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TECHNICAL REPORT

colour inside

Electrical accessories – Harmonization of general rules

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Electrical accessories – Harmonization of general rules

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRICAL ACCESSORIES – HARMONIZATION OF GENERAL RULES

FOREWORD

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IEC TR 61916, which is a Technical Report, has been prepared by IEC technical committee 23: Electrical accessories.

This fourth edition cancels and replaces the third edition published in 2014 and constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition:

a) clarification of the introduction and the scope;
b) clarification of subclause 6.3;
c) modification of Clause 7;
d) modification of Clause 10;
e) addition of Annex B for temperature selection for GWEPT.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
23/742/DTR	23/766/RVDTR

Full information on the voting for the approval of this Technical Report can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

In this Technical Report, the following print types are used:

- requirements proper: in roman type;
- *test specifications: in italic type*;
- Explanatory matter: in smaller roman type.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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

The purpose of this document is to have harmonized rules on the same subjects in all the standards published by IEC TC 23 and its subcommittees, in order to give coordinated indications to subcommittees when developing their standards.

These recommendations are meant as a guide. Consequently, subcommittees, according to their own particularities, can use whole or part of the document, which is not meant to be compulsory.

In this document, the word “shall” is used only to illustrate how the relevant requirement should be implemented in a product standard and does not itself imply a product requirement within this document.

In publishing these recommendations, IEC TC 23 wishes to spread the information so that other committees of the IEC can use these recommendations, if necessary.

ELECTRICAL ACCESSORIES – HARMONIZATION OF GENERAL RULES

1 Scope

This document, which is a Technical Report, provides guidance on requirements and tests for subjects applicable to electrical accessories that are within the scope of IEC TC 23 and its subcommittees.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

3.1
tracking
progressive formation of conductive paths, which are produced on the surface of or within a solid insulating material, due to the combined effects of electric stress and electrolytic contamination

[SOURCE: IEC 60050-212:2010, 212-11-56, modified – The note has been deleted.]

3.2
electric erosion
wearing away of insulating material by the action of electric discharges

[SOURCE: IEC 60050-212:2010, 212-11-55]

3.3
comparative tracking index
CTI
numerical value of the maximum voltage in volts at which a material withstands 50 drops without tracking

Note 1 to entry: The value of each test voltage and the CTI should be divisible by 25.

[SOURCE: IEC 60050-212:2010, 212-11-59, modified – In the definition, the number of drops is specified and the text "and without a persistent flame occurring under specified test conditions" has been removed at the end of the definition. Note 1 to entry has been added.]

3.4
proof tracking index
PTI
numerical value of the proof voltage in volts at which an insulating material withstands 50 drops without tracking

[SOURCE: IEC 60050-212:2010, 212-11-60, modified – In the definition, the number of drops is specified. As a consequence, the words “can withstand in a specified tracking test without tracking failure and without a persistent flame occurring” have been deleted.]

3.5
material selection
process of assessing and choosing candidate materials for parts of components or subassemblies during the design stage of a product

4 General requirements

4.1 General

Before tests, the specimen is stored for at least 24 h in an atmosphere having a temperature between 15 °C and 35 °C and relative humidity between 45 % and 75 %, except for the test of Clause 7 where IEC 60112 applies.

Accessories within the scope of TC 23 standards, and those of its subcommittees, shall be designed and constructed so that, in normal use, their performance is reliable and safe for the user and the surroundings.

Standard conditions for operation in service for electrical accessories complying with the existing standards should be suitable for use at ambient temperatures not normally exceeding 40 °C, and whose average over a period of 24 h does not exceed 35 °C, with a lower limit of the ambient air temperature of −5 °C.

4.2 Standard conditions for operation in service

4.2.1 Ambient temperature

4.2.1.1 General

Unless covered by a temperature classification, accessories within the scope of TC 23 standards, and those of its subcommittees, should be at least capable of operating under the following standard conditions.

4.2.1.2 Ambient air temperature range in normal use

Electrical accessories complying with the existing standards are suitable for normal use at ambient temperatures not normally exceeding 40 °C, but their average over a period of 24 h does not exceed 35 °C, with a lower limit of the ambient air temperature of −5 °C.

NOTE This temperature range corresponds to AA4 of IEC 60364-5-51:2005, Table 51A. Part of the temperature range of IEC 60721-3-3, class 3K5, with the high air temperature restricted to 40 °C.

Accessories intended to be used in ambient air temperatures outside the above mentioned conditions permanently or during a long period shall be covered by special requirements or tests, if necessary, to be decided by each product committee.

4.2.1.3 Ambient air temperature range in cold climate

In areas where electrical accessories are to be used in cold or arctic climate, any tests may need to be performed in a suitable cold ambient temperature.

Product committees have the responsibility to evaluate if the accessories intended to be used in ambient air temperatures in cold climate permanently or during a long period shall be tested in a temperature corresponding to the climate area, for example AA3 or AA2 of IEC 60364-5-51:2005, Table 51A.

4.2.2 Altitude

Unless otherwise specified, the accessories are intended to be installed at an altitude not higher than 2 000 m.

4.2.3 Maximum relative humidity at 40 °C

Unless otherwise specified, the maximum relative humidity at the temperature of 40 °C is 50 %.

Higher relative humidity values are admitted at lower temperature (for example 90 % at 20 °C).

4.2.4 External magnetic field

Unless otherwise specified, the external magnetic field is considered not exceeding five times the Earth's magnetic field in any direction.

NOTE When an equipment is installed in proximity to a strong magnetic field, supplementary requirements can be necessary.

4.2.5 Accessory orientation

Unless otherwise specified, the mounting coordinates of the accessories with respect to the horizontal or vertical are as stated by the manufacturer, with a tolerance of 2° in any direction.

4.3 Ambient air temperature range for testing

Unless otherwise specified, the tests are carried out at an ambient temperature of (20 ± 5) °C.

5 Resistance to heat

5.1 General

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering requirements and tests to determine the resistance to heat of accessories.

These recommendations are in accordance with IEC 60669-1.

The text includes two subclauses.

- Requirements (5.2).
- Tests (5.3).

For editing purposes, the order and the numbers may be altered if necessary.

5.2 Requirements

Accessories including enclosures, if any, shall be sufficiently resistant to heat.

Compliance is checked by the tests of 5.3.

5.3 Tests

5.3.1 Verification of resistance to heat:

a) for surface mounting boxes, separable covers, separable cover plates and separable frames, by the test of 5.3.4;

b) for accessories, with the exception of the parts, if any, covered by a), by the tests of 5.3.2, 5.3.3 and, with the exception of the accessories made from natural or synthetic rubber or a mixture of both, by the test of 5.3.4.

5.3.2 The specimens are kept for 1 h in a heating cabinet at a temperature of 100 °C ± 2 °C.

During the test, they shall not undergo any change impairing their further use, and sealing compound, if any, shall not flow to such an extent that live parts are exposed.

After the test and after the specimens have been allowed to cool down to approximately room temperature, there shall be no access to live parts which are normally not accessible when the specimens are mounted as in normal use, even if probe B of IEC 61032 is applied with a force not exceeding 5 N.

After the test, markings shall still be legible.

