 60083:1975, *Plugs and socket-outlets for domestic and similar general use. Standards*

IEC 60227: *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*

IEC 60238:1991, *Edison screw lampholders*

IEC 60245: *Rubber insulated cables – Rated voltages up to and including 450/750 V*

IEC 60320:1981, *Appliance couplers for household and similar general purposes*

IEC 60598-1:1999, *Luminaires – Part 1: General requirements and tests*

IEC 61184, *Bayonet lampholders*

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

CISPR 14:1993, *Limits and methods of measurement of radio interference characteristics of household electrical appliances, portable tools and similar electrical apparatus*

20.2 General test requirements

The provisions of section 0 of IEC 60598-1 apply. The tests described in each appropriate section of IEC 60598-1 shall be carried out in the order listed in this section of IEC 60598-2.

20.3 Definitions

For the purpose of this section, the definitions given in section 1 of IEC 60598-1 apply together with the following definitions:

20.3.1

lighting chain

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

NOTE 1 For lighting chains with non-standardised lamps (e.g. lamps of the push-in type) the lamps are regarded as part of the chain.

NOTE 2 For lighting chains with non-removable lamps, the lamps are regarded as part of the chain.

NOTE 3 A lighting chain may incorporate control devices (e.g. flasher units, see clause 20.6.16).

20.3.2

sealed chain

a lighting chain enclosed in a rigid or flexible insulating translucent pipe or tube, sealed at the ends and having no joints

20.4 Classification of luminaires

Luminaires shall be classified in accordance with the provisions of section 2 of IEC 60598-1 together with the requirements of 20.4.1 and 20.4.2.

NOTE As lighting chains are mandatorily required to be suitable for mounting on normally flammable surfaces they do not require F marking nor provision of a warning notice.

20.4.1 According to the type of protection against electric shock, lighting chains shall be classified as Class II or Class III.

20.4.2 According to the degree of protection against dust and moisture, lighting chains for outdoor use shall be classified as "of rain-proof, splash-proof, jet-proof or watertight construction".

20.5 Marking

To provisions of section 3 of IEC 60598-1 apply together with the requirements of 20.5.1 and 20.5.2.

20.5.1

- a) Lighting chains shall be marked with the type reference or the electrical data of the lamps and with the rated voltage of the complete chain. Where it is impractical to mark this information on the lighting chain, the information shall be marked on a durable non-removable sleeve or label fitted to the cable.
- b) Lighting chains shall be accompanied by the substance of the following warnings:
 - 1) do not remove or insert lamps while the chain is connected to the supply;
 - 2) for series-connected lamps, replace failed lamps immediately by lamps of the same rated voltage and wattage to prevent overheating; this requirement does not apply to sealed chains;
 - 3) do not connect the chain to the supply while it is in the packing unless the packing has been adapted for display purposes;

- 4) for series-connected lamps where fused lamps are used to ensure compliance with 20.12.3 hereafter, do not replace a fused lamp with a non-fused lamp [see item e)].
- 5) ensure all lampholders are fitted with a lamp.
- c) Ordinary lighting chains shall additionally be accompanied by the substance of the following information:

"FOR INDOOR USE ONLY"

Lighting chains which rely on gaskets to provide the specified degree of protection against dust and moisture shall additionally be accompanied by the substance of the following information:

**"WARNING – THIS LIGHTING CHAIN MUST NOT
BE USED WITHOUT ALL GASKETS BEING IN PLACE"**

- d) Lighting chains not intended for interconnection shall in addition be accompanied by the substance of the following warning:
"Do not connect this chain electrically to another chain."
- e) Lighting chains fitted with fused lamps to ensure compliance with 20.12.3 shall be accompanied by information indicating the means for identification of fused lamps (see 20.5.3).

NOTE For the purpose of this subclause, a fused lamp is a lamp designed so as to break the circuit in the event of an overcurrent either by means of a separate fuse incorporated within the lamp or by any other means e.g. a special filament.
- f) Lighting chains with non-standardised lamps shall be accompanied by information indicating that replacement lamps must be of the same type as delivered or of a type specified by the manufacturer (see 20.5.2).
- g) Lighting chains provided with non-replaceable lamps shall be accompanied by the information that the lamps are not replaceable.

The information required under items b)3, f) and g) shall be indicated on the packing.

