DEAS 495-4: 2024

ICS 29.120.30

DRAFT EAST AFRICAN STANDARD

Plugs, socket-outlets, adaptors, and connection units — Part 4: fused connection units: Switched and unswitched

EAST AFRICAN COMMUNITY

Second Edition

Copyright notice

Contents

Page

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 054, *Electrical appliances, machines, and equipment.*

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

This second edition cancels and replaces the first edition (EAS 495-1), which has been technically revised.

DEAS 495 consists of the following parts, under the general title *Plugs, socket-outlets, adaptors and connection units*:

— *Part 1: Specification for rewirable and non-rewirable fused plugs*

— *Part 2: Specification for switched and unswitched socket outlets*

— *Part 3: Specification for adaptors*

— *Part: 13 A fused connection units: Switched and unswitched*

Plugs, socket-outlets, adaptors and connection units — Part 4: fused connection units: Switched and unswitched

1 Scope

This part of EAS 495 specifies requirements of up to 13 A fused fixed connection units for household, commercial and light industrial purposes, with particular reference to safety in normal use. The connection units are suitable for the connection of appliances, in a.c. circuits only, operating at voltages not exceeding 250 V r.m.s at 50 Hz.

Requirements are specified for connection units incorporating a fuse-link complying with EAS 496.

Requirements are specified for 13 A connection units with or without associated controlling switches, for flush mounting in suitable enclosures, e.g. boxes complying with EAS 203, or for surface or panel mounting. Connection units are intended for use with cables complying with IEC 60227 having copper conductors. Connection units with card outlets are additionally intended for use with flexible cords, complying with IEC 60245 or IEC 60227on the load (output) side.

This standard does not apply to connection units incorporating screwless terminals for the

connection of external conductors of the following types:

a) flat quick-connect terminals;

b) insulation-piercing connecting devices; and

c) twist-on connecting devices.

Certain installations require the inclusion of intumescent and acoustic pads and this might have an effect on the conformance of the connection unit to the requirements of this standard. This might influence temperature rise and internal clearances. Verification of suitability of the connection unit needs to be obtained from the manufacturer.

NOTE 1 The titles of the publications referred to in this standard are listed on the inside back cover.

NOTE 2 Requirements for electromagnetic compatibility are not given for the following reasons.

A connection unit does not emit intolerable electromagnetic interference since significant electromagnetic disturbances are only generated during insertion and withdrawal which are not continuous.

A connection unit is mechanical by nature of construction. The product is therefore immune from electromagnetic interference.

This standard applies to all connection Units in East African Region

2 Normative references

The following referenced documents are indispensable for the application of this East African Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EAS 496, General purpose fuse links for domestic and similar purposes (primarily for use in plugs) –Specification

IEC 60112, Method for the determination of the proof and the comparative tracking indices of solid insulating materials

ISO 9453, Soft solder alloys – Chemical compositions and forms

EAS 495-1, 13 A plugs, socket-outlets, adaptors and connection units — Part 1: Specification for rewirable and non-rewirable 13 A fused plugs.

EAS 495-2, 13A plugs, socket-outlets, adaptors arid connection units — Part 2: Specification for 13A switched and unswitched socket-outlets

EAS 495-3, 13 A plugs, socket-outlets, adaptors and connection units — Part 3: Specification for adaptors

EAS 203, Boxes for enclosure of electrical accessories — Specification

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

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

IEC 60245-8:1998+AMD1:2003+AMD2:2011 Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 8: Cords for applications requiring high flexibility

IEC 60695-2-10, Fire Hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure

EAS 370, Test probes to verify protection by enclosure

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

NOTE Where the terms voltage and current are used, they imply r.m.s values, unless otherwise stated.

3.1

fused connection unit

a device associated with the fixed wiring of an installation by which appliances may be connected, and having provision for a replaceable cartridge fuse-link

3.2

cord outlet connection unit

a fixed wiring device as in 3.1 having provision for a flexible cable or cord

3.3

switched connection unit

a fused connection unit as in 3.1 or 3.2, with an associated switch to disconnect the supply to both line and neutral load terminals

3.4

surface-mounted connection unit

a fused connection unit as in 3.1, 3.2 or 3.3, which is intended to be mounted on a wall or other flat surface without the need for recessing

3.5

flush-mounted connection unit

a fused connection unit as in 3.1, 3.2 or 3.3, which is intended to be mounted in a box which is recessed into a wall or other flat surface. The fused connection unit plate and the base are regarded as forming a complete unit, and the connection unit plate is mounted with its back either flush with a wall or other flat-surfaced structure, or flush with the front of a box or enclosure

3.6

panel-mounted connection unit

a fused connection unit intended for incorporation into equipment panels or electrical trunking and which depends upon such incorporation for its enclosure

3.7

connection unit base

that part of the fused connection unit which carries live parts. It may be integral with the fused connection unit plate

3.8

connection unit plate

the external plate which covers the base and live parts of a fused connection unit

3.9

actuating member

that part which is moved, e.g. pulled, pushed or turned by the user, to operate the switch mechanism

3.10

indicator lamp (pilot lamp)

a lamp which illuminates to indicate that the connection unit load terminals are energized

3.11

terminal

a means by which the user can make an electrical connection between the appropriate cable or flexible cord and the conducting parts of the connection unit without the use of special tools

3.12

screw-type terminal

a terminal in which the connection is made directly by means of screws or nuts of any kind or indirectly through an intermediate metal part such as a washer, clamping plate or anti spread device on which the screw or nut bears directly.

NOTE The following are examples of screw-type terminals.

a) A pillar terminal is a terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws.

b) A screw terminal is a terminal in which the conductor is clamped under the head of the screw.

c) A stud terminal is a terminal in which the conductor is clamped under a nut.

3.13

fuse carrier

a movable or removable part designed to carry, retain, cover and/or remove the fuse-link

3.14

type test

a test or series of tests made on a type test sample, for the purpose of checking compliance to the design of a given product with the requirements of the relevant standard

3.15

type test sample

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

3.16

accessible external surface of a connection unit

all surfaces of a fused connection unit which can be touched by test probe B of EAS 370 when the connection unit is installed as in use

3.17

live parts

current-carrying parts and those metal parts in contact with them during normal use

NOTE Metal parts of the earthing circuit are not considered to be current-carrying parts

3.18

fine wire thermocouple

a thermocouple having wires not exceeding 0.3 mm in diameter

3.19

calibrated link

a calibrated heat source for use in place of a fuse-link during temperature rise tests

3.20

creepage distance

the shortest distance along the surface of the insulating material between two conductive parts

3.21

clearance

shortest distance in air between two conductive parts

3.22

basic insulation

insulation applied to live parts to provide basic protection against electric shock

NOTE Basic insulation does not necessarily include insulation used exclusively for functional purposes.

3.23

supplementary insulation

independent insulation applied in addition to basic insulation, in order to provide protection against electric shock in the event of failure of basic insulation

3.24

reinforced insulation

a single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in the relevant standard

3.25

functional insulation

insulation between conductive parts which is necessary only for the proper functioning of the equipment

3.26

small parts

parts where each surface lies completely within a circle of 15 mm diameter or where some of the surface lies outside the 15 mm diameter circle but in such a way that it is not possible to place a circle of 8 mm diameter on any of this remaining surface

3. 27

screw-type terminal

terminal in which the connection is made directly by means of screws or nuts of any kind or indirectly through an intermediate metal part such as a washer, clamping plate or anti-spread device on which the screw or nut bears directly

NOTE The following are examples of screw-type terminals.

a) A pillar terminal is a terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws.

b) A screw terminal is a terminal in which the conductor is clamped under the head of the screw.

c) A stud terminal is a terminal in which the conductor is clamped under a nut.

3.28

insignificant mass

insufficient combustible mass to constitute a fire hazard

NOTE Parts of insignificant mass are usually less than 2 g.

3.29

isolation

function intended to make dead for reasons of safety all or a discrete section of the electrical installation by separating the electrical installation or section from every source of electrical energy

3.30

clamp type (screwless) terminal

terminal for the connection and subsequent disconnection of one or more conductor(s), the

connection being made directly or indirectly by means of springs, wedges or the like

4 General requirements and conditions of use

4.1 Connection units shall be so designed and constructed that in normal use their performance is reliable and minimizes the risk of danger to the user or to the surroundings. Such connection units shall be capable of meeting all the relevant requirements and tests specified in this part of EAS 495.

4.2 Fused connection units shall be suitable for use under the following conditions:

a) an ambient temperature in the range -5 °C to 45°C, the average value over 24 h not exceeding 30°C;

NOTE Under normal conditions of use, the available cooling air is subject to natural atmospheric variations of temperature and hence the peak temperature occurs only occasionally during the hot season, and on those days when it does occur it does not persist for lengthy periods.

b) a situation not subject to exposure to direct radiation from the sun or other source of heat likely to raise temperatures above the limits specified in a);

d) an atmosphere not subject to abnormal pollution by smoke, chemical fumes, rain, spray, prolonged periods of high humidity or other abnormal conditions. This is equivalent to pollution degree 2, see Annex E, and overvoltage category III, see Annex D.

5 General conditions for type testing

5.1 All tests shall be type tests.

Unless otherwise specified in this part of EAS 495, connection units shall be tested as delivered by the manufacturer or responsible vendor and under normal conditions of use, at an ambient temperature of 20 °C ± 5 °C, after being conditioned at normal laboratory temperature and humidity levels for at least 4 days.

Unless otherwise stated by the manufacturer, flush-mounted connection units shall be tested when mounted on a corresponding insulated box complying with EAS 203, the fixing screws being tightened with a torque of 0.6 N-m ± 5 %. Other types are mounted according to the manufacturer's instructions.

Connection units having a declared IP rating shall be tested as a complete assembly (connection unit and enclosure) when mounted in accordance with the manufacturer’s instructions and conditions of use.

Connection units used for the tests shall be representative of normal production items in respect of all details which may affect the test results.

Connection units shall be deemed to comply with this part of EAS 495 if no specimen fails in the complete series of tests given in Table 1.

Table 1 — Test schedule

Sequence	Samples	Test	Clause number
1	3	Inspection, measurement, and manipulation	5, 6, 7, 9, 11.1, 13 (13.1, 13.2, 13.3 and 13.4 only),
2	3	General	5, 10 19.1, 14.2, 13.5 (9.1.1 only), 20.1.3.
3	3		5, 14.1, 15, 13.5 (20.1.2 and 17.1.3 only), 17.1.2, 13.6, 16,21.3
4	3		5, 14.1, 15, 18,
5	3		5, 22
6	3	Materials	5, 23.2
7	3		5, 24, 21.3
8a)	27	Positive break	5, 13.6.2
9	3	Isolation	5, 15,2
10	3	Ingress protection	5, 13.9
11	3	Additional tests for connection units with screwless terminals	5, 14.1, 11.9

NOTE The order of tests given in sequence no. 1 is preferred but not mandatory except where required within the text of the appropriate clause.

[a] An additional new set of three samples prepared with the contacts closed is supplied by the manufacturer for this test.

If one specimen fails in the complete series of tests given in Table 1, then connection units of that type shall be deemed to have failed to comply with this part of EAS 495, unless the connection units can be shown to be not representative of normal production or design, in which case a further type test sample shall be submitted to the test or tests in that particular group. If there is no failure in this re-test then connection units of that type shall be deemed to comply with this Part of EAS 495.

If more than one specimen fails in the complete series of tests given in Table 1 then connection units of that type shall be deemed not to comply with this part of EAS 495.

For type testing, all tests have been included in the test schedule and shall be performed in the specified order.

NOTE 1 References to carrying out specific tests in various clauses are not intended to indicate a sequence of testing different to that in the schedule and should not be conducted as separate additional tests.

5.2 All inspections and tests, of any one classification (see Clause 6), shall be carried out as specified in the clauses listed in Table 1 on the number of specimens in the sample column and in the order given.

6 Classification and rating

6.1 Classification

Fused connection units shall be classified as follows:

6.1.1 according switching capacity

a)switched or unswitched;

b) flush or surface or panel-mounting;

6.1.2 According to method of mounting:

a) fixed flush;

b) fixed surface; or

c) fixed panel-mounting.

6.1.3 According to provision for outgoing flexible cable:

a) with outgoing flexible cable; or

b) without outgoing flexible cable.

6.1.4 According to indicator type:

a) with indicator lamp; or

b) without indicator lamp.

6.1.5 According to the IP rating if declared.

6.1.6 According to the type of terminal:

a) connection units with screw-type terminals;

b) connection units with screwless terminals for rigid conductors only; or

c) connection units with screwless terminals for rigid and flexible conductors.

6.2 Ratings

The rated current of all connection units shall be up to 13 A. The rated voltage of connection units shall 220 V up to and including 250 V.

7 Marking and labelling

7.1 Connection units shall be legibly and durably marked with the following information, which shall not be placed on screws, removable washers or other easily removable parts, or upon parts intended for separate sale:

a) either the name or trademark of the manufacturer or responsible vendor, which may be duplicated on a removable fuse carrier ;

b) b) the number of this East African Standard, i.e. EAS 495-4 (1)

c) terminals intended for the connection of the various conductors shall be identified by the symbols given in 7.2;

d) the words "FUSE" or "FUSED" or the symbol (given in 7.2) on the external accessible surface of a connection unit or fuse carrier;

e) all connection units shall be marked with:

1) rated current;
2) rated voltage;
3) nature of supply;
4) incoming (in or supply) terminals;
5) outgoing (out or load) terminals.

6) Rated frequency

f) for connection units with screwless terminals:

1) an appropriate marking indicating the length of insulation to be removed before insertion of the conductor into the screwless terminal;
2) an indication of the suitability to accept rigid conductors only for those connection units having this restriction;
3) an indication of the suitability to accept flexible conductors only for those connection units having this restriction; an

g) where the declared IP classification is higher than IP20 then the IP classification shall be marked. The marking shall be discernible when the connection unit is mounted and wired as in normal use.