Discoloration, blisters or slight displacement of the sealing compound is disregarded provided that safety is not impaired within the meaning of the relevant standard.

5.3.3 *Parts of insulating material necessary to retain current-carrying parts and parts of the earthing circuit in position are subjected to a ball-pressure test according to IEC 60695-10-2:2014, except that the insulating parts necessary to retain the earthing terminals in a box shall be tested instead to the test as specified in 5.3.4.*

A current-carrying part or a part of the earthing circuit retained by a mechanical means is considered to be retained in position. The use of grease or the like is not considered to be mechanical means.

In case of doubt, to determine whether an insulating material is necessary to retain current-carrying parts and parts of the earthing circuit in position, the specimen is examined without conductors while held in all positions with the insulating material in question removed.

Before the test is started, the ball and the support on which the specimen shall be placed, are brought to the temperature specified. The part under test shall be placed on a 3 mm thick steel plate in direct contact with it, so as to be supported to withstand the test force.

When it is not possible to carry out the test on the specimens, the test shall be carried out on a piece at least 2 mm thick which is cut out of the specimen. If this is not possible, up to and including four layers, each cut out of the same specimen, may be used, in which case the total thickness of the layers should be not less than 2,5 mm.

The test load and the supporting means shall be placed within the heating cabinet for a sufficient time to ensure that they have attained the stabilized testing temperature before the test commences.

The test is made in a heating cabinet at a temperature of 125 °C ± 2 °C.

After 60^{+2}_{0} *min, the ball is removed from the specimen which is then cooled and treated according to Clause 7 of IEC 60695-10-2:2014.*

The diameter of the impression caused by the ball is measured in accordance with IEC 60695-10-2:2014 and shall not exceed 2 mm.

5.3.4 Parts of insulating material not necessary to retain current-carrying parts and parts of the earthing circuit in position, even though they are in contact with them, are subjected to a ball pressure test in accordance with 5.3.3, but the test is made at a temperature of 70 °C ± 2 °C or 40 °C ± 2 °C plus the highest temperature rise determined for the relevant part during the test of clause “Temperature rise test”, whichever is the higher.

6 Screws, current-carrying parts and connections (electrical and mechanical)

6.1 General

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering the requirements and tests of screws, current-carrying parts and connections (electrical and mechanical) of accessories.

These recommendations are in accordance with IEC 60669-1.

The text includes three subclauses as follows.

- Definitions (6.2).
- Requirements (6.3).
- Tests (6.4).

For editing purposes, the order and numbers may be altered, if necessary.

6.2 Types of screw

6.2.1 Thread-forming screw

A tapping screw having an uninterrupted thread which by screwing-in forms a thread by displacing material in the cavity.

An example of a thread-forming screw is shown in Figure 1.

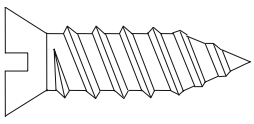


Figure 1 – Thread-forming screw

6.2.2 Thread-cutting screw

A screw having an interrupted thread which, by screwing-in, makes a thread by removing material from the cavity.

An example of thread-cutting screw is shown in Figure 2.

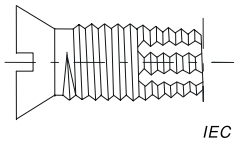


Figure 2 – Thread-cutting screw

6.3 Requirements

6.3.1 Connections, electrical or mechanical, using screws and nuts, shall withstand the mechanical stresses occurring in normal use.

Screws and nuts which transmit mechanical contact pressure for electrical continuity and conductor retention shall be of metal and shall be in engagement with a metal thread.

Screws for connecting external conductors shall be neither thread-cutting screws nor thread-forming screws.

Screws and nuts which are operated when mounting an accessory during installation, and/or which are likely to be operated during the life of the accessory, shall be in engagement with a metal thread or appropriate requirements shall be considered to ensure that they withstand the mechanical stresses occurring in normal use.

NOTE Screws and nuts which are operated when mounting the accessory include screws for fixing the cover of cover plates, etc., but not connecting means for screwed conduits and screws for fixing the base of the accessory.

Compliance is checked by inspection and by the test of 6.4.

6.3.2 For screws in engagement with a thread of insulating material and screws of insulating material, which are used for the installation of the accessory and/or which are likely to be operated during the life of the accessory, correct introduction of the screw into the screw hole or nut shall be ensured.

Screws of insulating materials shall not be used in cases when the replacement with metal screws could impair the insulation of the accessory.

Compliance is checked by inspection and by manual test.

The requirements with regard to correct introduction are met if introduction of the screw in a slanting manner is prevented, for example by guiding the screw by the part to be fixed, by a recess in the female thread or by the use of a screw with the leading thread removed.

6.3.3 Screws and rivets intended to be used for electrical connections and screws and rivets intended to be used for mechanical connection shall be locked against loosening or turning.

NOTE Spring washers can provide satisfactory locking. For rivets, a non-circular shank or an appropriate notch can be sufficient. Sealing compound which softens on heating provides satisfactory locking only for screw connections not subjected to torsion in normal use.

Compliance is checked by inspection and manual test.

6.3.4 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 no less suitable, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or yielding of the insulating material.

Compliance is checked by inspection.

NOTE The suitability of the material is considered with regard to the stability of the dimensions.

6.3.5 Current-carrying parts, including those of terminals (also earthing terminals), shall be of a metal having, under the conditions occurring in the equipment, mechanical strength, electrical conductivity and resistance to corrosion adequate for their intended use.

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

Examples of suitable metals, when used within a permissible temperature range and under normal conditions of chemical pollution, are:

– copper;
– an alloy containing at least 58 % copper for parts that are worked cold or at least 50 % copper for other parts;
– stainless steel containing at least 13 % chromium and not more than 0,09 % carbon;
– steel provided with an electroplated coating of zinc according to ISO 2081, the coating having a thickness of at least
  - 5 µm (ISO service condition 1) for ordinary equipment,
  - 8 µm (ISO service condition 2) for drip-proof and splash-proof equipment,
  - 12 µm (ISO service condition 3) for jet-proof and watertight equipment;
– steel provided with an electroplated coating of nickel and chromium according to ISO 1456, the coating having a thickness of at least
  - 10 µm (ISO service condition 1) for ordinary equipment,
  - 20 µm (ISO service condition 2) for drip-proof and splash-proof equipment,
  - 30 µm (ISO service condition 3) for jet-proof and watertight equipment;
– steel provided with an electroplated coating of tin, according to ISO 2093, the coating having a thickness equal to at least that specified for
  - 12 µm (ISO service condition 1) for ordinary equipment,
  - 20 µm (ISO service condition 2) for drip-proof and splash-proof equipment,
  - 30 µm(ISO service condition 3) for jet-proof and watertight equipment;

Parts which may be subjected to mechanical wear, shall not be made of steel provided with an electroplated coating.

– steel provided with an electroplated coating of zinc: only permitted for prime current-carrying parts if no fixed connection is intended to be made. For connection, an electroplated coating of zinc is permissible only on parts which do not participate directly in current transmission, such as screws or washers used for certain types of terminals in which they transmit only the contact pressure.

This requirement is not intended to apply to contacts, magnetic circuits, heating elements, bimetallic components, shunts, parts of electronic devices, etc.