20.5.2 The following information shall be marked on the lampholder or on the cable, or on a durable non-removable sleeve or label fitted to the cable:

- a) Mark of origin (this may take the form of a trade mark, the manufacturer's identification mark or the name of the responsible vendor).
- b) Symbol for class II or class III, if applicable.
- c) Marking for degree of protection against dust and moisture, if applicable, or warning that the chain is for indoor use only.
- d) Rated voltage of class III chains.
- e) Voltage and wattage of replacement lamps.
- f) Use only replacement lamps of the same kind provided with this lighting chain.

20.5.3 Fused lamps used to ensure compliance with 20.12.3 shall have a suitable means of identification, such as a special colour.

20.6 Construction

The provisions of section 4 of IEC 60598-1 apply together with the requirements of 20.6.1 to 20.6.16.

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

Bayonet lampholders shall meet the requirements of IEC 61184.

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

E5 and similar small lampholders of the push-in type shall meet the requirements of the appropriate clauses of IEC 60238.

In lighting chains fitted with parallel-connected lamps, E27 and B22 lampholders with insulation piercing contacts shall meet the requirements of this section.

20.6.2 Clause 4.6 of section 4 of IEC 60598-1 referring to terminal block does not apply.

20.6.3 Clause 4.7 of section 4 of IEC 60598-1 referring to terminals and supply connections applies together with the following requirement:

The method of connection of wiring, external or internal, to components of chains shall give reliable electrical contact over the service life of the component.

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

20.6.4 Only 4.11.4 and 4.11.5 of clause 4.11 of section 4 of IEC 60598-1, referring to electrical connections and current-carrying parts, apply.

20.6.5 Gaskets used to provide the specified degree of protection against dust 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 shall be checked by inspection and by manual test.

No requirements are specified at present for checking the weather resistance of gaskets.

20.6.6 Compliance with the mechanical strength requirements of clause 4.13 of section 4 of IEC 60598-1 for Edison screw lampholders, and small lampholders of the push-in type shall be checked by the tests given in clause 15 of IEC 60238.

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 section 4 of IEC 60598-1 shall be met.

20.6.7 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 E10 and similar small lampholders 60 V;

and the maximum rated wattage of the lighting chain does not exceed:

- for lighting chains using E5 or similar small lampholders 50 W;
- for lighting chains using E10 or similar small lampholders 100 W.

Compliance shall be checked by inspection.

20.6.8 For lighting chains fitted with series-connected lamps, resistors, if any, for bridging the lamp filaments shall be contained within the lamps. The protection against electric shock and fire shall not be impaired when these resistors are functioning.

Compliance shall be checked by inspection and, where appropriate, by a test during which the filaments of the lamps are interrupted.

20.6.9 Flasher units forming an integral part of the lighting chain, shall be enclosed in non-flammable insulating material; they shall be securely fixed to the cable of the chain.

Compliance shall be checked by inspection and, for the non-flammability of the insulating material, by the test of clause 20.15.

20.6.10 No requirement.

20.6.11 Lampholders for replaceable push-in lamps shall have a body of insulating material.

Compliance shall be checked by inspection.

20.6.12 The lamp (bulb) glass of push-in lamps shall not rotate in relation to the lamp cap and the lamp cap 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 then occur between the parts during the test.

20.6.13 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 between 3 N and 10 N (under consideration). Withdrawal of the lamp from the holder shall be effected when subjected to a pull force of between 3 N and 10 N (under consideration).

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 a new sample by manual test; by measurement of the forces and by inspection.

The sample is then placed in an oven at a temperature of $120\text{ °C} \pm 5\text{ °C}$ for 2 h (under consideration) following which it is allowed to cool down to room temperature.

The sample is then re-submitted to the same tests, requirements and compliance criteria as those specified for the sample before the heating treatment.

20.6.14 Sealed lighting chains shall have adequate mechanical strength.

For rigid sealed lighting chains, compliance is checked by subjecting the pipe 45 times to each of the following tests carried out in turn:

- a) A pull of 60 N, the stress being applied to the ends of the pipe, without jerks, for 1 min.
- b) A torque of 0,15 Nm, the stress being applied to the ends of the pipe in the most unfavourable direction (alternatively in cases of doubt) without jerks for 1 min.