7.1.1 Compliance shall be checked by inspection and by rubbing the markings for 15 s with a cloth soaked in water, and again for approximately 15 s with a cloth soaked in an aliphatic solvent hexane with a content of aromatics of maximum 0.1 % by volume, a kauri-butanol value of 29, initial boiling point approximately 69 °C and a relative density of approximately 0.68. The marking shall remain legible. Markings produced by an engraving or moulding process shall be deemed to comply without test.

[1] Marking EAS 495 on or in relation to a product represents a manufacturer's declaration of Compliance, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with second or third-party certification of Compliance. Further testing and Compliance certification remains at the discretion of the manufacturer and is not a requirement of this standard.

7.2 If symbols are used they shall be as follows

Parameters	**Symbols**
volts	V
alternating current	~
line	L
neutral	N
earth	(preferred) or
NOTE The letter "E" may be used in addition to either of these symbols.	
fuse	
For screwless terminals suitable for rigid conductors only	r
For screwless terminals suitable for flexible conductors only	f
Degree of protection, where relevant	IPXX

For the marking of the rated current and rated voltage of the connection unit figures may be used alone, the figures for the current rating being placed before or above that of the rated voltage and separated by a line. If a symbol for nature of supply is used, it shall be placed next to the marking for rated current and rated voltage.

Examples are as follows:

13 A 250V ∿ or 13/250 ∿ or $\frac{13}{250}$ ∿

or 13 A 250 V a.c. or 13/250 a.c. or $\frac{13}{250}$ a.c

8 Clearances, creepage distances and solid insulation

Fused connection units shall be constructed so that the clearances, creepage distances and solid insulation are adequate to withstand the electrical stresses taking into account the environmental influences that may occur. Clearances, creepage distances and solid insulation shall comply with the relevant subclauses 8.1, 8.2, 8.3. and 8.4

The distance between lead wires in the pinch of a neon lamp with external resistor shall be a minimum of 1 mm. Connection units complying with the requirements for basic insulation shall be deemed to meet the requirements of this clause. If the manufacturer declares an insulation level exceeding basic insulation then the connection unit shall be tested accordingly.

NOTE 2 The requirements and tests are based on IEC 60664-1.

NOTE 2 Product insulation consists of basic insulation and protective earthing as required by IEC 61140 for Class I equipment. Mechanical strength equivalent to that which would be provided by reinforced insulation as listed in IEC 61140 is achieved in EAS 495 products through specific mechanical and material tests.

8.1 Clearances

Accessories energized directly from the low-voltage supply fall into Overvoltage Category III.

The clearances shall be dimensioned to withstand the rated impulse voltage declared by the manufacturer considering the rated voltage and the Overvoltage Category as given in Annex D and the pollution degree declared by the manufacturer in accordance with Annex E.

For the measurements:

— all parts which may be removed without the use of a tool are removed and moveable parts which can be assembled in different orientations are placed in the most unfavourable position.

NOTE Moveable parts are, for example hexagonal nuts, the position of which cannot be controlled throughout an assembly.

Clearances distances are measured in accordance with Annex B

8.1.1 Clearances for basic insulation

The clearances for basic insulation shall not be less than the values given in Table 8.

Compliance shall be checked by· inspection, and if necessary by measurement, or by the test of Annex F.

Smaller clearances (except those values marked in Table 3 with Note b) may be used if the accessory meets the impulse withstand voltage test of Annex F at the impulse voltage specified in Annex D but only if the parts are rigid or located by mouldings or if the construction is such that it is unlikely that distances will be reduced by distortion or by movement of the parts during mounting, connection and normal use.

If clearance distances are to be measured, this shall be carried out in accordance with Annex B

8.1.2 Clearances for functional insulation

The clearances for functional insulation shall not be less than the values specified for basic insulation in 8.1.1.

If clearance distances are to be measured, this shall be carried out in accordance with Annex B

8.1.3 Clearances for supplementary insulation

The clearances for supplementary insulation shall not be less than the values specified for basic insulation in 8.1.1.

Compliance shall be checked by inspection, and if necessary by measurement, or by the test of Annex F.

Table 2— Minimum clearances for basic insulation

Rated impulse withstand voltage kV[a]	Minimum clearances in air
0.33	0.2[b]
0.50	0.2[b]
0.80	0.2[b]
1.5	0.5
2.5	1.5
4.0	3
6.0	5.5

[a] See Annex D. This voltage is:

— for functional insulation: the maximum impulse voltage expected to occur across the clearance;

— for basic insulation directly exposed to or significantly influenced by transient overvoltage from the low voltage mains: the rated impulse withstand voltage of the accessory;

— for other basic insulation: the highest impulse voltage that can occur in the circuit.

[b] Minimum clearance values are based on IEC 60664-1.

8.1.4 Clearances for reinforced insulation

The clearance for reinforced insulation shall be not less than the values specified for basic insulation in 8.1.1 but using the next higher step for rated impulse withstand voltage given in Table 2.

Compliance shall be checked by inspection and by measurement or by the test of Annex F

8.1.5 Contact gap

The minimum contact gap shall be 3 mm in the open position. Compliance shall be checked by measurement.

8.2 Creepage distances

The creepage distances shall be dimensioned for the voltage, which is expected to occur in normal use taking into account the pollution degree, and the material group as declared by the manufacturer.

For the measurements:

— all parts which may be removed without the use of a tool are removed and moveable parts which can be assembled in different orientations are placed in the most unfavourable position.

NOTE 1 Moveable parts are, for example hexagonal note, the position of which cannot be controlled throughout an assembly.

NOTE 2 A creepage distance cannot be less than the associated clearance.

Creepage distances are measured in accordance with Annex B

The relationship between material group and between comparative tracking index (CTI) values and proof tracking index (PTI] values is as follows:

Material group I 600 ≤ CTIIPTI
Material group II 400 ≤ CTIIPTI <600
Material group IIIa 175 ≤ CTI/PTI <400
Material group IIIb 100 ≤ CTI/PTI <175

The CTI or PTI values are determined in accordance with Annex C.

NOTE 3 For glass, ceramics and other inorganic materials which do not track, creepage distances need not be greater than their associated clearance.

8.2.1 Creepage distances for basic insulation

The creepage distances for basic insulation shall not be less than the values given in Table 3.

Compliance shall be checked by measurement.

Table 3 — Minimum creepage distances for basic insulation

Rated voltage V (r.m.s.)	**Pollution Degree 2**			**Pollution Degree 3**		
up to and including	**Material group[b]**			**Material group[b]**		
	I	II	IIIa/IIIb	I	II	IIIa
250	1.3	1.8	2.5	3.2	3.6	4.0
a This voltage is the voltage rationalized through Table 3a and Table 3b of IEC 60664-1 based on the rated voltage.						
b Details of pollution degrees are given in Annex E						

8.2.2 Creepage distances for functional insulation

The creepage distances for functional insulation shall not be less than the values specified for basic insulation in 8.2.1.

Compliance shall be checked by measurement.

8.2.3 Creepage distances for supplementary insulation

The creepage distances for supplementary insulation shall not be less than the values specified for basic insulation in 8.2.1.

Compliance shall be checked by measurement.

8.2.4 Creepage distances for reinforced insulation

The creepage distances for reinforced insulation shall not be less than those derived from twice the distance specified for basic insulation in Table 3.

Compliance shall be checked by measurement.

8.3 Solid insulation

Solid insulation for basic, supplementary and reinforced insulation shall be capable of withstanding electrical stresses which may occur in normal use.

No minimum thickness is specified for solid insulation.

8.3.1 Compliance shall be checked by tests in accordance with 15.1.3 using the values given in Table 4.

Table 4 — Withstand voltages for insulation types

Insulation	Test voltage
	V (r.m.s)
Functional insulation	1 500
Basic insulation	1 500
Supplementary insulation	1 500
Reinforced insulation	3 000

8.4 Requirements for printed wiring boards and equivalent construction

Printed wiring boards and equivalent construction shall conform to IEC 60664-5.

Where coating, potting or moulding is used articles shall conform to IEC 60664-3.

9 Accessibility of live parts

9.1 Connection units shall be so designed that when they are mounted and wired as in normal use, live parts are not accessible even after removal of parts which can be removed without the use of a tool.

9.1.1 Compliance shall be checked by the application of the test probe B of EAS 370 to the accessible external surface of the connection unit applied with a force of 5^{0}_{-1} N in the most unfavourable position. It shall not be possible to touch live parts.

10 Provision for earthing

10.1 All accessible metal parts of connection units shall be in electrical contact with the earthing terminal(s) except that metal parts on, or screws in or through, non-conducting material, and separated by such material from current-carrying parts in such a way that in normal use they cannot become live, need not be in effective electrical contact with the earthing terminal(s) of the connection unit.

Metal parts having an accessible surface coating of lacquer or enamel shall be tested as accessible metal parts

10.1.1 Compliance shall be checked by inspection and electrical test.

a) for metal parts insulated from live parts, by the test described in 15.1.3;

b) for metal parts connected to an earthing terminal by the following test. A current of 25 ± 0.75 A, derived from an a.c. source having a no-load voltage not exceeding 12 V, is passed for $60\ ^{+5}_{0}$ s between the earthing terminal and any accessible metal part intended to be earthed;

The resistance between the earthing terminal and any other nominated part shall not exceed 0.05 Ω.

10.2 If means are provided for electrically bonding the mounting box to the earthing circuit of the connection unit by means of the fixing screws the connection between the screw and earthing terminal shall be of low resistance.

10.2.1 Compliance shall be checked by the test described in 10.1.1b) applied between the connection unit earthing terminal(s) and any fixing screw in electrical contact with the earthing circuit. For the purpose of this test the connection unit shall be attached to its appropriate mounting box, the fixing screws being tightened to a value of two-thirds those given in Table 5.

Table 5 — Torque values for screws and nuts

Declared diameter of screw thread mm	Torque (see Note 1)		
	For metal screws as described below (see Note 2) N-m	For other metal screws and nuts N.m	For screws of insulating material N m
Up to and including 2.8	0.2	0.4	0.4
Over 2.8. up to and including 3	0.25	0.5	0.5
Over 3, 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	0.6
Over 3.6, up to and including 4.1	0.7	1.2	0.6
Over 4.1, up to and including 4.7	0.8	1.8	0.9
Over 4.7, up to and including 5.3	0.8	2.0	1.0
Over 5.3. up to and including 6	—	2.5	1.25

NOTE 1 The recording of a measured value given in this table is considered to comply with this part of EAS 495 on condition that the uncertainty of measurement at not less that 95 % confidence level does not exceed ±10%

NOTE 2 This column applies to metal screws without heads if the screw when tightened does not protrude from the hole,

and to metal screws which cannot be tightened by means of a screwdriver with a blade wider than the diameter of the screw.

11 Terminals

11.1 Terminals shall provide for effective clamping and securing of conductors connected to them, so that efficient electrical connection is made.

11.1.1 Compliance for screw-type shall be checked in accordance with 11.2 to 11.8 and screwless terminals shall be checked in accordance with 11.9

11.2 Connection units shall be provided with line, neutral and earth terminals as defined in 3.12 or 3.30. Separate terminals shall be provided for incoming (supply) and outgoing (load) connections.

11.2.1 Compliance shall be checked by inspection.

Screwed and "snap-on' terminals shall not be used. Crimped connections shall not be made on to pre-soldered flexible cords unless the soldered area is entirely outside the crimp.

11.3 Incoming (or supply) line and neutral terminals shall permit the connection, without special preparation, of one, two or three 2.5 mm^2 solid or stranded, or of one or two 4 mm^2 stranded conductors as given in IEC 60227, Table 4.

11.3.1 Compliance shall be checked by inspection and by fitting the appropriate conductors.

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11.4"Incoming earthing terminals shall permit the connection, without special preparation, of one, two or three 1.5 mm^2 or 2.5 mm^2 solid or stranded, or of one or two 4 mm^2 stranded conductors as given in IEC 60227-5 or IEC 60245-4 or IEC 60245-8 .

11.5 mm^2 stranded.

Outgoing (or load) line, neutral and earth terminals shall permit the connection without special preparation of one conductor of solid or stranded cords of 1.5 mm^2 or 2.5 mm^2 or one conductor of a flexible cable having a nominal cross-sectional area of 0.5 mm^2 up to and including 1.5 mm^2 where provision is made by the connection unit for the fitting of such a cable.

11.5.1 Compliance shall be checked by inspection and by fitting the appropriate conductors.

11.7 Where pillar terminals are used they shall have clamping screws of sufficient length to extend to the far side of the conductor hole. The end of the screw shall be slightly rounded so as to minimize damage to the conductors. The sizes of the conductor hole and the clamping screw shall be such that the clearance between the sides of the major diameter of the clamping screw and the conductor hole does not exceed 0.4 mm when intended for the connection of flexible cords and 0.6 mm when intended solely for the connection of fixed wiring.

11.6.1 Compliance shall be checked by inspection and measurement.

11.7 Terminal screws shall have a declared outside diameter of not less than 3 mm or be not smaller than 6 B.A.

Thread cutting and/or thread forming screws shall not be used.

11.7.1 Compliance shall he checked by inspection and measurement.

11.8 Outgoing (or load) terminals of cord outlet connection units shall be so located or shielded that should a stray strand of a flexible conductor escape when the conductors are fitted, there is negligible risk of accidental connection between live parts and accessible external surfaces, or of a stray strand bypassing the fuse link if any.

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

A 6 mm length of insulation is removed from the end of a flexible conductor having a nominal having a nominal cross-sectional area of 1.5 mm^2. One free strand of the flexible conductor is left free and the other strands are fully inserted into and clamped in the terminal. The stray strand is bent, without tearing the insulation back, in every possible direction, but without making sharp bends round barriers.

The free strand of a flexible conductor connected to a live terminal shall not:

a) touch any metal part, so as to bypass any fuse link;

b) touch any metal part which is accessible or is connected to an accessible metal part;

c) reduce creepage distances and clearances to accessible surfaces to less than 1.3 mm.

The free strand of a flexible conductor connected to an earthing terminal shall not touch any live parts.

11.9 Screwless terminals

11.9.1 Screwless terminals for connection units shall be provided with clamping units which allow the proper connection of conductors as specified in 11.2, 11.3, 11.4 or 11.5 as appropriate.