NOTE Screws, nuts, washers, clamping plates and similar parts of terminals are not regarded as current-carrying parts.

Under moist conditions, metals having a great difference of electrochemical potential with respect to each other shall not be used in contact with each other.

Compliance is checked by inspection.

6.3.6 Thread-forming screws and thread-cutting screws shall not be used for the connection of current-carrying parts. Thread-forming screws and thread-cutting screws may be used to provide earthing continuity, provided that it is not necessary to disturb the connection in normal use and at least two screws are used for each connection.

Compliance is checked by inspection.

NOTE The use of thread-forming screws without displacement of material which are operated when mounting the accessory is under consideration.

6.4 Tests

Compliance with the requirements of 6.3.1 is checked by inspection and by the following test.

The screws and nuts are tightened and loosened:

- *10 times for metal screws in engagement with a thread of insulating material and for screws of insulating material;*
- *5 times in all other cases.*

Screws or nuts in engagement with a thread of insulating material and screw of insulating material are completely removed and re-inserted each time.

The test is made by means of a suitable test screwdriver or spanner applying a torque as shown in Table 1.

The shape of the blade of the test screwdriver shall suit the head of the screw for screws and nuts which are operated when mounting and connecting up the device by the following test.

The screws and nuts shall be tightened smoothly. In the case of a test on terminals, the conductor is moved each time the screw or nut is loosened.

Table 1 – Torque per thread diameter

Nominal diameter of thread mm			**Torque** Nm				
			I	**II**	**III**	**IV**	**V**
Up to and including 2,8			0,2	–	0,4	0,4	–
over	2,8 up to and including	3,0	0,25	–	0,5	0,5	–
over	3,0 up to and including	3,2	0,3	–	0,6	0,6	–
over	3,2 up to and including	3,6	0,4	–	0,8	0,8	–
over	3,6 up to and including	4,1	0,7	1,2	1,2	1,2	1,2
over	4,1 up to and including	4,7	0,8	1,2	1,8	1,8	1,8
over	4,7 up to and including	5,3	0,8	1,4	2,0	2,0	2,0
over	5,3 up to and including	6,0	1,2	1,8	2,5	3,0	3,0
over	6,0 up to and including	8,0	2,5	2,5	3,5	6,0	4,0
over	8,0 up to and including	10,0	–	3,5	4,0	10,0	6,0
over	10,0 up to and including	12,0	–	4,0	–	–	8,0
over	12,0 up to and including	15,0	–	5,0	–	–	10,0

Column I applies to screws without head if the screw when tightened does not protrude from the hole, and to other screws which cannot be tightened by means of a screwdriver with a blade wider than the diameter of the screw.

Column II applies to nuts of mantle terminals which are tightened by means of a screwdriver.

Column III applies to other screws which are tightened by means of a screwdriver.

Column IV applies to screws and nuts other than nuts of mantle terminals which are tightened by means other than a screwdriver.

Column V applies to nuts of mantle terminals which are tightened by means other than a screwdriver.

NOTE For mantle screws, the specific nominal diameter is that of the slotted stud.

For screws with a nominal diameter over 5,3 mm and having a head with a slot, the test is made twice, first applying to the hexagonal head the torque specified in column IV, and then on another set of specimens applying the torque specified in column III by means of a screwdriver.

For smaller screws having a hexagonal head with a slot, only the test with the screwdriver is made.

During the test, the screwed connection shall not work loose and there shall be no damage, such as breakage of screws or damage to the head slots, threads, washers or stirrups, that will impair the further use of the accessory.

7 Resistance to abnormal heat and to fire

7.1 General

Clause 7 is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering requirements and tests to determine the resistance to abnormal heat and to fire of combustible parts of electrotechnical equipment.

Subclauses 7.2 and 7.3 are meant to give to TC 23 and its subcommittees information on how to use IEC 60695-2-10:2013 and IEC 60695-2-11:2014.

NOTE IEC 60695-2-11:2014, Annex A gives guidance to assist TC 23 and its subcommittees to select the appropriate glow-wire temperature.

7.2 Requirements

Parts of insulating material of electrotechnical equipment which might be exposed to excessive thermal stress due to electric effects and the deterioration of which might impair the safety of the equipment shall not be unduly affected by heat and by fire generated within the equipment.

For certain accessories (e.g. switches, plugs, or others) the requirements apply to all parts of the insulating material, whereas for other accessories (e.g. circuit breakers), which have their insulating material submitted to severe resistance to fire tests, the requirements apply only to the external parts of the insulating material.

Parts of insulating material or of other solid combustible material which are liable to propagate flames inside the equipment may be ignited by glowing wires or glowing elements. Under certain conditions, for example a fault current flowing through a wire, overloading of components, and bad connections, certain elements may attain a temperature such that they will ignite parts in their vicinity.

NOTE In some subcommittees, only external parts are taken into account.

Compliance is checked by the glow-wire test according to 7.3.

7.3 Glow-wire flammability test for end-products, IEC 60695-2-11

7.3.1 Purpose and principle

7.3.1.1 General

The glow-wire is a specified loop of resistance wire, which is electrically heated to a specified temperature. The test apparatus is described in IEC 60695-2-10.

When selecting test temperatures, product committees should consider Annex B, which gives suggested glow-wire end-product test (GWEPT) temperatures.

The purpose of IEC 60695-2-11 is to ensure that, under defined conditions, the glow-wire does not cause ignition of parts, and that a part, if ignited, has a limited duration of burning without spreading fire by flames or by burning or glowing particles falling from the test specimen.

The glow-wire end-product test (GWEPT) shall be conducted on a complete end-product chosen so that the conditions of the test will not be significantly different from those occurring in normal use.

If parts of an end-product are dedicated to different glow-wire temperatures, this has to be identified and tested accordingly.

The glow-wire flammability test method is not feasible for small parts (see Figure 3). This is because such parts cannot be effectively supported to avoid heat losses (see 4.4 of IEC 60695-2-11:2014), and they are not able to accommodate the penetration of the glow-wire.

The glow-wire flammability test is not necessary for single parts of insignificant mass.

Recommendations for small parts and for parts of insignificant mass are given in 7.3.1.2 and 7.3.1.3, respectively.

7.3.1.2 Recommendations for small parts

For small parts which cannot be assessed in accordance with IEC 60695-2-11:2014 (GWEPT), TC 23 and its subcommittees should consider if these small parts need to be tested and, if required, what is the appropriate test.