For flexible sealed lighting chains, compliance is checked by the tests of a) and b) above followed by the additional test below:

Test:

Wind the pipe on a cylinder of 250 mm diameter with a pull of 60 N for the number of operations and at the ambient temperature given below:

- for chains having an IP number up to and including 20 10 times at $25\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$
- for chains having an IP number over 20 10 times at $25\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$
followed by
10 times at $-15\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$

After the test, the pipe shall show no damage affecting the safety of the chain and shall comply with the electric strength test of clause 20.14 applied between live parts and the body.

NOTE 1 Failure of lamps during the test is permitted.

NOTE 2 An example of a test device suitable for winding a flexible pipe is given in figure 3.

20.6.15 The lamp bulbs in lighting chains fitted with parallel-connected non-standardised or non-removable lamps shall meet the mechanical requirements of clause 4.13.1 of IEC 60598-1 using an impact energy of 0,2 Nm.

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

Compliance shall be checked by carrying out the relevant tests.

20.7 Creepage distances and clearances

The provisions of section 11 of IEC 60598-1 apply except that for Edison screw lampholders and small lampholders of the push-in type, clause 17 of IEC 60238 applies.

20.8 Provisions for earthing

The provisions of section 7 of IEC 60598-1 do not apply.

20.9 Terminals

The provisions of section 15 of IEC 60598-1 apply.

20.10 External and internal wiring

20.10.1 Subclause 5.2.2 of section 5 of IEC 60598-1 does not apply. Internal and external cables of lighting chains other than sealed chains, and external cables of sealed chains shall not be lighter than the following:

- for ordinary lighting chains using series/parallel-connected lampholders	60227	IEC 43
- for Class III lighting chains and parts of chains supplied by SELV with a maximum rated wattage exceeding 50 W	60227	IEC 42*
- for Class II ordinary lighting chains using series/parallel-connected lampholders	60227	IEC 52
- for other lighting chains using series/parallel-connected lampholders	60245	IEC 57
- for other lighting chains where the length of cable between the supply plug and the nearest lampholder exceeds 3 m - for that part of the cable	60245	IEC 66

* IEC 42 will be withdrawn from the cable standard IEC 60227. However, due to the fact that the cable will still be available on the market, on request, the reference will be retained until the next revision of this standard.

Compliance is checked by inspection, measurement and by calculation.

The nominal cross-sectional area of the conductors shall be not less than one of the following values:

- a) 0,5 mm² for ordinary lighting chains with E5 or E10 lampholders or other small lampholders.
- b) 0,75 mm² for other lighting chains with E5 or E10 lampholders or other small lampholders, and for lighting chains with E14, E27, B15 or B22 lampholders and fitted with series-connected lamps.
- c) 1,5 mm² for lighting chains with E14, E27, B15 or B22 lampholders and fitted with parallel connected lamps.

If the maximum rated wattage of class III lighting chains and parts of chains supplied by SELV is less than 50 W then the conductors of the internal and external cables may have a cross-sectional area of 0,4 mm² or less provided that the current-carrying capacity and the mechanical properties are adequate. If the maximum rated wattage exceeds 50 W, the cables shall comply with 60227 IEC 42 (see asterisk above). If the wattage is less than 50 W the insulation of the cables shall comply with the requirements of 5.3.1 of IEC 60598-1.

For sealed chains, the internal conductors may have a cross-sectional area of 0,4 mm² or less provided the current-carrying capacity and the mechanical properties are adequate. In addition, conductors without insulation are accepted provided adequate precautions have been taken to ensure maintenance of the minimum creepage distances and clearances and compliance with the requirements of 5.3.1 of IEC 60598-1.

Compliance is checked by inspection, measurement and by calculation.

In the USA cable shall:

- have a minimum insulation thickness of 0.762 mm;
- have a minimum flame rating of VW-1;
- be UV rated;
- have a temperature rating of 105 °C;
- be rated for indoor and/or outdoor use.

20.10.2 For lighting chains incorporating a single-core cable, the test described in 5.2.10.1 of section 5 of IEC 60598-1 is made in the following way:

The cable is subjected 50 times to a pull of 30 N. The torque test is not made.

20.10.3 Plugs of lighting chains shall meet the requirements of IEC 60083.

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 lampholder shall be not less than 1,5 m.

Compliance shall be checked by measurement.

NOTE 1 Lampholders in a non-rewirable lighting chain fitted with parallel-connected lamps may be connected to a flat cable by means of pin contacts or edge contacts, which penetrate the insulation of the cable and provide electric contact with the conductors.