NOTE The terminals may be of the type suitable for the following:

a) Brigid (solid or stranded) copper conductors only;

b) flexible copper conductors only; or

c) both rigid (solid or stranded) and flexible copper conductors.

Conformity shall be checked by inspection and by fitting the appropriate conductors.

For screwless terminals intended to be suitable for the connection of both rigid and flexible copper conductors the tests given in 11.9 shall be carried out with rigid conductors first and then repeated with flexible conductors.

11.9.2 Screwless terminals shall be such that the conductor is able to be connected without special preparation.

NOTE Special preparation includes soldering of the wires of the conductor and use of terminal ends, but not reshaping of the conductor before its introduction into the terminal or the twisting of a stranded conductor to consolidate the end.

Conformity shall be checked by inspection.

11.9.3 Screwless terminals shall be so designed that they clamp the specified conductors with sufficient contact pressure and without undue damage to the conductor.

The conductor shall be clamped between metal surfaces.

Conformity shall be checked by inspection and by the test of 11.9.8.

11.9.4 It shall be clear how the conductors are to be inserted and disconnected.

The intended disconnection of a conductor shall require an operation, other than a pull on the conductor, which can be effected manually with or without the help of a tool in normal use.

Openings for the use of a tool intended to assist the insertion or disconnection shall be clearly distinguishable from the opening intended for the conductor.

Conformity shall be checked by inspection and by the test of 11.9.8.

11.9.5 Screwless terminals which are intended to be used for the interconnection of two or more conductors shall be so designed that:

a) during the connection or disconnection the conductors are able to be connected or disconnected either at the same time or separately; and

b) each conductor is introduced in a separate clamping unit (not necessarily in separate holes).

Conformity shall be checked by inspection and by tests with the appropriate number and size of conductors (see 11.9.1).

11.9.6 Screwless terminals shall be so designed that undue insertion of the conductor is prevented and adequate insertion is obvious.

Marking indicating the length of insulation to be removed before the insertion of the conductor into the screwless terminal shall be given on the connection unit or in manufacturer’s instructions.

Conformity shall be checked by inspection and by the test of 11.9.8.

11.9.7 Screwless terminals shall be properly fixed to the connection unit.

When tested in accordance with 11.9.8, screwless terminals shall not work loose when the conductors are inserted or disconnected during installation.

Conformity shall be checked by inspection and the test of 11.9.8.

11.9.8 Screwless terminals shall withstand the mechanical stresses occurring in normal use. When tested in accordance with the following method, the conductors shall not have moved noticeably in the clamping unit, neither the terminals nor the clamping part shall have worked loose and the conductors shall show no deterioration, such that further use is impaired.

The test shall be carried out with uninsulated conductors on one screwless terminal of each sample.

The appropriate copper conductors shall be used, first conductors having the largest cross-sectional area, and then conductors having the smallest cross-sectional area specified in 11.3, 11.4 or 11.5 as appropriate.

Conductors shall be inserted and disconnected five times, new conductors being used each time, except for the fifth time, when the conductors used for the fourth insertion shall be clamped at the same place. For each insertion, the conductors shall be either:

a) pushed as far as possible into the terminal; or

b) inserted so that adequate connection is obvious.

After each insertion, the conductor shall be subjected to a pull of 30 0 N. The pull shall be applied in one smooth and continuous motion, for 60 ±5 s, in the direction of the longitudinal axis of the conductor space.

During the application of the pull, the conductor shall not come out of the screwless terminal and the terminal shall not have become detached from the connection unit.

11.9.9 Screwless terminals shall withstand the electrical and thermal stresses occurring in normal use. When tested in accordance with the following methods, the screwless terminals shall show no changes likely to impair further use, e.g. cracks, deformation.

The following tests shall be carried out on five screwless terminals which have not been used for any other test.

Both tests shall be carried out with new copper conductors.

a) The screwless terminals shall be connected with 1 m long conductors having a cross-sectional area of 1.5 mm^2 and loaded for 60 min ±1 min with an alternating current of 19 A.

   The test shall be carried out on each clamping unit.

   During the test the current shall not be passed through the connection unit, but only through the terminals. Immediately after this period, the voltage drop across each screwless terminal shall be measured with 13^{0}_{-2} A flowing.

   In no case shall the voltage drop exceed 15 mV.

   The measurements shall be made across each screwless terminal, as near as possible to the point of contact of each conductor.

NOTE The samples may be prepared by the manufacturer.

During the preparation of the samples, care shall be taken to ensure that the behaviour of the terminal is not affected.

When performing the test and taking the measurements, the conductors and the measurement equipment shall not be moved.

b) The screwless terminals, after being subjected to the determination of the voltage drop in accordance with item a) shall be tested as follows.

   During the test, a current of 19 A shall be passed through the terminal.

The whole test arrangement, including the conductors, shall not be moved until the measurements of the voltage drop have been completed.

The terminals shall be subjected to 192 temperature cycles, each cycle having a duration of approximately 1 h and being carried out as follows:

1) with the current flowing for approximately 30 min; and

2) with no current flowing for approximately a further 30 min. T

The voltage drop in each screwless terminal shall be determined in accordance with the test in item a) after every 24 temperature cycles and after the 192 temperature cycles have been completed.

In no case shall the voltage drop exceed 22.5 mV.

On completion of the test, each screwless terminal shall be inspected using normal or corrected vision without additional magnification.

The mechanical stress test in accordance with 12.9.8 shall be repeated. All samples shall withstand the mechanical stress test.

12 Construction of connection units

12.1 Surface-mounted connection units shall be provided with means to ensure proper seating on a flat surface and with fixing holes which will accept No.6 wood screws.

Flush or semi-flush mounted connection unit plates shall have provision for two M3.5 fixing screws at centres of 60.3± 0.2mm on the horizontal or vertical centerlines for boxes intended to accommodate 1-gang connection units, 120.6 mm ± 0.3mm on the horizontal or vertical centerlines for boxes intended to accommodate 2-gang connection units or 180.9 mm ± 0.4 mm on the horizontal or vertical centerlines for boxes intended to accommodate 3-gang connection units in accordance with EAS 203.

The size and disposition of fixing holes shall be such as to allow satisfactory attachment to boxes having centers manufactured to a ± 0.8mm tolerance.

12.1.1 Compliance shall be checked by inspection and measurement.

12.2 For flush mounted connection units plates for use with boxes complying with EAS 203, either of insulating material or metal, or a combination of both, shall be 82.5 mm × 82.5 mm minimum.

12.2.1 Compliance shall be checked by inspection and measurement.

12.3 For flush-mounted connection units, the size of the base or bases shall be such that the clearance for the purpose of wiring between the base or bases and the inside walls of the box or enclosure does not prevent its safe installation in a box or enclosure specified in the manufacturer's instructions and/or literature. The enclosure will meet the requirements given in EAS 203

There shall be no live metal protruding from or flush with the connection unit base. Any exposed

live metal part shall be recessed to give the necessary clearance distance from any earthed metal or with the lugs of a mounting box as described in EAS 203 which could come into contact with the base when the connection unit is installed in accordance with the manufacturer's instructions.

This requirement shall be met when the terminals are fitted with the conductors described in 12.5

and with terminal screws tightened to the values given in Table 7.

12.4 Conductive component parts of connection units shall be so located and separated that, in normal use, they cannot be displaced so as to affect adversely the safety or proper operation of the connection units.

12.4.1 Compliance shall be checked by inspection and manipulation.

12.5 Provision shall be made for a fuse-link complying with EAS 496 and it shall be mounted in suitable contacts between the supply line terminal and the corresponding load terminal.

When a switch is incorporated the fuse link shall be mounted in suitable contacts between the outgoing contact of the line pole of the switch and the corresponding load terminal.

The design shall be such that the fuse-link whilst passing current without dismantling the connection unit and no parts which are live shall become accessible during its removal or removal or replacement.

The connections of a fuse link contact directly to another conductive part (excluding the line terminal) shall be formed in one piece or connected in such a way that an efficient electrical connection is made that cannot work loose in normal use. These connections shall not be made by means of a screw.

12.5.1 Compliance shall be checked by inspection and by the test probe B and test probe 13 of EAS 370 applied with a maximum force of 5 N, applied in accordance with 9.1.1.

Fuse-link clips in connection units shall be checked for mechanical strength by the insertion and withdrawal test described in 19.1.2.

Current making and breaking of fuse-links shall be checked by the test described in 16.1.3 after which the temperature-rise test described in Clause 16 shall be carried out.

12.6 The actuating mechanism shall be so constructed that when operated, the switch can remain only in a position giving adequated contact or adequate separation of the contacts.

Switches shall be so constructed that undue arcing cannot occur when the switch is operated slowly

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

Following the test described in Clause 16.1.2, the circuit is broken a further 10 times, each time moving the actuating member by hand over a period of approximately 2 s in a manner such as to attempt to stop the moving contact in an intermediate position causing arcing. The actuating member shall be released after approximately 2 s and any arcing shall cease.

12.6.2 The actuating member of a switch shall not remain at rest in the off position whilst the switch contacts remain closed.

The actuating mechanism shall be so constructed that when operated the switch can remain only in a position giving adequate contact separation of contacts.

For connection units that cannot be dismantled after assembly an additional new set of three samples prepared with the contacts closed is supplied by the manufacturer for this test.

12.6.3 Compliance shall he checked by inspection and by the test of 12.6.4.

12.6. 4 The necessary force (F) to switch off shall first be measured and the force shall be applied to the extremity of the actuating member.

With the actuating member of the switch in the closed position, the fixed and moving contacts of each pole shall be mechanically fixed together. Three samples shall be prepared as follows:

a) the fixed and moving contacts of one pole shall be mechanically fixed together and the actuating member of the switch tested;

b) the fixed and moving contacts of the other pole shall be mechanically fixed together and the

actuating member of the switch tested; and

c) the fixed and moving contacts of both poles shall be mechanically fixed together and the actuating member of the switch tested. The method for fixing the contacts shall not unduly affect the test result. The test sample can be dismantled where necessary in preparation for this test and the test sample and components shall not be damaged during this preparation.

The actuating member shall be subjected to a test force as defined in Table 6. This force shall be applied in one smooth and continuous motion to the extreme point of the actuating member in the most favourable direction to open the contacts for a period of 10 s.

If locking means are designed to lock the actuating members in the opened position, it shall not be possible to lock the actuating members in this position while the force is applied.

After the test and when the test force is no longer applied, the actuating member shall not remain at rest in the “off” position.

Table 6 — Actuator test force

Type of actuator	Test force	Minimum test force N	Maximum test force N
Switch actuator	3F	50	150
F is the normal operating force in new condition. The test force shall be 3F with the stated minimum and maximum values applied.			
NOTE 1 The use of grease and the likes are not considered to be a mechanical means.			

12.7 For connection units incorporating an indicator lamp, the connection of the indicator lamp shall only be made across the line and neutral load terminals. No other connection arrangements shall be permitted.

12.7.1 Conformity shall be checked by inspection.

12.8 Connection units having an IP classification higher than IP20 shall be so constructed so that when they are fixed and wired as in normal use there are no free openings in their enclosures according to their classification.

12.8.1 Conformity shall be checked by inspection and the tests in accordance with 13.3.

Drain holes, small gaps between cables and conduits, or between enclosure and operating means shall be neglected provided they do not compromise the declared IP rating.

12.9 Surface mounted connection units having an IP classification higher than IP20 shall maintain their IP classification when fitted with conduits or with sheathed cables as in normal use.

Fixed surface mounted connection units having degrees of protection IPX4, IPX5 or IPX6 shall have provisions for opening a drain hole.

If a connection unit is provided with a drain hole, it shall be not less than 5 mm in diameter, or 20 mm^2 in area with a width and a length not less than 3 mm.

If the design of the connection unit is such that only one mounting position is possible, the drain hole shall be effective in that position. Alternatively, the drain hole shall be effective in at least two positions of the connection unit when it is mounted on a vertical wall, one of these with the conductors entering at the top and the other with the conductors entering at the bottom.

Lid springs, if any, shall be corrosion resistant.

12.9.1 Conformity shall be checked by inspection, measurement and by the relevant tests of 13.3. For lid springs conformity shall be checked by inspection and if necessary by the test of 23.2.1**.**

A drain hole in the back of the enclosure shall have a minimum clearance of 5 mm from the mounting surface or provides a drainage channel of at least the size specified in 12.9.

13 Resistance to ageing, resistance to humidity and protection provided by enclosures

13.1 Resistance to ageing.

Connection units shall be resistant to ageing

13.1.1 Compliance is checked by the following test.

Connection units are subjected to a test in a heating cabinet with an atmosphere having the composition and pressure of the ambient air and ventilated by natural circulation.

Connection units having an IP classification higher than IPX0 shall be tested after having been mounted and assembled as specified in 13.3.2

For connection units having a lid, the lid shall be closed during the tests.

The temperature in the cabinet is maintained at 70 °C ± 5 °C.

The specimens are kept in the cabinet for 168 h (0, +2) h.

NOTE 1 The use of an electrically heated cabinet is recommended.

NOTE 2 Natural circulation may be provided by holes in the walls of the cabinet.

After the treatment, the samples are removed from the cabinet and kept at room temperature and relative humidity for 1 h; and following which they are examined and shall show no damage which:

— would lead to non-compliance with this standard;

— would impair safety;

— would prevent further use.

13.2 Resistance to humidity

Connection shall be proof against humid conditions which may occur in normal use.

13.2.1 Compliance shall be checked by the following humidity treatment followed within 20 min by the measurement of the insulation resistance and by the electric strength test specified in Clause 15.

Vitrified ceramic material, which after 24 h immersion in water has not increased in mass by more than 0.5 % after all the moisture has been removed from its surface, shall not be subjected to further tests, providing the resistance to water of the material does not de end on laze or varnish.

To suit the ambient conditions at the time of test, a convenient temperature, *T* (in °C), between 20 °C and 30 °C, is chosen as a reference temperature. The sample is brought to a temperature of between *T* and *T* + 4 °C and is then placed in a humidity cabinet containing air with a relative humidity maintained o between 85 % and 95 %. The temperature of the air where the samples are placed shall be maintained m within ± 2 °C of the chosen value *T*.