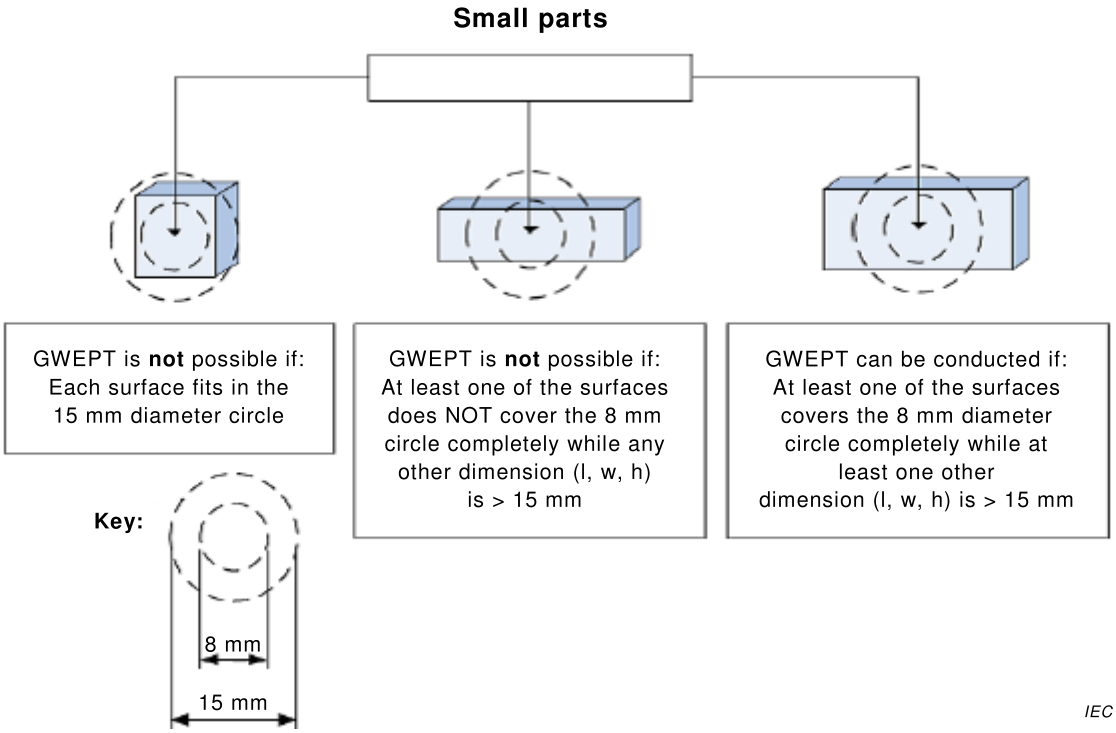


Figure 3 – Small parts

7.3.1.3 Recommendations for parts of insignificant mass

As part of the fire hazard assessment, consideration should be given to parts of insignificant mass, which are those parts having insufficient combustible material to constitute a fire hazard.

TC 23 and its subcommittees shall assign a maximum value for the insignificant mass appropriate to the relevant electrical equipment and its scale.

NOTE According to IEC 60695-2-11:2014, the default value is 2 g, but product TCs can assign a different value (e.g. 1 g) appropriate to the product type and scale.

However, if the product is composed of several parts of insignificant mass, they may represent a significant amount of combustible material; therefore this scenario should be evaluated carefully by TC 23 and its subcommittees.

7.3.2 Test method

The tip of the heated glow-wire is brought into contact with a test specimen for a specific period of time and a range of observations and measurements are made, depending upon the particular test procedure.

The tip of the glow-wire is applied horizontally to the part of the test specimen which is likely to be subjected to thermal stresses in normal use.

7.3.3 Relevance of test data

This test identifies a pass/fail criterion at a temperature specified by the relevant product committee. The main use of the test by electrotechnical committees is to ensure the suitability of insulating materials in contact with live parts or electrical connections that might overheat due to a fault. The aim is to ensure that possible ignition of the insulating material does not cause a fire to spread from the product.

Overheating of the electrical connection can cause ignition in the product but, on removal of the fault current, an insulating material which has passed the test would be expected to self-extinguish. Therefore, although the product can have been rendered unusable, flame spread is unlikely to have occurred and so the user and other property will not have been put at risk from fire.

As well as checking the integrity of the supporting insulating material, the test also records whether flaming or molten droplets fall onto a specified surface below. In a large product this would be assessed by placing below the test specimen a sample of the material that would, in normal use, be subjected to the droplets. If this layer was not damaged and contained the molten material then this would be considered satisfactory. When there is no surface to trap the droplets, and they are likely to escape from the product (for example onto a flammable surface) then a standard sheet of wrapping tissue on a wooden board is used.

This test also records whether or not the material ignites and can provide further data by measuring the flame height. Flame height is difficult to measure and so some product committees note that ignition has occurred and then assume a standardized zone above the area of the live part or electrical connection to carry out further tests. This is known as consequential testing and it may be carried out using the needle flame test.

8 Resistance of insulating materials to tracking

8.1 General

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering requirements and tests to determine the resistance of insulating material to tracking. Subclauses 8.2 and 8.3 give information on how to use IEC 60112.

8.2 Requirements

For accessories higher than IPX0 where tracking paths can be formed across insulating material, this material shall be resistant to tracking. For materials other than ceramics, compliance is checked by the test of IEC 60112.

8.3 Tracking index test, IEC 60112

8.3.1 Purpose and principle

IEC 60112 specifies the method of test for the determination of the proof tracking index and the comparative tracking index of solid insulating materials on pieces taken from parts of equipment and on plaques of material using alternating voltages. The standard also provides for the determination of electrical erosion when required.

8.3.2 Test method

The upper surface of the test specimen is supported in an approximately horizontal plane and subjected to an electrical stress via two platinum electrodes, 4 mm apart, using an AC voltage of between 100 V and 600 V. The surface between the electrodes is subjected to a succession of drops of electrolyte either until an over-current device operates, or until ignition and a persistent flame occurs, or until the test period has elapsed.

The test specimen shall be substantially flat, at least 3 mm thick, and have an area sufficient to ensure that during the test no liquid flows over the edges of the test specimen: 20 mm × 20 mm is recommended as a minimum size.

The individual tests are of short duration (less than 1 h) with up to 50 or 100 drops of about 20 mg of electrolyte falling at 30 s intervals. The number of drops needed to cause failure usually increases with decreasing applied voltage and, below a critical value, tracking ceases to occur.

During the test, the specimen may also erode or soften, thereby allowing the electrodes to penetrate it. If required, electrical erosion is measured. If a hole is formed, this is reported.

8.3.3 Relevance of test data

The test discriminates between materials with relatively poor resistance to tracking, and those with moderate or good resistance, for use in equipment which can be used under moist conditions.

NOTE More severe tests of longer duration can be required for the assessment of performance of materials for outdoor use, utilizing higher voltages and larger test specimens – see the inclined plane test, IEC 60587.

9 Resistance to rusting

9.1 General

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering requirements and tests to determine the resistance to rusting of ferrous parts of accessories.

These recommendations are based on IEC 60669-1.

The text comprises two subclauses.

- Requirements (9.2).
- Test (9.3).

For editing purposes, the order and numbers may be changed if necessary.

9.2 Requirements

Ferrous parts, including covers and boxes, shall be adequately protected against rusting.

Compliance is checked by the test of 9.3.

9.3 Test

All grease is removed from the parts to be tested by immersion in a degreasing agent, for 10 min ± 0,5 min.

The parts are then immersed for 10 min ± 0,5 min in a 10 % solution of ammonium chloride in water at a temperature of 20 °C ± 5 °C.

Without drying, but after shaking off any drops, the parts are placed for 10 min ± 0,5 min in a box containing air saturated with moisture at a temperature of 20 °C ± 5 °C.

After the parts have been dried for 10 min ± 0,5 min in a heating cabinet at a temperature of 100 °C ± 5 °C, their surface shall show no signs of rust.