NOTE 2 National rules in some countries do not permit plugs in accordance with IEC 60083.

20.11 Protection against electric shock

The provisions of section 8 of IEC 60598-1 apply together with the requirements of 20.11.1 to 20.11.3.

20.11.1 For lighting chains with means for retaining lamps other than E10 or larger lampholders, the protection against electric shock shall be at least equivalent to that required for lighting chains provided with E10 lampholders.

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 1. The two parts of the connector shall not separate when subjected to a pull force of 10 N.

For metal parts of lampholders and for the cap of bayonet lamps, compliance shall be checked by a test with the standard test finger specified in IEC 60529.

A lamp with the longest commercially available lamp-cap shall be inserted when the inaccessibility of bayonet lamp-caps is checked.

NOTE The gasket referred to in 20.6.5 may serve as protection against accidental contact with the cap of a lamp with a bayonet cap.

For plugs incorporating means for disconnecting one end of the chain, the degree of protection against electric shock shall be such that it is not possible to touch the contact piece with the standard test finger specified in IEC 60529. In general, the contact piece is a pin fitted in the body of the plug, the pin being shrouded by the body of the plug or otherwise protected.

20.11.2 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.

20.11.3 Lampholder contact shall be reliably secured in the lampholder body by means other than friction to avoid such a displacement of the lampholder contacts that live parts of the chain become accessible. An example of an adequate securing method is by the provision of ears on the contacts of the lampholder.

Compliance shall be checked by inspection and by the following test.

Six lampholders are heated for 7 h according to the requirements of clause 12.3 of section 12 of IEC 60598-1 in an orientation to reach the highest temperature. After the lampholders have cooled down to room temperature, the incandescent 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 $3 \pm 0,8$ 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 2.

20.12 Endurance tests and thermal tests

The provisions of section 12 of IEC 60598-1 apply together with the requirements of 20.12.1 to 20.12.3.

Luminaires with an IP classification greater than IP20 shall be subjected to the relevant tests of clauses 12.4, 12.5 and 12.6 of section 12 of IEC 60598-1 after the test(s) of clause 9.2 but before the test(s) of clause 9.3 of section 9 of IEC 60598-1 specified in clause 20.13 of this section of IEC 60598-2.

20.12.1 The requirements of item d) of 12.3.1 and item d) of 12.4.1 of section 12 of IEC 60598-1 are replaced by the following:

The tests are carried out at a voltage such that the wattage is equal to 1,05 times the wattage measured when the lighting chain is supplied at the rated voltage.

20.12.2 The requirements of item e) of 12.3.1 and item g) of 12.4.1 of section 12 of IEC 60598-1 apply except that lamps for sealed chains are not replaced.

20.12.3 The operation of devices for bridging the lamp filament, where fitted in accordance with 20.6.8, 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, the lamp not being replaced. 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 X and XI of IEC 60598-1.

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

20.13 Resistance to dust and moisture

The provisions of section 9 of IEC 60598-1 apply together with the following requirement. For luminaires with an IP classification greater than IP20 the order of the tests specified in section 9 of IEC 60598-1 shall be as specified in clause 20.12 of this IEC 60598-2.

Lighting chains are completely assembled ready for use, appropriate lamps are inserted and the lampholders are positioned at random during the test described in clause 9.2 of section 9 of IEC 60598-1.

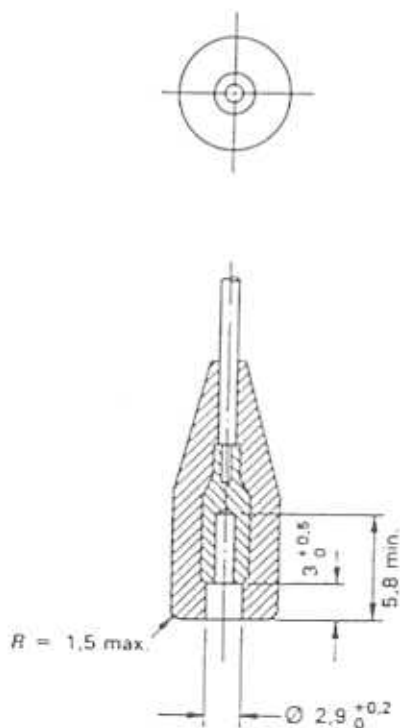
20.14 Insulation resistance and electric strength

The provisions of section 10 of IEC 60598-1 apply.