The sample is kept in the cabinet for 48 $_{0}^{+1}$ h.

NOTE 1 In most cases samples may be brought to the chosen reference temperature by keeping them at this temperature for at least 4 h before the humidity treatment.

NOTE 2 A relative humidity of between 85 % and 96 % can be obtained by placing in the humidity cabinet a saturated solution of potassium nitrate (KNO_3) or sodium sulfate (Na_2SO_4) in water having a sufficiently large contact surface with the air.

In order to achieve the specified conditions within the cabinet it is necessary to ensure constant circulation of the air within the cabinet and, in general, to use a cabinet which is thermally insulated.

The tests described in Clause 15 shall be made in the humidity cabinet or immediately after removal of the specimen from the cabinet in a room where the specified temperature is maintained. Inspection shall not reveal any damage to the sample which would impair its use or safety within the requirements of this part of EAS 495.

13.3 Protection provided by enclosures

13.3.1 General

The enclosure of the connection unit shall provide protection against access to hazardous parts, against harmful effect due to ingress of solid foreign objects and against effects due to ingress of water in accordance with the IP classification of the connection unit.

Conformity shall be checked by the tests of 13.3.2 and 13.3.3.

13.3.2 Protection against access to hazardous parts and against harmful effects due to ingress of solid foreign objects.

13.3.2.1 General

Conformity shall be checked by the appropriate tests of IEC 60529 under the conditions specified below.

Connection units shall be mounted as in normal use in accordance with the manufacturer's instructions.

Connection units with provision for outgoing flexible cable shall be tested first with the minimum and then the maximum sizes of flexible cable.

a) One sample shall be tested fitted with 2-core 0.5 mm^2 flexible cable as given in IEC 60227-5.

b) One sample shall be tested fitted with 3-core 1.5 mm2 flexible cable as given in

IEC 60227-5.

c) One sample shall be tested without a flexible cable fitted.

Mounting screws for boxes or enclosures and screws for fixing connection units to boxes or enclosures shall be tightened with a torque according to the manufacturer's instructions. In the absence of such instructions, the screws shall be tightened with a torque equal to two thirds of the values given in Table 5.

Connection units with screwed glands or membranes shall be fitted with circular cables having cross-sectional area of 1.5 mm^2 as given in IEC 60245-4. Glands shall be tightened with a torque according to the manufacturer's instructions.

In the absence of such instructions glands shall be tightened with a torque equal to two thirds of the values given in Table 7.

Table 7 — *Tightening torque values for cable glands*

Gland size mm	**Metal glands** Nm	**Glands of insulating material** Nm
16	7.5	5.0
20	7.5	5.0
25	10.0	7.5

Glands shall not be filled with sealing compound or the like.

Parts which are removable without the aid of a tool shall be removed.

13.3.2.2 Protection against access to hazardous parts

The appropriate test according to IEC 60529 shall be performed.

13.3.2.3 Protection against harmful effects due to ingress of solid foreign bodies

The appropriate test according to IEC 60529 shall be performed. For connection units classified as IP5X, the enclosure shall be deemed to be category 2.

Test probes shall not be applied to drain holes.

13.3.3 Protection against harmful effects due to ingress of water.

Conformity shall be checked by the appropriate tests of IEC 60529 under the conditions specified below.

Connection units shall be mounted as in normal use in accordance with the manufacturer's instructions.

Flush-mounted connection units shall be fixed in a test wall representing the intended use of the connection unit using an appropriate box in accordance with the manufacturer's instructions.

Where the manufacturer's instructions specify particular types of walls, these walls as well as any special installation requirements for the connection unit shall be described in sufficient detail.

Surface mounted connection units shall be mounted as in normal use on a vertical surface and fitted with circular cables having a cross-sectional area of 1.5 mm^2 as given in IEC 60245-4.

Connection units with provision for outgoing flexible cable shall be tested first with the minimum and then the maximum sizes of flexible cable.

a) One sample shall be tested fitted with 2-core 0.5 mm^2 flexible cable as given in

IEC 60227-5.

b) One sample shall be tested fitted with 3-core 1.5 mm^2 flexible cable as given in IEC 60227-5.

c) One sample shall be tested without a flexible cable fitted.

Mounting screws for boxes or enclosures and screws for fixing connection units to boxes or enclosures shall be tightened with a torque according to the manufacturer's instructions. In the absence of such instructions, the screws shall be tightened with a torque equal to two thirds of the values given in Table 5.

Connection units with screwed glands or membranes shall be fitted with circular cables having cross-sectional area of 1.5 mm^2 as given in IEC 60245. Glands shall be tightened with a torque according to the manufacturer's instructions. In the absence of such instructions glands shall be tightened with a torque equal to two thirds of the values given in Table 7.

Glands shall not be filled with sealing compound or the like.

Parts which are removable without the aid of a tool shall be removed.

If the enclosure of a connection unit that has an IP code less than IPX5 is designed with drain holes, one drain hole shall be opened as in normal use and in the lowest position. If an enclosure of a connection unit that has an IP code equal to or greater than IPX5 is designed with drain holes, they shall not be opened.

Care shall be taken not to disturb, e.g. knock or shake, the assembly to such an extent as to affect test results.

Within 5 min of completion of the test the samples shall withstand an electric strength test as specified in 14.1.3.

Inspection shall show that if any water has entered, it shall not:

1) be sufficient to interfere with the correct operation of the equipment or impair safety;

2) deposit on parts of insulating material where it could lead to tracking along the creepage distances;

3) reach live parts or windings not designed to operate when wet; or

4) accumulate near the cable end or enter the cable if any.

If the connection unit enclosure has drain holes which have been opened, it shall be proved by inspection that any water which enters does not accumulate and that it drains away without doing any harm to the complete assembly.

14 Insulation resistance and electric strength

14.1 The insulation resistance and electric strength of connection units shall be adequate.

14.1.1 Compliance shall be checked by the tests described in 14.1.2 and 14.1.3.

14.1.2 The insulation resistance is measured using a d.c. voltage of 500 $_{0}^{+250}$ V the measurement being made for 60 $_{0}^{+5}$ s after application of the voltage. The insulation resistance is measured consecutively between the following.

a) line and neutral terminals;

b) line and neutral terminals connected together and:

1) a metal foil in contact with the entire accessible external surface

2) the earthing terminal

3) any metal part of a cord anchorage;

c) each switched pole terminal of a switched connection unit and corresponding load terminal with the switch contacts open with the fuse-link in place.

The insulation resistance shall be not less than the following:

i) 5 MΩ between parts of opposite polarity:

ii) 5 MΩ between parts of opposite polarity connected together, and other parts insulated therefrom, including earthed metal;

iii) 2 MΩ across switch contacts with the switch open (where applicable).

One pole of neon indicators and the like shall be disconnected before making this test.

14.1.3 A 50 Hz voltage of substantially sinusoidal waveform is applied as described in 14.1.2.

Initially, not more than 1000 V is applied, the voltage then being raised to 2 000 V ± 60 V. The high voltage source used shall be such that when the output is adjusted to 2000 V ± 60 V for 60 $_{0}^{+5}$ s and is then short circuited, the output current is not less than 200 mA. Any overcurrent protection shall not operate at a current less than 100 mA.

During the test no flashover or breakdown shall occur.

Glow discharges without drop in voltage shall be ignored.

One pole of neon indicators and the like shall be disconnected before making this test.

14.2 Switched connection units shall be suitable for isolation.

Switched connection units are classified as Overvoltage Category III.

They shall be tested in the new, clean and dry conditions, when in the open position, across the terminals of each pole.

Conformity shall be checked by the following test:

The 1.2/50 µs impulse voltage according to IEC 61180, Figure 1 shall be applied between the line terminals connected together and the load terminals connected together with the contacts in the open position.

The impulses shall be given by a generator producing positive and negative impulses having a front time of 1.2 µs and a time to half value of 50 µs, the tolerance being:

a) ±5% for the peak value;
b) ±30% for the front time; and
c) ±20% for the time to half value.

The shape of the impulses shall be adjusted with the connection unit under test connected to the impulse generator. For this purpose appropriate voltage dividers and voltage sensors shall be used.

Small oscillations in the impulses are allowed, provided that their amplitude near the peak of the impulse is less than 5% of the peak value.

For oscillations on the first half of the front, amplitude up to 10% of the peak value is allowed.

The test voltage shall be chosen from Table 8, in accordance with the rated voltage.

The impulse voltage shall be applied three times at intervals of 1 s minimum.

There shall be no discharges during the test.

NOTE 1 The surge impedance of the test apparatus should be 500 Ω.

NOTE 2 The expression "discharge" is used to cover the phenomena associated with the failure of insulation under electric stress, which includes current flow and a drop in voltage

Table 8 — *Test voltage across the open contacts for verifying the suitability for isolation, referred to the rated voltage and to the altitude where the test is carried out*

Rated voltage	**Test voltage (kV) and corresponding altitudes above sea level**				
V	m				
—	Sea level	200	500	1 000	2 000
Exceeding 130	6.2	6	5.8	5.6	5

15 Temperature rise

15.1 Connection units and their surroundings shall not attain excessive temperatures in normal use.

15.1.1 Compliance shall be checked by the following tests

The tests shall be carried out at rated voltage $-20^{+10}\%$.

For these tests, where conductors are connected to terminals, the terminal screws shall be tightened with a torque equal to two-thirds of the values given in Table 5.

During the tests temperature rises are measured at the terminals or terminations and where overheating might result in a hazard and the values measured shall not exceed the values given in Table 9. Temperature rises are determined by means of fine wire thermocouples so chosen and positioned that they have minimum effect on the

temperature of the part under test. The thermocouples are attached by means of a mixture of equal parts of resin adhesive and zinc oxide, by soldering, or by other equally effective means.

NOTE If soldering is used, it is essential that care is taken to ensure that the heat from the soldering process does not affect the performance of the connection unit and that no electrical connections arc bridged by solder.

Table 9 — Permitted temperature rises

Measurement point	Temperature rise K
Terminals	52
Accessible external surface	52
NOTE The recording of a measured value up to and including the specified maximum permissible limit for temperature rise is considered to comply with the requirements of the standard on condition that the uncertainty of measurement at not less than 95 % confidence level does not exceed ±2 °C.	

Surface-mounted connection are mounted as in use with their accompanying mounting block or backplate fixed to a vertical plywood board having a nominal thickness of 24 mm and having a surface extending at least 150 mm in each direction beyond the extremity of the connection unit. For connection units that have an IP classification higher than IPX0 the test shall be carried out with any lids closed if the design permits this when in use.

Flush-mounted connection units designed for use with flush-mounted connection unit boxes as shown in either Figure lb) or Figure 2b) of EAS 203 are mounted on a test fixture designed to simulate normal conditions of use, comprising such a metal box having a nominal internal depth of 35 mm, which is fixed into a block of wood, so that the front edges of the metal box are between 2.5 mm to 6 mm below the front surface of the block. The size of the black shall be such that there is a minimum of 25 mm of wood surrounding the box on all four sides and the back. The connection unit is then mounted by means of its fixing screws so that the rear of the plate is flush with the surface of the block.

The incoming (supply) line neutral and earth terminals of a connection unit are connected to an incoming and outgoing 2.5 mm^2 2-core and earth PVC insulated and sheathed cable as given in IEC 60227-5.

The incoming cable shall enter on the horizontal axis on one side of the enclosure and, where specified, the outgoing cable shall leave on the horizontal axis on the opposite side of the enclosure. Where possible, the cables shall enter and leave the enclosure through the standard knockouts provided and these, if required, shall be fitted with suitable grommets. The points of entry and exit shall be sealed to prevent circulation of air.

The connection unit shall be wired with the incoming and outgoing (supply) cables as described above and with a 1.5mm^2 3-core flexible cord for the load (outgoing) which shall leave at the position dictated by the design or, where there is a choice, at the bottom of the enclosure. Connection units fitted with cord grips are wired as intended in normal use with the cord grip device operative.

For surface-mounted connection units the length of each of the cables within the enclosure shall be 75 mm ± 5 mm and for flush connection units the length of each cable within the box shall be 150 mm ± 5 mm. In each case the outer sheath shall be removed from the cores to within 20 mm of the point of entry of the cable to the box or enclosure.

Cables outside the box or enclosure shall each have a minimum length of 1 m.

The fuse link, if any, incorporated in the portable connection unit is replaced by a calibrated link, constructed and calibrated in accordance with Annex A.

Electrical loads shall be connected to the connection unit as follows:

a) total load on supply cables: 20 A nominal;

b) connected load on outgoing terminals: 14A ± 0.4A

c) balance of load on supply terminals: 6A ± 0.4 A.

NOTE The tolerance values for current take account of an uncertainty of measurement of not greater than ± 1.5 % at a confidence level of not less than 95 %.

The connection unit is operated as described for a minimum continuous period of 4 h or longer until stability is reached with a maximum duration of 8 h, stability being taken as less than 1 K rise within 1 h.

16 Breaking capacity of connection units

16.1 The breaking capacity of socket contacts, switches, and fuse contacts incorporated in connection units, shall be adequate.

16.1.1 Compliance shall be checked by the tests described in 16.1.2, 16.1.3 and 16.1.4 as applicable, which shall be completed with the connection units connected and mounted as in normal use.

After the test, the connection unit shall be capable of satisfying the subsequent tests detailed in Table 1 for the appropriate test sample.

16.1.2 The switch shall make and break a current of 1.25 times rated current ±0.4 A [i.e. (1.25 × 13) f 0.4 A] in a substantially non-inductive a.c. circuit at 275 V ± 5 V, 10 times in succession at intervals of approximately 30 s.

After the test, the connection unit shall be capable of satisfying the subsequent tests detailed in Table 1 for the appropriate test sample.

16.1.3 The (use contacts shall make and break a current by insertion and removal of a fuse in a substantially non-inductive a.c. circuit at 275 V ± 5 V, 10 times in succession at intervals of approximately 30 s, the values of the current being 1.25 times rated current ±0.4 A [i.e. (1.25 × 13) ± 0.4 A] for fuses in single connection units and 1.6 times rated current t0.4 A for fuses in multiple connection units. Standard 13 A fuse links in accordance with EAS 496 are used for this test, and may be replaced if necessary during the test. For the test, all metal parts not in contact with line contacts shall be connected to the earth pole of the test circuit.