NOTE 1 Traces of rust on sharp edges and any yellowish film removable by rubbing are ignored.

NOTE 2 For small springs and the like, and for inaccessible parts exposed to abrasion, a layer of grease can 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.

CAUTION – When using the liquids specified for the test, adequate precautions appropriate to the foreseeable risks shall be taken.

10 Legibility, durability and indelibility of marking

10.1 General

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering the requirements and tests to determine the legibility, durability and indelibility of markings on accessories.

Products complying with a previous edition of the standard need not be tested again as this requirement does not have impact on the safety of the product.

The text includes two subclauses.

- Requirements (10.2).
- Test (10.3).

10.2 Requirements

Marking shall be easily legible, durable and indelible.

Laser marking directly on the product and marking made by moulding, pressing or engraving are not subjected to this test.

Compliance is checked by inspection, using normal or corrected vision, without additional magnification and, if necessary, by the test of 10.3.

10.3 Test

The test is made by rubbing the marking for 15 s with a piece of cotton cloth soaked with water and again for 15 s with a piece of cotton cloth soaked with n-hexane 95 % (Chemical Abstracts Service Registry Number, CAS RN, 110-54-3).

NOTE n-hexane 95 % (Chemical Abstracts Service Registry Number, CAS RN, 110-54-3) is available from a variety of chemical suppliers as a high pressure liquid chromatography (HPLC) solvent.

When using the liquid specified for the test, precautions as stated in the relative material safety datasheet provided by the chemical supplier shall be taken to safeguard the laboratory technicians.

The marking surface to be tested shall be dried after the test with water.

Rubbing shall commence immediately after soaking the piece of cotton, applying a compression force of (5 ± 1) N at a rate of about one cycle per second (a cycle comprising a forward and backward movement along the length of the marking). For markings longer than 20 mm, rubbing can be limited to a part of the marking, over a path of at least 20 mm length.

The compression force is applied by means of a test piston which is wrapped with cotton comprising cotton wool covered by a piece of cotton medical gauze.

The test piston shall have the dimensions specified in Figure 4 and shall be made of an elastic material which is inert against the test liquids and has a Shore-A hardness of 47 ± 5 (for example synthetic rubber).

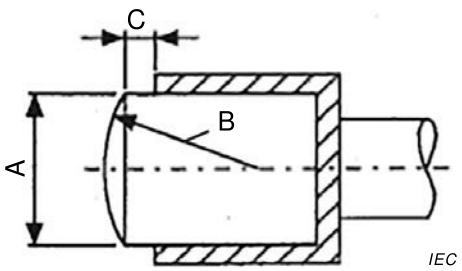
The following tolerances to dimensions A, B and C apply:

A: $^{+2}_{0}$ mm

B: ±0,5 mm

C: $^{+1}_{0}$ mm

When it is not possible to carry out the test on the specimens due to the shape/size of the product, a suitable piece having the same characteristics as the product can be submitted to the test.



Dimensions mm		
A	B	C
20	20	2

Figure 4 – Test piston dimensions

11 Screw-type terminals for connecting conductors

This guidance is applicable to relevant clause(s) of TC 23 standards, and those of its subcommittees, covering requirements and tests to screw terminals for the connection by screw clamping only of one or more rigid (solid or stranded) or flexible conductors conforming to IEC 60228 (having a normal cross-sectional area not exceeding 35 mm^2 and 25 mm^2, respectively).

The requirements and tests given in the IEC 60999 series, IEC 60998-1 and IEC 60998-2-1, having the status of group safety publications in accordance with IEC Guide 104, shall apply.

12 Criteria for tests in accessory standards

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering the requirements and tests to determine the criteria for tests in accessory standards.

Unless otherwise stated, three samples are subjected to all the tests and the requirements are satisfied if all the tests are met. If only one of the samples does not satisfy a test due to an assembly or manufacturing fault, that test and any preceding one which may have influenced the results of the test shall be repeated and also the tests which follow shall be made in the required sequence on another full set of samples, all of which shall comply with the requirements.

13 Tolerances

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering the requirements and tests to determine tolerances. When defining tolerances, Subcommittees should:

- for each critical set value, give the values based on a case by case analysis;
- be realistic in relation to the environment and accuracy of the measurement equipment as given in the last version of CTL 251.

When test values of the test quantities are given with tolerances, it is important that the actual value for the test is as close as possible to the given value.

14 Mechanical strength

14.1 Impact

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering requirements and tests to determine the ability of an accessory to withstand specified severities of impact and to demonstrate an acceptable level of robustness when assessing the safety of an accessory.

NOTE These recommendations are based on IEC 60068-2-75.

14.2 Free fall

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering requirements and tests to simulate falls which an accessory, normally in the unpacked state, could undergo during handling. These recommendations are based on IEC 60068-2-31.

Subcommittees should apply the appropriate test of IEC 60068-2-75 and/or IEC 60068-2-31 to the relevant accessory.

15 Appropriate dimensioning of insulation distances

15.1 General

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering requirements and tests to determine the dimensioning of clearances, creepage distances and solid insulation for equipment.

TC 23 subcommittees, when considering insulation distances, should cover the relevant requirements and testing procedures, consistently with the IEC 60664 series of standards, according to their needs.

Requirements provided within the basic safety standards for insulation coordination published as the IEC 60664 series are a minimum.

15.2 General information

Insulation coordination for equipment implies the assessment of the minimum necessary dimensioning for clearances, creepage distances and solid insulation in order to allow a safe use of the equipment during its lifetime by taking into consideration the foreseeable environment conditions.

The main standards in the field of insulation coordination are:

- IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*
- IEC 60664-3, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*
- IEC 60664-4, *Insulation coordination for equipment within low-voltage systems – Part 4: Consideration of high-frequency voltage stress*
- IEC 60664-5, *Insulation coordination for equipment within low-voltage systems – Part 5: A comprehensive method for determining clearances and creepage distances equal to or less than 2 mm*

In addition to the above mentioned standards, IEC TR 60664-2-1 is a useful document helping to correctly understand and apply IEC 60664-1, IEC 60664-3, IEC 60664-4 and IEC 60664-5.

In particular, IEC TR 60664-2-1:2011, Clause 5, introduces four practical examples showing appropriate dimensioning of insulation within equipment.

Information for correctly understanding the “Basic principles” and “Coordination of overvoltage categories inside equipment” according to the IEC 60664 series are provided in IEC TR 60664-2-1:2011, 4.1 and 4.2.

The main parameters to be taken into account for the understanding of the insulation coordination series of standards are:

- the maximum voltage stress to be withstood in order to avoid flashover;
- the frequency of the voltage. Because dielectric losses are becoming increasingly important with the voltage frequency, it has to be noted that IEC 60664-4 is applicable where the frequency is higher than 30 kHz;
- the characteristics of the solid insulating material;
- the environmental conditions (pollution degree and humidity levels).

NOTE The presence of humidity is an influencing factor whose effect is becoming increasingly important with the decrease of the creepage distance. IEC 60664-5 introduces the humidity levels regarding the effects of humidity on creepage distances equal to or less than 2 mm. It is possible to provide protection against pollution (including humidity) with coating, potting or moulding as described in IEC 60664-3.