20.15 Resistance to heat, fire and tracking

The provisions of section 13 of IEC 60598-1 apply, except that:

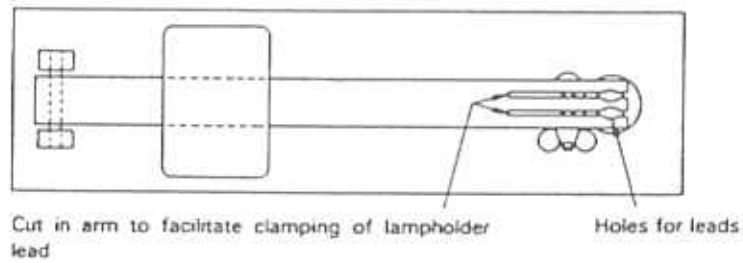
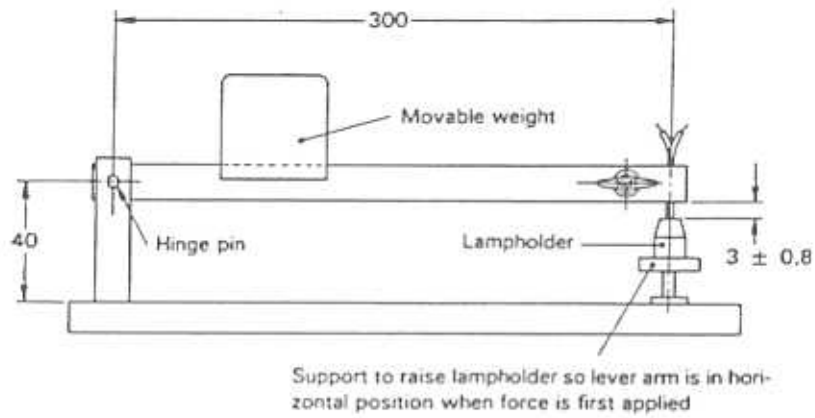
- for flexible pipes of sealed chains the test of 13.2.1 is replaced by the test of clause 8 of IEC 60811-3-1.



IEC 783/98

Dimensions in millimetres

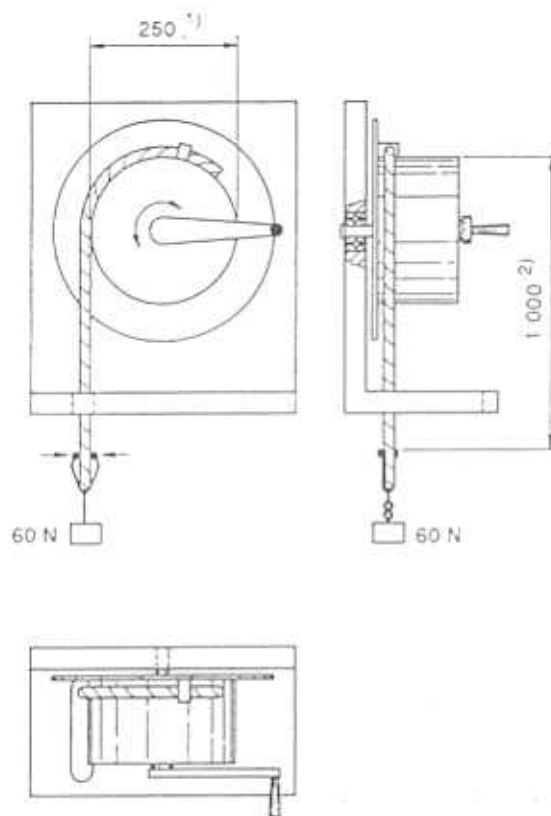
Figure 1 – An example of a suitable connection for lighting chains



IEC 784/08

Dimensions in millimetres

Figure 2 – Example of test device suitable for checking security of lampholder contacts



IEC 785/98

Dimensions in millimetres

- 1) Diameter of wooden cylinder.
- 2) Distance between the fixing point of the flexible pipe and the weight prior to commencement of the test.

Figure 3 – Example of test device suitable for winding a flexible pipe

Annex A
(informative)

Tumbling barrel test

(Applicable to class II lighting chains only.)

No requirement.

Bibliography

IEC 61347-1, *Lamp controlgear – Part 1: General and safety requirements*