After the test, the connection unit shall be capable of satisfying the subsequent tests detailed in Table 1 for the appropriate test sample.

17 Normal operation of connection units

17.1 Switched Connection units shall withstand without excessive wear or other harmful effects, the electrical and mechanical stresses occurring in use.

17.1.1 Compliance shall be checked by the following tests. In switched connection units the voltage drop across each switched pole, measured at points immediately adjacent to the switch, shall not exceed 60 mV at rated current. The leakage current across open poles shall not exceed 0.5 mA per pole in the new, clean and dry condition at test voltage of 110% of the rated voltage.

The switch shall then make and break a current of 13 A ± 0.4 A at 250 V ± 10 V 15 000 times (30 000 movements) in a substantially non-inductive a.c. circuit at a rate of approximately six complete cycles per minute at regular intervals. The periods during which the switch is "on" and "off' shall be approximately equal. The means used for operating the switch shall be such as to move the actuating member at a speed of approximately 300 mm/s both in making and breaking the circuit and shall be so positioned that the normal action of the mechanism is not interfered with in any way.

At the end of the test, the switch shall be capable of making and breaking the rated current of 13 A ± 0.4 A at 250 V ± 10 V and the voltage drop across each switched pole, measured as above, shall not exceed 75 mV.

The switch shall also be in accordance with Clause 14, the test voltages of 14.1.3 being reduced by 25.

18 Connection of flexible cords and cord anchorage

18.1 For connection units with cord outlets.

Provision shall be made for the entry and effective clamping without bending of 3-core flexible cords for rewirable portable connection units, as given in IEC 60245-8 (clause 5), IEC 60245-8 (clause 2), IEC 60245-8 (clause 3), IEC 60245-4 (clause 4), IEC 60227-5 (clause 5) and IEC 60227-5 (clause 6), having nominal conductor cross-sectional areas not exceeding 1.5 mm^2.

The cord anchorage shall be such that the conductors are relieved from strain, including twisting, where they are connected to the terminals.

The cord anchorage shall contain the sheath. Cord anchorages shall either be of insulating material or if of metal shall be provided with an insulating lining fixed to the metal parts.

Methods such as tying the flexible cord into a knot or trying the ends with string or the like shall not be used.

18.1.1 Compliance shall be checked by inspection and by the following tests.

a) Connection units are fitted with a 2-core flexible cord having a nominal cross-sectional area of 0.5 mm^2 as given in IEC 60227-5 (clause 5). The conductors are introduced into terminals and the terminal screws tightened just

sufficiently to prevent the conductors easily changing their positions. The cord anchorage is used in the normal way, the clamping screws, if any, being tightened to a torque of two-thirds of that given in Table 6.

The assembly is then left untouched for a minimum of 24 h.

After this preparation, it shall not be possible to push the flexible cord into the portable connection unit to such an extent as to impair safety or so that the cord anchorage is loosened.

The flexible cord is then subjected 25 times to the pull given in Table 10. The pulls are applied without jerks in the most unfavourable position momentarily. Immediately afterwards, the flexible cord is subjected for 60 $^{+5}_{0}$ s to the appropriate torque shown in Table 10, at a minimum distance of 150mm from the cord entry.

Table 10 — *Cable grip tests related to size of flexible cable*

Flexible cable or cord size outgoing mm2	**Cord grip tests**	
	Load $^{+2}_{0}$ **%** **kg**	**Torque** [a] **N.M**
0.50	3	0.15
1.50	6	0.35
a The recording of a measured value of torque in accordance with this table is considered to comply with this part of EAS 495 on condition that the uncertainty ±10%		

The above tests are repeated but with the connection unit fitted with a 3-core flexible cord having a nominal conductor cross-section area of 1.5 mm^2 as given in IEC 60227-5 (clause 6)

After the tests the flexible cord shall not have been displaced by more than 2mm.

For the measurement of longitudinal displacement a mark is made on the cord, whilst it is subjected to the load given in Table 10, at point adjacent to the anchorage in the case of cord outlet connection units, before starting the tests. After the test, the displacement of the mark on the flexible cord in relation to the cord anchorage is measured whilst the cord is again subjected to the load given in Table 10.

18.2 Cord anchorages in rewirable portable connection units shall anchor the cord securely to the connection unit. The design shall ensure the following:

a) the cord anchorage cannot be released from the outside without the use of a tool;

b) it shall not be possible to touch cord anchorage screws, if any, with test probe B of EAS 370 when the connection unit is energized;

c) the cord is not clamped by a metal part bearing directly on the flexible cord;

d) at least one part of the anchorage is securely fixed to the connection unit;

e) clamping the cord does not require the use of a special purpose tool;

18.2.1 Compliance shall be checked by inspection and test.

18.3 Screws which are used when clamping the flexible cord shall not serve to fix any other components unless the portable connection unit is rendered manifestly incomplete if the component is omitted or is replaced in an incorrect position, or the component intended to be fixed cannot be removed without further use of a tool.

18.3.1 Compliance shall be checked by inspection.

18.4 The cord entry to a cord outlet connection unit shall be so shaped as to prevent damage to the cord.

18.4.1 Compliance shall be checked by inspection.

19 Mechanical strength

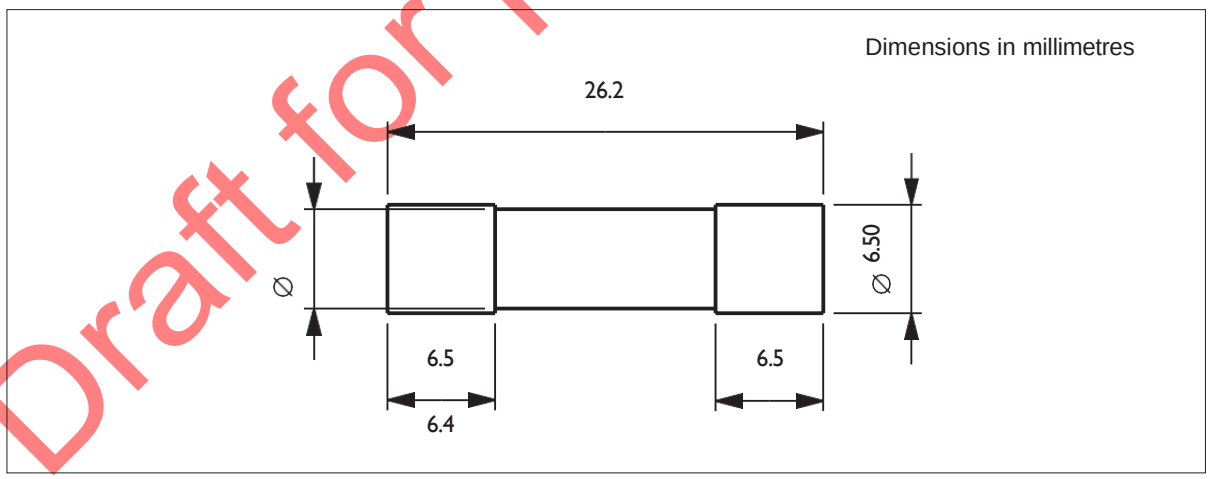
19.1 Connection units shall have adequate mechanical strength and be so constructed as to withstand such handling as may be expected in normal use.

19.1.1 Compliance shall be checked by the tests described in 19.1.2, 19.1.3.

Any decorative cover, cover plates or parts thereof, not providing protection against electric shock, shall be removed prior to testing.

19.1.2 A solid link of stainless steel as shown in Figure 19 is inserted and withdrawn from the fuse clips of a fused connection unit 20 times in succession in a normal manner, not in misuse conditions, at a rate not exceeding 10 per minute. A standard fuse link complying with EAS 496 is then fitted and the test given in 19.1.3 is completed.

Figure 19 — *Solid link for test on fuse clips*

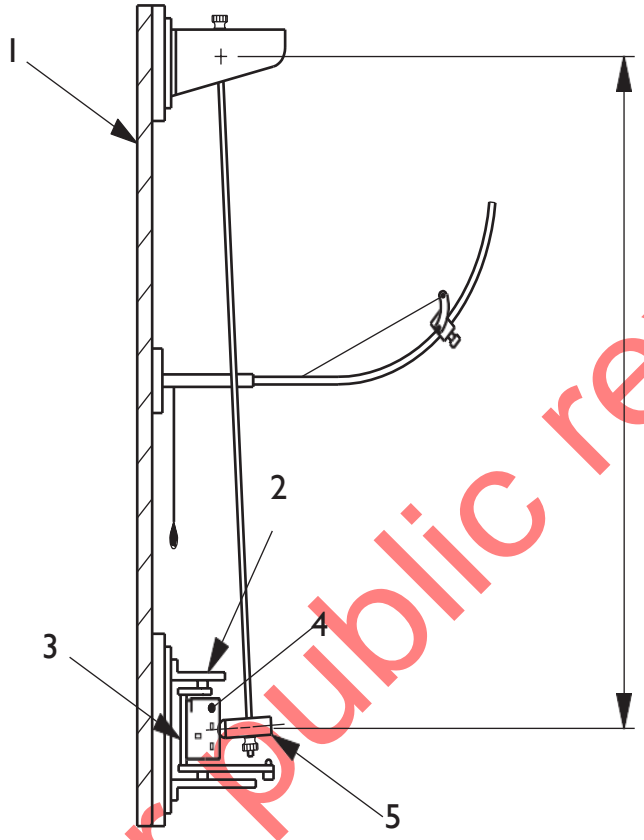


Note ***Finish: polished and sharp corners removed.***

19.1.3 Fixed connection units are tested with the impact test apparatus shown in Figure 21a). The pendulum consists of a steel tube with an external diameter of 9 mm nominal and a wall thickness of 0.5 mm nominal suspended in such a way that it swings only in a vertical plane. A hammer is rigidly fixed to the lower end.

Figure 21a) — *Pendulum impact test: General view of apparatus*

Dimensions in millimetres



Key

1 Frame
2 Bracket for mounting support
3 Mounting support [see Figure 21c)]
4 Sample
5 Striking element [see Figure 21b)]

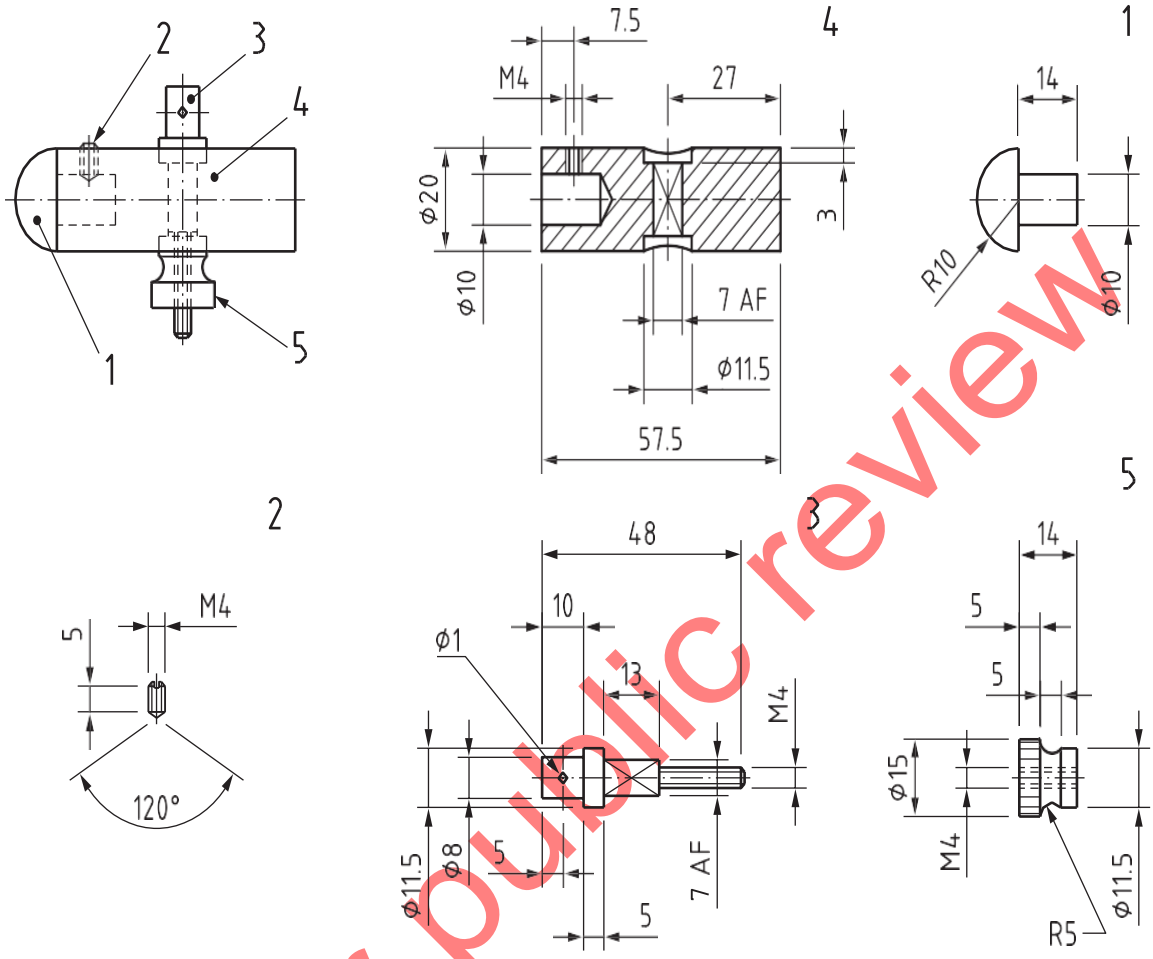
NOTE This drawing is not intended to govern design except as regards the dimensions and specific requirements shown.

The striking element has a hemispherical face made of poly amide having a Rockwell hardness of

85 ≤ HR ≤ 100, or hornbeam, and a radius of 10 mm ± 0.5 mm [see Figure 21b)]. The design of the apparatus is such that a force of between 1.9 N and 2 N has to be applied to the face of the hammer to maintain the pendulum in a horizontal position.