Other stresses such as heat, vibration, mechanical shocks, radiation, etc. can influence the insulation resistance of insulation materials. TC 23 subcommittees have to consider the risks related to these stresses when specifying conditions for testing equipment to be used under particular situations.

15.3 Dimensioning of clearances

Information for correctly dimensioning clearances according to the IEC 60664 series is given in IEC TR 60664-2-1:2011, 4.3.

The explanations below can assist with the understanding.

The dimensioning of clearances aims to choose an air distance able to withstand the maximum peak voltage through the air gap between two parts at different voltages. According to the Paschen law, the ability of air to withstand a maximum voltage value is related to air pressure. Tables F.2 and F.7 of IEC 60664-1:2007 have therefore been drafted up to 2 000 m. An altitude correction factor is given in IEC 60664-1:2007, Table A.2 for different altitudes.

The pollution degree does not have a strong influence on clearances. It can be observed from Table F.2 of IEC 60664-1:2007 that, above a certain minimum value, the same distances are given for clearances whatever the chosen pollution degree. However, the pollution degree cannot be ignored for small clearances where pollution such as solid particles, dust and water could bridge the air gap.

15.4 Dimensioning of creepage distances

Information for correctly dimensioning creepage distances to avoid failure due to tracking according to the IEC 60664 series is given in IEC TR 60664-2-1:2011, 4.4.

The explanations below can assist with the understanding.

a) It has to be understood that pollution at the surface of a material is generally not conductive.

However presence of water at the surface of the material modifies the conductivity of the pollution. A higher conductivity allows circulation of current at the surface of the materials either between live parts or between live parts and earth. These currents are called tracking currents. During drying out the tracking current will break causing surface scintillation whose high temperature (around 1 200 °C) is at the origin of degradation of the surface of the insulation material. This phenomenon entails tracking.

Pollution degree 4 cannot be used for the dimensioning of creepage distances since the surface is continuously conductive.

b) There are some materials such as ceramics and glasses which do not track because the scintillation cannot break the chemical bonds at the surface of the material. The experience has shown that materials having a higher relative performance in terms of tracking also have approximately the same relative ranking according to the comparative tracking index (CTI). The CTI can be measured with the method given in IEC 60112.

For practical reasons, IEC 60664-1 introduces the following four different material groups:

– material group I: 600 ≤ CTI;

– material group II: 400 ≤ CTI < 600;

– material group IIIa: 175 ≤ CTI < 400;

– material group IIIb: 100 ≤ CTI < 175.

According to IEC TR 60664-2-1:2011, 4.4.4, the creepage distances shown in Table F.4 of IEC 60664-1:2007 have been determined for insulation intended to be under continuous voltage stress for a long time.

TC 23 and its subcommittees responsible for equipment in which insulation is under voltage stress for only a short time may consider allowing reduced creepage distances than those specified in Table F.4 of IEC 60664-1:2007.

Creepage distances of basic and supplementary insulation are selected from Table F.4 of IEC 60664-1:2007 taking into account the maximum nominal voltage of the supply low-voltage mains powering the equipment and the foreseeable pollution degree.

NOTE In TC 23 pollution degree 2 (PD2) is generally applied.

Creepage distance for reinforced insulation is twice the creepage distance for basic insulation from Table F.4 of IEC 60664-1:2007.

c) During the dimensioning of a creepage distance two situations can be considered:

1) Either the creepage distance selected from Table F.4 of IEC 60664-1:2007 is greater than the associated clearance so that no impulse withstand voltage test is necessary, or

2) the creepage distance selected from Table F.4 of IEC 60664-1:2007 associated with the clearances is designed between case A and case B values according to Tables F.2 and F.7 of IEC 60664-1:2007, so that an impulse withstand voltage test is required in order to check that no flashover occurs over the associated clearance.

When the electric field is homogeneous Tables F.2 and F.7 of IEC 60664-1:2007 give the shortest clearance allowing the highest voltage to be withstood. It is therefore not possible to reduce the creepage to a lower value than the clearance value from Tables F.2 and F.7 of IEC 60664-1:2007. However in practice the electric field is always somewhere between the best case homogenous (case B) and the worst case inhomogeneous (case A), as described in Tables F.2 and F.7 of IEC 60664-1:2007. It is therefore probable that the actual electrical field conditions over the clearance associated with the creepage distance allow the maximum voltage stress to be withstood. This has to be checked with an impulse voltage test.

In addition,

- it is physically impossible for a creepage distance to be smaller than the associated clearance, and

- the creepage distance required in accordance with Table F.4 of IEC 60664-1:2007 may be larger than the associated clearance selected in accordance with the appropriate requirements for inhomogeneous fields elsewhere in IEC 60664 standards.

As a consequence, if

- the permitted creepage distance is less than the requirement for the associated clearance and
- the physically measured clearance is less than the required clearance for inhomogeneous fields,

then a test is necessary to confirm that no flashover will occur across the clearance.

15.5 Dimensioning of solid insulation

Information for correctly dimensioning solid insulation according to the IEC 60664 series is given in IEC TR 60664-2-1:2011, 4.5

The explanations below can assist with the understanding.

The electrical field stress and dielectric losses through the solid insulation regarding the risk of partial discharges have to be considered. In particular subcommittees have to consider a partial discharge test if the peak value of the voltage across the insulation material is higher than 700 V with a voltage field stress above 1 kV/mm (see IEC 60664-1:2007, 6.1.3.1).

15.6 Dimensioning of functional insulation

Information for correctly dimensioning functional insulation according to the IEC 60664 series is given in IEC TR 60664-2-1:2011, 4.6.

15.7 Practical application of the IEC 60664 series with regards to particular questions

Information for correctly applying the IEC 60664 series with regards to particular practical questions such as

- testing complete equipment in case of components bridging the basic insulation,
- testing complete equipment in case of components bridging the functional insulation,
- dimensioning of insulation distances for parts of equipment which can have isolation capability,
- testing with respect to high frequency voltage stress, and
- practical information in case of substitution of an impulse withstand test by an AC or DC test

is given in IEC TR 60664-2-1:2011, 4.7. It can be helpful for TC 23.

15.8 Other information useful for TC 23 and its subcommittees

Most of the equipment covered in the scope of TC 23 is intended to be used under pollution degree 2.

IEC 60664-1 introduces the four following pollution degrees ranked according to the presence of pollution and water on the surface of the material for evaluating clearances and creepage distances.

- *Pollution degree 1*

  No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

- *Pollution degree 2*

Only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is to be expected.

- *Pollution degree 3*

  Conductive pollution occurs or dry non-conductive pollution occurs which becomes conductive due to condensation which is to be expected.

- *Pollution degree 4*

  Continuous conductivity occurs due to conductive dust, rain or other wet conditions.

Most of the equipment covered by the scope of TC 23 is directly connected to the public supply system.

The rated impulse voltages given in Table F.1 should be in accordance with the appropriate overvoltage category.

Equipment with an impulse withstand voltage corresponding to overvoltage category I should not have direct connection to a public supply system.

The rated impulse voltages given in Table F.1 are considered as the maximum values that any equipment directly connected to the mains should withstand when equipment is subjected to an overvoltage through the public network.

In general, category III is used for equipment for fixed installation and category II for portable accessories.