Figure 21b) — *Pendulum impact test: Constructional details of striking elements*

Dimensions in millimetres



Key

1	Polymide or hornbeam
2	Steel
3	Steel
4	Steel
5	Steel

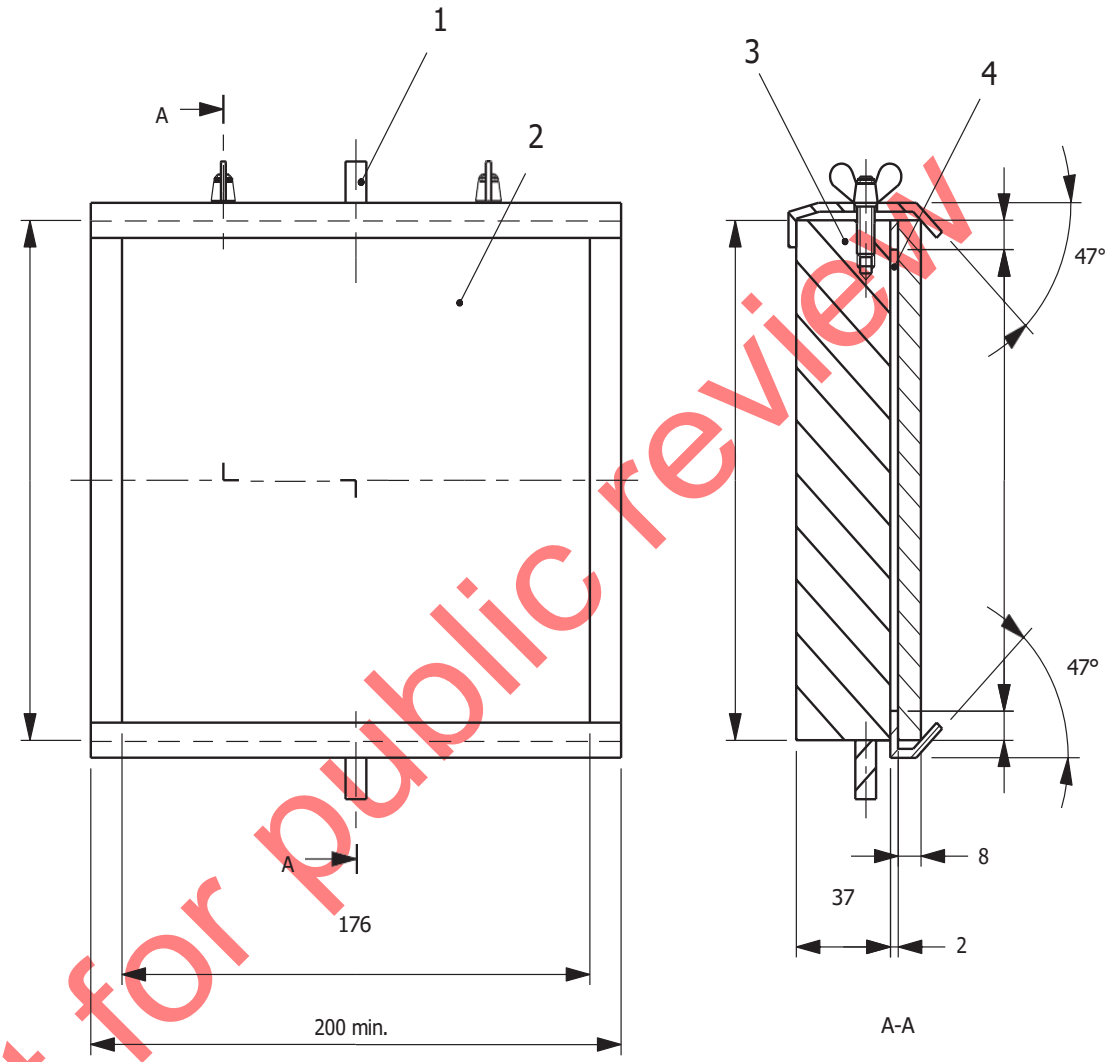
NOTE This drawing is not intended to govern design except as regards the dimensions and specific requirements shown.

The connection unit is mounted on a sheet of plywood approximately 8 mm thick and 175 mm square, secured at its top and bottom edges to a mounting support.

The mounting support [see Figure 21c)], having a mass of 10 kg ± 1 kg, is mounted on a rigid bracket by means of pivots. The bracket is mounted on a frame which is fixed to a solid wall.

Figure 21c) — *Pendulum impact test: Constructional details of mounting support for test samples*

Dimensions in millimetres



Key

1 Pivot
2 Sheet of plywood
3 Cast iron or steel
4 Air gap

NOTE This drawing is not intended to govern design except as regards the dimensions and specific requirements shown.

The design of the mounting assembly shall be such that:

a) the specimen can be so placed that the point of impact lies in the vertical plane through the axis of the c pendulum pivot:

b) the specimen can be moved horizontally and turned about an axis perpendicular to the surface of the plywood;

c) the plywood can be turned about a vertical axis.

The connection unit is mounted on the plywood as in normal use.

Flush connection units and their boxes (if any) are placed in a block of hardwood which is itself fixed to the sheet of plywood.

The wood used shall have the direction of the wood fibres perpendicular to the direction of impact.

To simulate the condition of normal use the rear of the plate is flush with the surface of the block. The front edge of the box is between 2.5 mm and 5 mm behind the face of the block.

The connection unit is placed so that the point of impact lies in the vertical plane through the axis of the pivot of the pendulum. For all tests the hammer falls from a height of $150\ ^{0}_{-5}$ mm measured vertically between the point of impact on the specimen and the face of the hammer at the point of release. Ten blows are applied to points evenly distributed over the connection unit. Any lens incorporated in a connection unit receives one blow of the hammer at a point approximately at its centre. One of the 10 blows of the hammer is applied to the actuating member, if any.

After the test the connection unit shall still be in accordance with Clause 8, Clause 9 and Clause 14. After the test on a lens, the lens may be cracked and/or dislodged but it shall not be possible to touch live parts using the test probe of EAS 370 applied with a maximum force of 5 N, applied in accordance with 9.1.1.

Damage to the finish, small dents which do not reduce creepage distances and clearances below the values specified in Clause 8 and small chips that do not adversely affect the protection against electric shock or moisture shall be ignored.

Cracks not visible with normal or corrected vision without additional magnification, and surface cracks in fibre-reinforced mouldings and the like shall be ignored.

20 Screws, current-carrying parts and connections

20.1 Screwed connections, electrical and otherwise, shall withstand the mechanical stresses occurring in normal use. Screws directly transmitting electrical contact pressure shall screw into metal. Screws shall not be of metal which is soft and liable to creep.

Screws shall not be of insulating material if their replacement by a metal screw would affect the safety or performance requirements of the connection unit.

Contact pressure in electrical connections within the connection unit and between the connection unit and the cable or flexible cord connected to it shall not be 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.

NOTE The suitability of the material i.e. considered in respect of the stability of the dimensions under all conditions of normal use especially in view of shrinking, ageing or cold flow of the insulating part.

20.1.1 Compliance shall be checked by inspection and, for screws and nuts which are intended to be tightened during installation, or use, or during replacement of a fuse link by the following test.

The screw is tightened and loosened as follows:

a) 10 times for screws in engagement with a thread of insulating material, the screw being completely removed and replaced each time;

b) five times for nuts and other screws.

When testing terminal screws and nuts a 2.5 mm^2 flexible conductor is placed in the terminal in the case of portable connection units, and a 1.5 mm^2 flexible conductor in the case of flexible cord outlet connection units. The conductor is moved each time the screw is loosened The test shall be made by means of a suitable test screwdriver, applying a torque (as given in Table 6) in one smooth and continuous motion. The shape of the blade of the test screwdriver shall suit the head of the screw being tested.

During the test no damage impairing the further use of the screwed connection shall occur.

NOTE It is essential that the shape of the blade of the test screwdriver suits the head of the screw being tested and that the screw is not tightened in jerks.

20.2 Thread-cutting and/or thread-screws shall not be used for the connection of current-carrying parts.

NOTE Thread-forming 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.

Screws which make a mechanical connection between different parts of the connection unit shall be locked against loosening, if the connection carries current.

Rivets used for current-carrying or earth continuity connections shall be locked against loosening, if these connections are subject to torsion in normal use which is likely to loosen the connection.

20.2.1 Compliance shall be checked by inspection and by manual test.

NOTE 1 Spring washers and the like may provide satisfactory locking.

NOTE 2 For rivets a non-circular shank or an appropriate notch may be sufficient.

20.3 Current-carrying parts shall be of brass, copper, phosphor-bronze or other metal at least equivalent with regard to its conductivity, resistance to corrosion.

NOTE This requirement does not apply to screws, nuts, washers, clamping plates and similar parts terminals, nor to pans of connection units used for earth continuity purposes other than the grounding contacts.

20.3.1 Compliance shall be checked by inspection and by the relevant tests described in 10.1, Clause 15 and Clause 23.

21 Resistance to heat

21.1 Connection units shall be resistant to heat.

21.1.1 Compliance shall be checked as follows.

NOTE Parts made from rubber or ceramics in connection units are not subjected to these tests. For complete connection units and for separate ancillary components specimens are kept for 60^{5}_{0} min in a heating cabinet maintained at the following temperature:

a) 100 °C ± 5 °C for portable connection units,

b) 70 °C ± 5 °C mounting boxes, separate covers and separate cover plates;

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

NOTE A slight displacement of the sealing compound should be disregarded.

After the test the connection unit shall still comply with 9.1.1 and 14.1.3, and it shall not be possible to touch live parts with test probe 11 of EAS 370 applied with a force of 30^{0}_{-2} N

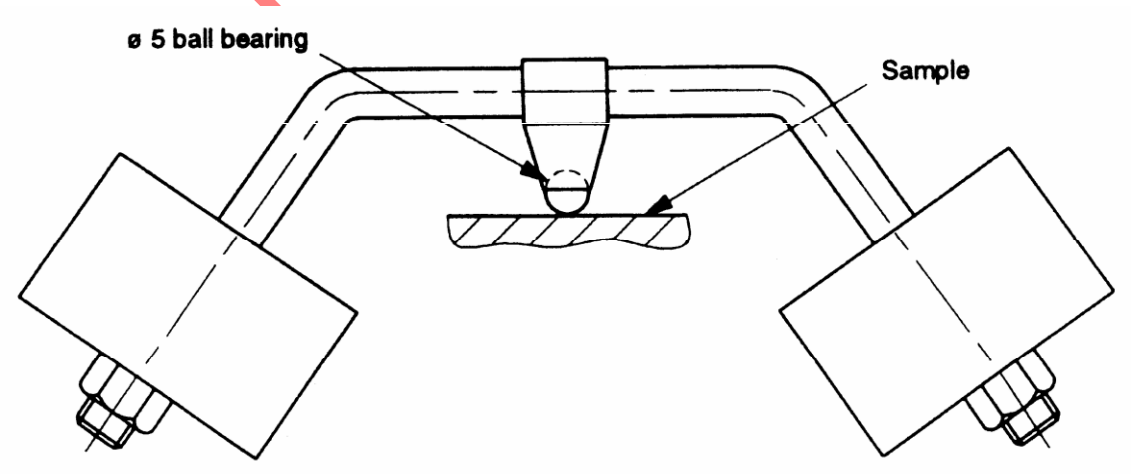
.

21.2 Parts of insulating material shall be sufficiently resistant to heat having particular regard to their location and function in the complete connection unit.

21.2.1 Compliance shall be checked as follows:

a) parts of ceramic material are deemed to comply without testing;

b) all other parts of insulating material shall be subjected to the ball pressure test in accordance with IEC 60695-10-2 using the apparatus shown in Figure 24.



All dimensions are in millimetres

NOTE This drawing is not intended to govern design except as regards the dimensions and specific values shown.

Figure 24 — Apparatus for ball pressure test

22 Resistance to abnormal heat and fire

22.1 General

Connection units shall be proof against abnormal heat, fire and tracking.

22.1.1 Compliance shall be checked by the test described in 23.2.

The tests shall not be made on parts of ceramic material or metal.

22.2 Glow-wire test

The test is performed in accordance with IEC 60695-2-10 and at the test temperature given in Table 11.

Table 11 — Application of glow-wire test

Part	Temperature of glow wire °C
Parts necessary to retain live parts in position	850 ± 15
Parts not necessary to retain live parts in position(although they may be in contact with live parts)	650 ± 10

NOTE 1 If the test specified is required to be made at more than one place on the same specimen, it is essential that care is taken to ensure that any deterioration caused by previous tests does not affect the result of the test to be made.

NOTE 2 Small parts unlikely to be subjected to abnormal heat and whose failure to pass these tests would not materially affect the safety of the connection unit are not subjected to the test.

The glow-wire test is applied to ensure that an electrically heated test wire under defined test conditions does not cause ignition of insulating parts or to ensure that a part of insulating material which might be ignited by the heated test wire under defined conditions, has a limited time to burn without spreading fire by flame or burning parts or droplets falling down from the tested part onto a pinewood board covered with tissue paper.

The test specimen shall be either a complete connection unit or, if the test cannot be made on a complete connection unit, a suitable part may be cut from one for the purpose of the test.

The test shall be made on one specimen.

In case of doubt, the test shall be repeated on two further specimens.

The test is made, applying the glow wire once.

The specimen shall be positioned during the test in the most unfavourable position of its intended use (with the surface tested in a vertical position).

The tip of the glow wire shall be applied to the specified surface of the specimen taking into account the conditions of the intended use under which a heated or glowing element may come into contact with the specimen.

The specimen shall be regarded as having passed the glow-wire test if:

a) there is no visible flame and no sustained glowing;

b) flames and glowing at the specimen extinguish within 30 s after the removal of the glow wire;

There shall be no ignition of the tissue paper or scorching of the board.

23 Resistance to excessive residual stresses and to rusting

23.1 Press-formed or similar current-carrying parts of copper alloy containing less than 80 % of copper shall be resistant to failure in use due to stress corrosion.

23.1.1 Compliance shall be checked by the following test.

The sample is degreased in a suitable alkaline degreasing solution or organic solvent, then immersed in an aqueous solution of mercurous nitrate containing 10 g of Hg_2 (NO_2 and 10 ml of HNO_3 (relative density 1.42) per litre of solution for 30 min ± 1 min at a temperature of 20 °C ± 5 °C.

NOTE Attention is drawn to the fact that due precautions should be taken when using these liquids as they are toxic.

After the treatment the sample is washed in running water, any excess mercury wiped off, and the sample is immediately visually examined.

There shall be no cracks visible with normal or corrected vision without additional magnification.

23.2 Ferrous parts, the rusting of which might cause the connection unit to become unsafe, shall be adequately protected against rusting.

23.2.1 Compliance shall be checked by the following test.

The sample is degreased in a suitable alkaline degreasing solution or organic solvent, 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 at least 10 min in a heating cabinet at a temperature of 100 °C ± 5 °C their surfaces shall show no signs of rust.

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

NOTE 2 For small helical springs and the like, and for parts exposed to abrasion, a layer of grease may provide sufficient protection against rusting. Such parts are only subjected to the test if there is doubt about the effectiveness of the grease film and the test should then be made without previous removal of the grease.

Annex A (normative)

The construction and calibration of a calibrated link

A.1 Construction

The calibrated link (see Figure 28) shall employ the following components used to produce fuses complying with EAS 496:

a) ceramic body (as standard);

b) filling (as standard);

c) end caps [modified standard cap as shown in Figure 28a)].

The resistive element shall be of copper nickel wire having a resistivity value between 44 NΩcm and 49 NΩ cm. The overall length shall be $25.4^{+0}_{-0.8}$ mm and the diameter such as to allow a small reduction in the cross-sectional area to adjust the watts loss to the required value. The ends are turned down so that the distance between the shoulders so formed shall be $25.4^{+0}_{-0.8}$ mm less twice the end cap end wall thickness *t* [see Figure 28b)].

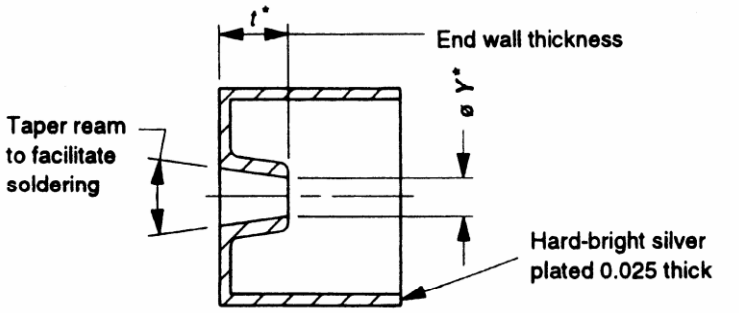
The resistive element shoulders shall be firmly butted to the inside faces of the end caps and soldered using a tin silver solder, grade 96S as specified in ISO 9453. The assembly thus formed [see Figure 28c)] shall be checked for watts loss in accordance with A.2. Metal shall then be carefully filed from the resistive element over as long a length as is possible and the assembly rechecked until the desired watts loss is achieved.

One end cap shall then be unsoldered, a standard ceramic body Fitted, the cavity filled and the end cap resoldered in position making sure the shoulder of the element is butted to the inside face of the end cap (the ceramic body shall not interfere with this condition). [See Figure 28d)]

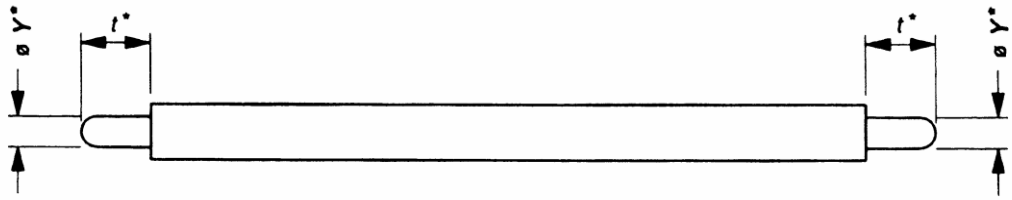
The watts loss shall be rechecked in accordance With A.2 and adjusted if necessary.

The resulting calibrated link shall be marked "NOT A FUSE" on the ceramic body and shall dimensionally be in accordance with EAS 496.

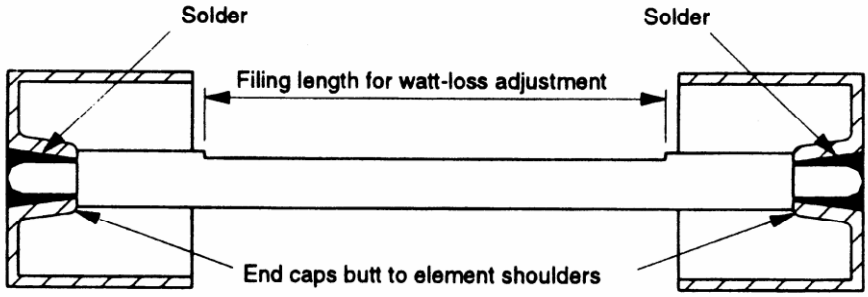
Figure 28 — Calibrated link (see A.1)



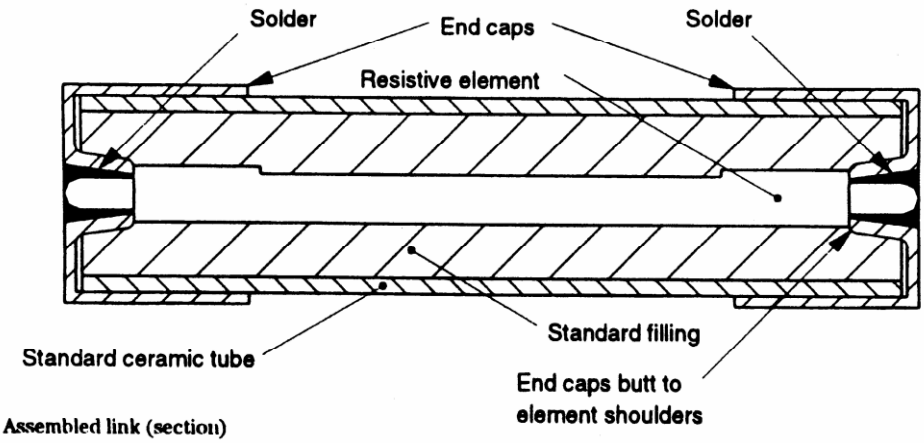
a) Modified standard end cap (section)



b) Resistive element Cu Ni



c) Assembly for calibration (section)



d) Assembled link (section)

* See Annex A.

All dimensions are in millimetres

NOTE This drawing is not intended to govern design except as regards the dimensions and specific values shown.

A.2 Calibration

The calibration jig shown in Figure 29 is mounted horizontally approximately 25 mm above a wooden board by means of two ceramic pillars. A fine wire thermocouple is attached to the centre of each fuse contact clip, on the outside of the top edge, in such a way that it does not interfere with the contact area. The thermocouples are taken out of the box in slots cut in one end of the jig base, the width of the slots just being sufficient to accept the diameter of the thermocouples. The connection to the jig base shall be by means of PVC insulated single-core copper cables, 0.3 m ± 0.05 m in length and 2.5 mm^2 cross-section.

The surroundings shall be free from draughts and the ambient air temperature, measured by a suitable thermometer or thermocouple at a horizontal distance of 1 m to 2 m from the calibrated link, shall be in the range of 15 °C to 25 °C. The calibrated link shall be inserted into the clips provided in the calibration jig and the cover replaced. A current of 13 A ± 0.1 A is then passed continuously through the calibrated link for 60 min ± 5 min. At the end of this time the temperatures measured by the thermocouples are noted, the cover of the jig is then removed and the millivolt drop between the end surfaces of the end caps of the calibrated link is measured whilst it is still carrying the test current.

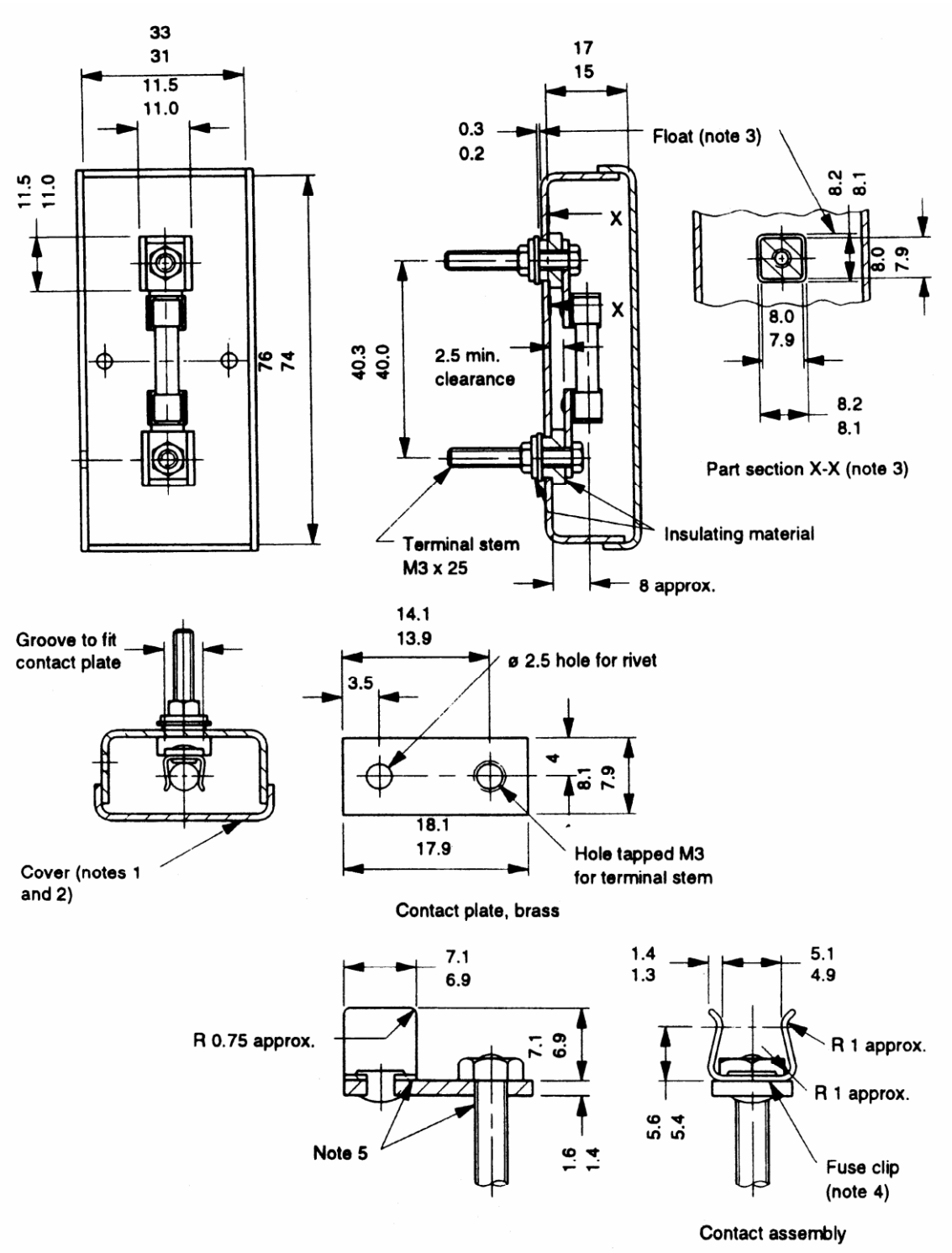
A.C. shall be used for the calibration.

The calibration is considered to be correct when the following apply:

a) the product of the measured millivolt drop multiplied by the test current gives a result of $1^{0.00}_{-0.05}$ W

b) the temperature difference between the fuse contact clips does not exceed 2 °C.

Figure 29 — Calibration jig for calibrated link (see A.2)



All dimensions are in millimetres NOTE 1 Box and cover made from 1.25 mm brass sheet, clean natural finish.

NOTE 2 Cover should be a push fit on box and should not be rigidly attached.

NOTE 3 The end float and clearance between the insulation and the box is to allow the contacts to be self-aligning.

NOTE 4 Fuse clip. Made from beryllium copper 0.45 mm thick and heat treated (170 HV minimum). Base clip to be flat; finish, silver plated.

NOTE 5 Joints between clip, contact plate and terminal stem to be soldered.

Annex B (normative)

Measurement of clearances and creepage distances

B.1 General

The width X specified in Examples 1 to 11 apply to all examples as a function of the pollution degree as given in Table B.1.

Table B.1 — Minimum values of width X

Pollution degree	Minimum values of width X mm
1 2 3	0.25 1.0 1.5

If the associated clearance is less than 3mm, the minimum groove width may be reduced to one-third of this clearance.

The methods of measuring creepage distance and clearances are indicated in the following Examples 1 to 11. These cased do not differentiate between gaps and grooves or between types of insulation.

The following assumptions are made:

— any recess is assumed to be bridged with an insulating link having a length equal to the specified width X and being placed in the most unfavourable position (see Example 3);

— where the distance across a groove is equal to or larger than the specified width X, the creepage distance is measured along the contours of the groove (see Example 2);

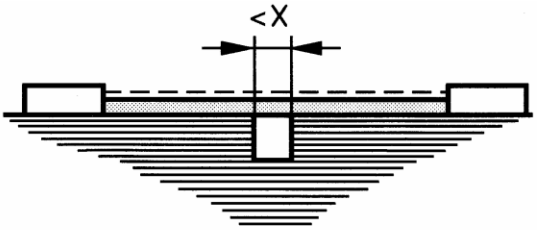
— creepage distances and clearances measured between parts which can assume different positions in relation to each other, are measured when these parts are in their most unfavourable position.