NOTE 1 The higher value of temporary overvoltage for equipment connected to the mains is given in IEC 60664-1:2007, 5.3.3.2.3. For short term temporary overvoltages, the minimum withstand value is U_n + 1 200 V, where U_n is the nominal line-to-neutral voltage of the neutral-earthed supply system.

The peak value of steady-state voltages and of this short-term temporary overvoltage for equipment connected to a 230/400 V three phase system is generally lower than the required impulse voltage for overvoltage category III as given in IEC 60664-1:2007, Table F.1. Therefore overvoltage category III equipment within the scope of TC 23 is generally not concerned with Table F.7.

NOTE 2 Below an example is given and can be generally considered applicable for most of the products within the scope of TC 23 and its subcommittees:

Fixed installation:

Overvoltage category III.

Pollution degree 2

Components for electrical equipment and portable accessories:

Overvoltage category II or III.

Pollution degree 2 or 3

IEC TR 60664-2-1:2011, 4.3.2.1 provides relevant information and should be read. In particular Note 5, and the example given in Note 5, can provide valuable explanations for TC 23 and its subcommittees.

16 Resistance to UV

16.1 General

This guidance is applicable to the relevant clause(s) of TC 23 standards, and those of its subcommittees, covering requirements and tests to determine the resistance of products to ultraviolet (UV) radiation.

A UV test is necessary in case safety problems are created by the degradation of plastic material after exposure to UV radiation.

16.2 Basic principles

Requirements for resistance to UV radiation apply only to enclosures and external parts of accessories intended for outdoor application directly exposed to solar radiation and which are constructed of plastic or elastomeric materials or metals that are coated with plastic or elastomeric material.

The characteristics of the products which risk being lost due to UV stress can include:

- protection against electric shock;
- protection against mechanical stresses;
- protection against ingress of foreign objects and water;
- flammability and ignition.

However the protection against mechanical stresses is considered to be the most critical characteristic.

Therefore, depending on the product, the relevant mechanical test shall be applied to verify the behaviour of a product after it has been subjected to its relevant UV test.

Therefore it follows, based on the guidance given by this document, that all the necessary verification should be defined by TC 23 subcommittees in order to make sure that products maintain their safety characteristics.

Where a UV requirement is provided, in addition it is recommended to include a classification as follows:

According to resistance to UV radiation:

- not declared;
- resistant to UV radiation.

An indication concerning the compliance of the products with respect to UV shall at least be reported in the manufacturer's literature.

16.3 Tests

16.3.1 General

If products are intended to be resistant to UV radiation, the UV test and the relevant mechanical test shall be done on a complete end-product.

At the discretion of the manufacturer, if the test cannot be performed on complete end-product (for example, due to dimensional reasons), the test can be performed on a representative part taken from the product. A representative specimen manufactured with the same manufacturing process as used for the end-product can be used if the end-product has dimensions and/or shape which do not allow the mechanical test to be performed.

16.3.2 UV test

Any part of enclosures and external parts of accessories directly exposed to solar radiation and which are constructed of plastic or elastomeric materials or metals that are entirely coated with plastic or elastomeric material are subjected to the UV test.

Three samples shall be exposed for 500 h to Xenon-arc, Method A, Cycle 1 in accordance with ISO 4892-2.

The chamber temperature shall be maintained at (38 ± 3) °C and the relative humidity at (50 ± 10) %.

The following special requirement applies during the rain cycle: the relative humidity can deviate from (50 ± 10) %.

NOTE Subcommittees can introduce a more detailed classification including higher exposure time, with steps of 500 h.

There shall be continuous exposure to light and intermittent exposure to water spray. The cycle shall consist of 102 min without water spray and 18 min with water spray. The apparatus shall operate with a water-cooled or air-cooled xenon-arc lamp having borosilicate glass inner and outer daylight filters, a spectral irradiance of (0,51 ± 0,02) W/(m^2·nm) at 340 nm and a black-standard temperature of $\left(65^{+3}_{-3}\right)$ °C.

If the irradiance varies between various parts of the sample, subcommittees should specify where the required irradiance is to be applied.

When an end-product is not used for the tests, a part taken from it or a representative specimen manufactured with the same manufacturing process as used for the end-product having dimensions suitable for the applicable mechanical test and a thickness not greater than the minimum thickness of any exposed part of the accessory shall be used.

Samples shall be mounted in the UV apparatus in an appropriate manner,

- suitable for both the product to be tested and the test equipment and
- so that the samples do not touch each other.

16.3.3 Mechanical test

Subcommittees should identify which is the most appropriate mechanical test (for example impact, pull, loop tensile strength, etc.) to be applied to the accessory or to the specimens subjected to UV test, intended to verify that the safety characteristics are maintained.

Annex A
(informative)

Material selection process

A.1 General

It has been agreed by TC 23 that material selection is part of the product design process. Product standards provide requirements and testing procedures for testing the product whatever the design. Any design is acceptable as long as the end-product test is passed.

It is intended that subcommittees refer to Clause 7 when writing requirements and tests in relation to the resistance to abnormal heat and to fire.

Annex A is intended to be a guide in the process of assessing and selecting insulating materials. It describes how material selection provides comparative test methods to evaluate the performance of a test specimen and how the data evaluated in the material selection process can be used in the selection of materials for parts during the design stage of a product. It further describes how standardized test methods can play a useful part in the decision making processes intended to minimize fire hazards in electrical accessories.

A.2 Requirements for material selection process

The acceptability of an insulating material for a particular application can be determined by a material selection process which uses data deriving from relevant standardized test methods on specified material test specimens. The grading and classification obtained from a comprehensive material assessment process may be used to specify the basic minimum performance of materials used in products.

One objective of the material selection is to reduce product fire hazard risks (see IEC 60695-1-30).

The properties required by individual components and sub-assemblies are determined by their function and the related dimensions and requirements of the final product. The selection and magnitude of these properties will be dependent upon the details of reasonable foreseeable use, abuse and environmental exposure.

An integral element of material selection is the acquisition of relevant information regarding a material’s characteristics. This knowledge can be acquired from an analysis of data obtained from standardized test methods conducted on specified test specimens.

The material selection process should describe how standardized test methods may be used in decision-making processes to minimize the fire hazards in electrical accessories. The material selection process should take into account the relevant features of the product, since the actual performance of the material may be affected by various factors and constructional characteristics.

Consequently, a material selection procedure to assess the adequate performance of a final product requires test data on materials for parts used in components and sub-assemblies and should take into account all of the relevant features (for example, the environmental conditions, association with other items, and possible ignition sources).

A.3 Material selection process

A.3.1 Material selection based on flammability classifications

The first step for the material selection process of parts of insulating material necessary to retain current-carrying parts and parts of the earthing circuit in position is to determine the flammability classification according to IEC 60695-11-10 or GWFI (glow-wire flammability index*)* classification according to IEC 60695-2-12.

The second step, depending upon the flammability classification of the material as specified in Table A.1 or GWFI classification as specified in Table A.2, is to verify the conformity with the corresponding values of GWIT (glow-wire ignition temperature) using samples of the selected material.

The samples to be used for the material selection process are selected with a thickness not greater than the minimum thickness of the part of the product where it will be subjected to the glow-wire test according to IEC 60695-2-11.