Explanation for Examples 1 to 11

---------- clearance

creepage distance

All dimensions are in millimetres

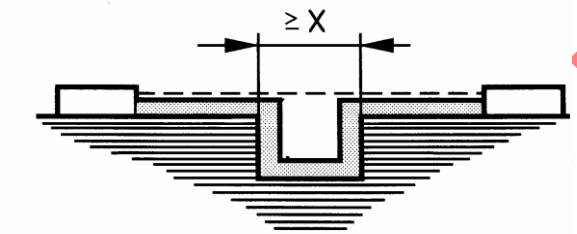


Example 1

Example 1

Condition: Path under consideration includes a parallel- or converging-sided groove of any depth with a width less than "X" mm.

Rule: Clear ante distance and clearance are measured directly across the groove as shown.

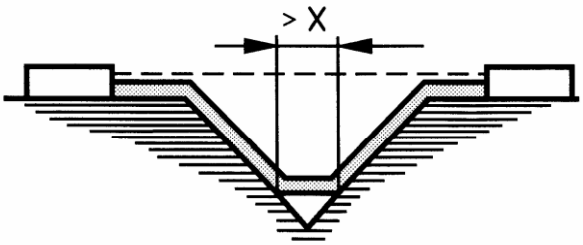


Example 2

Example 2

Condition: Path under consideration includes a parallel-sided groove of any depth and with a depth equal to or more than "X" mm.

Rule: Clearance is the "line of sight" distance. Creepage path follows the contour of the groove.

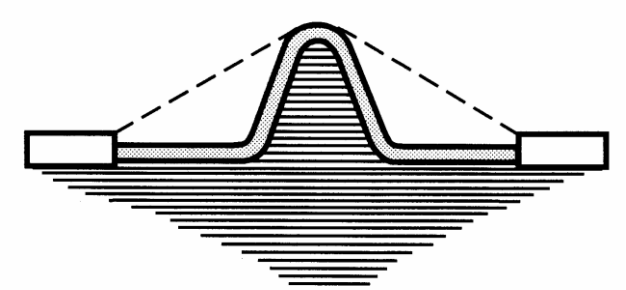


Example 3

Example 3

Condition: Path under consideration includes a V-shaped groove with a width greater than "X" mm.

Rule: Clearance is the "line of sight" distance. Creepage path follows the contour of the groove but "short-circuits" the bottom of the groove by an "X" mm link.

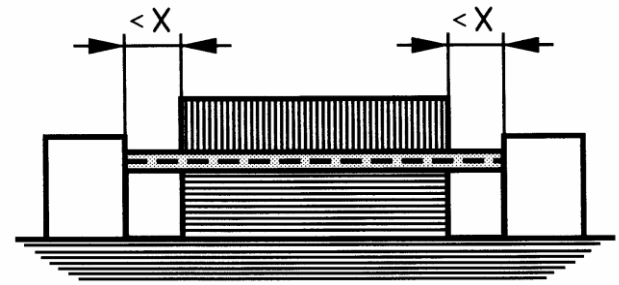


Example 4

Example 4

Condition: Path under consideration includes a rib.

Rule: Clearance is the shortest direct air path over the top of the rib. Creepage path follows the contour of the rib.

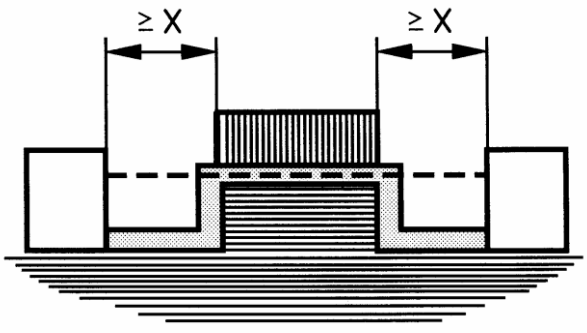


Example 5

Example 5

Condition: Path under consideration includes an uncemented joint with grooves less than "X" mm wide on each side.

Rule Creepage and clearance path is the "line of sight" distance shown.

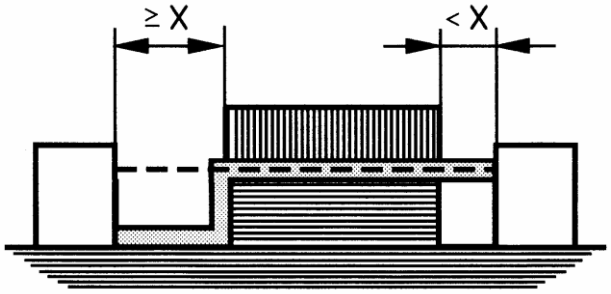


Example 6

Example 6

Condition: Path under consideration includes an uncemented joint with grooves equal to or more than "X" mm wide on each side

Rule Creepage and clearance path is the "line of sight" distance. Creepage follows the contour of the grooves.

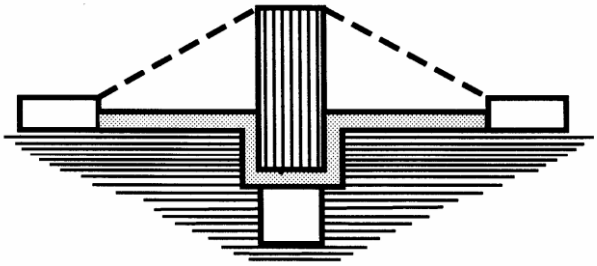


Example 7

Example 7

Condition: Path under consider anon includes an uncemented joint with groove on one side less than "X" mm wide and the groove on the other side equal to or more than "X" mm wide.

Rule: Clearance and creepage paths are as shown.

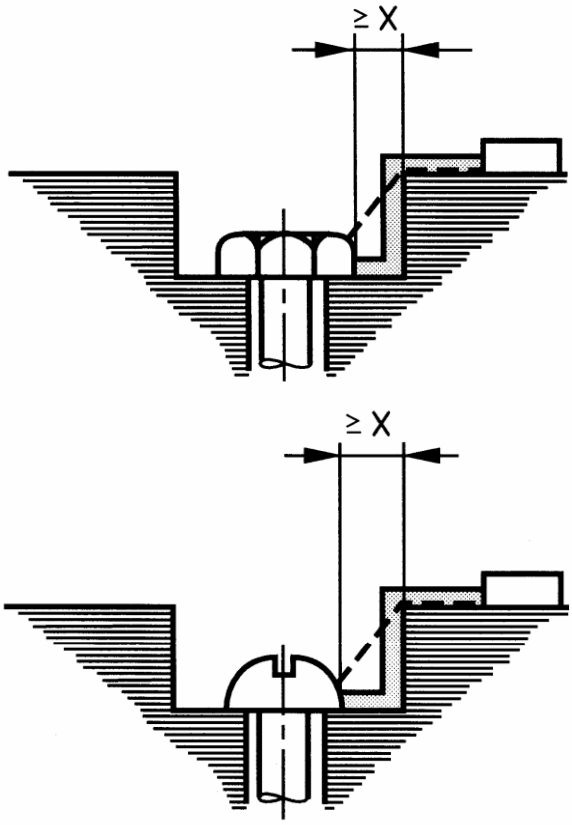


Example 8

Example 8

Condition: Creepage distance through uncemented joint is less than creepage distance over barrier.

Rule Clearance is the shortest direct air path over the top of the barrier.

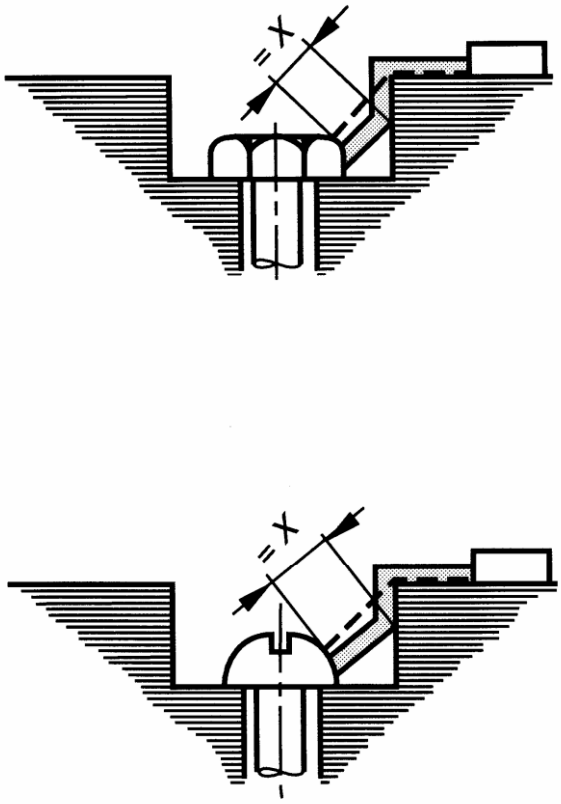


Example 9

Example 9

Condition: Gap between head of screw and wall of recess wide enough to be taken into account.

Rule: Clearance and creepage distance paths are shown.

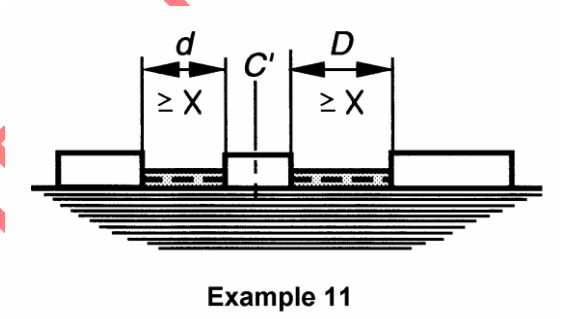


Example 10

Example 10

Gap between head of screw and wall of recess too narrow to be taken into account.

Measurement of creepage distance is from screw to wall when the distance is equal to "X" mm.



Example 11

Example 11

C = floating part

Clearance is distance $d_1 + d_2$

Creepage distance is also $d_1 + d_2$

Annex C (normative)

Determination of the Comparative Tracking Index (CTI) and Proof Tracking Index (PTI)

The CTI or PTI is determined in accordance with IEC 60112. For the purpose of this standard, the following applies.

a) The test specimen:

— the last sentence of the first paragraph does not apply;

— Notes 2 and 3 also apply to the PTI;

— if the surface 15 mm × 15 mm cannot be obtained because of the small dimensions of the PT system then special samples made with the same manufacturing process may be used.

b) The test solution "A" described in IEC 60112 shall be used.

c) In IEC 60112, Procedure, either CTI or PTI is determined:

— CTI is determined in accordance with IEC 60112;

— the proof tracking test of IEC 60112 is performed on 5 samples at the voltage based on the appropriate creepage distance, material group, pollution degree conditions and on the rated voltage of this standard declared by the manufacturer.

Annex D (normative)

Relation between rated impulse withstand voltage, rated voltage and Overvoltage Category

Table E.1 — Rated impulse withstand voltage for accessories energized directly from the low voltage mains

Nominal voltage of the supply system based on IEC 60038[a] V	Voltage line to neutral derived from nominal voltages a.c. or d.c. up to and including V	Rated impulse withstand voltage V		
		Overvoltage Category		
		I	II	III
230/400	300	1500	2500	4000

NOTE 1 For more information concerning supply systems see IEC 60664-1.

NOTE 2 For more information concerning Overvoltage Category see IEC 60664-1.

NOTE 3 Accessories fall into Overvoltage Category III. Parts of accessories where appropriate overvoltage reduction is provided fall into Overvoltage Category I. Energy consuming equipment falls into Overvoltage Category II.

[a] The / mark indicates a four-wire three-phase distribution system. The lower value is the voltage line-to-neutral, while the higher value is the voltage line-to-line.

Annex E (normative)

Pollution degree

The micro-environment determines the effect of pollution on the insulation. The macro-environment, however, has to be taken into account when considering the micro-environment.

Means may be provided to reduce pollution at the insulation under consideration by effective use of enclosures, encapsulation or hermetic sealing. Such means to reduce pollution may not be effective when the PT-system is subject to condensation or if, in normal operation, it generates pollutants itself.

Small clearances can be bridged completely by solid particles, dust and water and therefore minimum clearances are specified where pollution may be present in the micro-environment.

NOTE Pollution will become conductive in the presence of humidity. Pollution caused by contaminated water, soot, metal or carbon dust is inherently conductive.

Degrees of pollution in the micro-environment

For the purpose of evaluating creepage distances and clearances, the following three degrees of pollution in the micro-environment are established.

— 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.

Annex F (normative)

Impulse voltage test

The purpose of this test is to verify that clearances will withstand specified transient overvoltage.

The impulse withstand voltage test is carried out with a voltage having a 1.2/50 µS waveform as specified in IEC 60060-1 and is intended to simulate overvoltage of atmospheric origin. It also covers overvoltages due to switching of low-voltage equipment.

The test shall be conducted for a minimum of three impulses of each polarity with an interval of at least 1 s between pulses.

NOTE 1 The output impedance of the impulse generator should be not higher than 500 Ω.

The impulse shall have the following characteristics:

— the waveform 1.2/50 µS for the no load voltage with amplitudes equal to the values given in Table F.1;

— the waveform 8/20 µS for an appropriate surge current.

NOTE 2 If the sample is provided with surge suppression, the impulse voltage wave may be chopped but the sample should be in a condition to operate normally again after the test. If the sample is not provided with surge suppression and it withstands the impulse voltage, the waveform will not be noticeably distorted.

Table F.1 — Test voltages for verifying clearances at sea level

Rated impulse withstand voltage kV	**Impulse test voltage at sea level** kV
0.33	0.35
0.5	0.55
0.8	0.91
1.5	1.75
2.5	2.95
4.0	4.8
6.0	7.3

NOTE 1 When testing clearances, associated solid insulation will be subjected to the test voltage. As the impulse test voltage of Table F.1 is increased with respect to the rated impulse withstand voltage, solid insulation will have to be designed accordingly. This results in an increased impulse withstand capability of the solid insulation.

NOTE 2 The test maybe made with the pressure adjusted to the value corresponding to the altitude of 2 000 m (80 kPa) and 20 °C with the test voltage corresponding to the rated impulse withstand voltage. In this case, solid insulation will not be subjected to the same withstand requirements as when testing at sea level.

NOTE 3 Explanations concerning the influencing factors (air pressure, altitude, temperature humidity) with respect to electric strength of clearances are given in IEC 60664-1.

Bibliography

[1] ISO #####-#, *General title — Part #: Title of part*

[2] ISO #####-##:20##, *General title — Part ##: Title of part*