Table A.1 – Minimum glow-wire ignition temperature (GWIT) of insulating materials required for the flammability classification of the selected material

Flammability classification: IEC 60695-11-10	V0	V-1	V-2	HB
GWIT (IEC 60695-2-13) [°C]	650	650	700	725

Table A.2 – Minimum glow-wire ignition temperature (GWIT) of insulating materials required for the GWFI classification of the selected material

GWFI Classification: IEC 60695-2-12	960	850	750
GWIT (IEC 60695-2-13) [°C]	650	700	725

The description of test methods is given in IEC 60695-2-12, IEC 60695-2-13, IEC 60695-11-10 and A.3.2.

A.3.2 Arc ignition test

The following AI test (arc ignition test) shall be applied with the appropriate number of arcs in relation to the classification chosen in A.3.1.

Table A.3 – Minimum number of arcs required for the flammability classification of the selected material

Flammability classification: IEC 60695-11-10	V0	V-1	V-2	HB
AI (minimum number of arcs to ignite)	15	15	30	60

Table A.4 – Minimum number of arcs required for the GWFI classification of the selected material

GWFI Classification: IEC 60695-2-12	960	850	750
AI (minimum number of arcs to ignite)	15	30	60

NOTE The minimum number of arcs related to the classification chosen, as shown in Tables A.3 and A.4, is based on historical test data provided by the US NC.

One electrode shall be stationary and the other movable. The stationary electrode shall consist of a 8 mm^2 to 10 mm^2 solid copper conductor having a horizontal chisel point with a total angle of 30°. The movable electrode shall be a 3 mm diameter stainless steel rod having a symmetrical conical point with a total angle of 60°, and shall be capable of being moved along its own axis. The radius of curvature for the electrode tips shall not exceed 0,1 mm at the start of a given test. The electrodes shall be located opposing each other, at an angle of 45° to the horizontal. With the electrodes short-circuited, the variable inductive impedance load shall be adjusted until the current is 33 A at a power factor of 0,5.

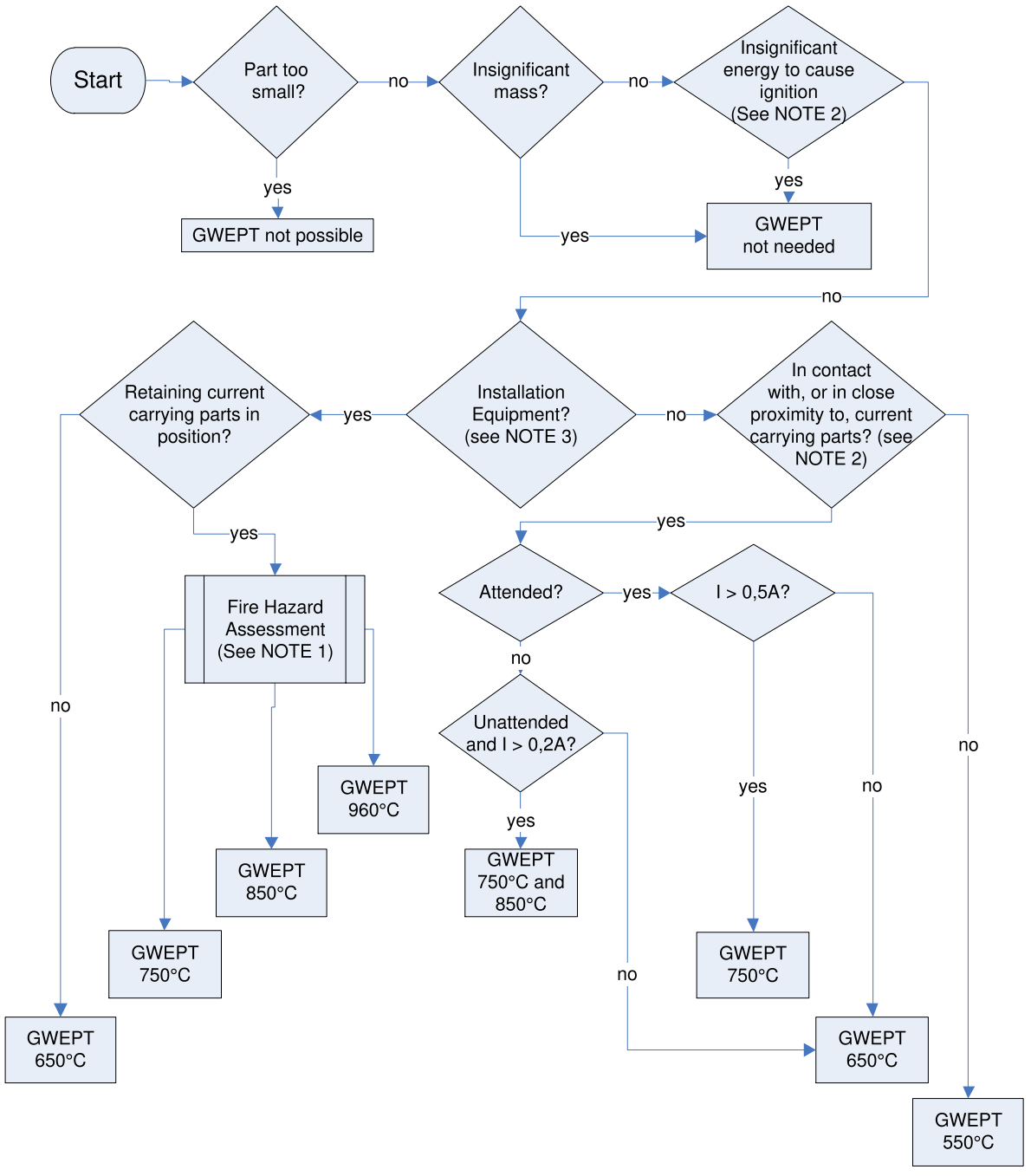
The samples under test shall be supported horizontally in air so that the electrodes, when touching each other, are in contact with the surface of the samples. The movable electrode shall be manually or otherwise controlled so that it can be withdrawn along its axis from contact with the stationary electrode to break the circuit, and lowered to remake the circuit, so as to produce a series of arcs at a rate of approximately 40 arcs per minute, with a separation speed of (250 ± 25) mm/s.

The test is to be continued until ignition of the samples occurs, a hole is burned through the sample, or a total of 200 cycles has elapsed.

The average number of arcs to ignition and the thickness of each sample shall be recorded. The arc ignition (AI) test value requirements related to the flammability classification or GWFI classification shall be in conformity with the corresponding values as specified in Table A.3 or Table A.4.

Annex B
(informative)

Suggested GWEPT temperatures



Key

I = rated current

A = amps

GWEPT = Glow Wire End Product Test

NOTE 1 A separate Fire Hazard Assessment (FHA) as determined by the relevant product standard will dictate the appropriate GWEPT temperature.

NOTE 2 The phrases “insufficient energy” and “close proximity” should be defined by the relevant product committee. It is dependent upon a number of factors (for example: the severity of the hazard).

NOTE 3 Examples of installation equipment include socket outlets, circuit protection devices, and LV switchgear.

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[1] Withdrawn.

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