SRI LANKA STANDARD 734 : PART 4 : 2017

UDC 621.316

SPECIFICATION FOR

13 A PLUGS, SOCKET-OUTLETS, ADAPTORS AND CONNECTION UNITS

PART 4 : SPECIFICATION FOR 13A FUSED CONNECTION UNITS SWITCHED AND UNSWITCHED

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard

SPECIFICATION FOR 13 A PLUGS, SOCKET-OUTLETS, ADAPTORS AND CONNECTION UNITS PART 4: SPECIFICATION FOR 13A FUSED CONNECTION UNITS SWITCHED AND UNSWITCHED

SLS 734: Part 4: 2017

(AMD 521 Attached)

Gr.19

SRI LANKA STANDARDS INSTITUTION
17, Victoria Place
Elvitigala Mawatha
Colombo – 08
Sri Lanka

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This Standard does not purport to include all the necessary provisions of a contract.

CONTENTS

CLAUSE **PAGE**

Tables

Figures

Annexes

Sri Lanka Standard
SPECIFICATION FOR 13 A PLUGS, SOCKET-OUTLETS, ADAPTORS AND CONNECTION UNITS
PART 4 SPECIFICATION FOR 13A FUSED CONNECTION UNITS SWITCHED AND UNSWITCHED

FOREWORD

This Standard was approved by the Sectoral committee on Electrical appliances and accessories and was authorized for adoption and publication as a Sri Lankan standard by the council of the Sri Lanka standards institution on 2017-06-14.

This standard is presented in five parts as given below and Part **1** and Part **2** are second revision of **SLS 734: 1996** and other parts are newly included in this standard:

Part 1: Specification for rewirable and non-rewirable 13A fused plugs
Part 2: Specification for 13A switched and unswitched socket outlets
Part 3: Specification for adaptors
Part 4: Specification for 13A fused connection units, switched and unswitched
Part 5: Specification fused conversion plugs

This is Part **4** of the **SLS 734** and it specifies requirements for 13 A fused fixed connection units for household, commercial and light industrial purposes, with particular reference to safety in normal use.

All values given in this specification are in SI unit.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value observed or calculated, expressing the results of a test or an analysis shall be rounded off in accordance with **SLS 102**.The number of figures to be retained in the rounded off values shall be the same as that of the specified value in this standard.

In the preparation of this standard, the assistance derived from the **BS 1363** for 13 A Plugs, Socket outlets, Adaptors and Connection units, Part **4: 2016** Specification for 13A Fused connection units switched and unswitched, is gratefully acknowledged.

1 SCOPE

This part of **SLS 734** specifies requirements for 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 conforming to **SLS 1533.**

Requirements are specified for 13 A connection units with or without associated controlling switches, for flush mounting in suitable enclosures, e.g. boxes conforming to **SLS 1310**, or for surface or panel mounting. Connection units are intended for use with cables conforming to **SLS 733** having copper conductors. Connection units with cable outlets are additionally intended for use with flexible cables, conforming to the relevant part of **SLS 1504** on 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:

- flat quick-connect terminals;
- insulation-piercing connecting devices; and
- twist-on connecting devices.

NOTES:

1 *The titles of the publications referred to in this part of **SLS 734** are listed in the references.*

2 *Requirements for electromagnetic compatibility are not given for the following reason.*

A connection unit is mechanical by nature of construction. A connection unit does not emit intolerable electromagnetic interference and the product is immune from electromagnetic interference.

2 REFERENCES

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

IEC 60417-DB,Graphical symbols for use on equipment

IEC 60664-1 Insulation coordination for equipment within low voltage Systems
Part 1: Principles, requirements and tests
Part 3: Use of coating, potting or moulding for protection against pollution
Part 5: Comprehensive method for determining clearances and creepage distances equal to or less than 2 mm

IEC 60695	Fire hazard testing Part 2-11: Glowing hot – wire based test methods-glow-wire flammability test method for end-products *(GWEPT)* Part 10- 2- Abnormal heat – ball pressure test
IEC 61032	Protection of persons and equipment by enclosures-probes for verification
IEC 61140	Protection against electric shock – Common aspects for installation and equipment
IEC 61180	Guide to high-voltage test techniques for low-voltage equipment Part 1: Definitions, test and procedure requirements
BS 219	Specification for soft solders
BS 7211	Electric cables – Thermosetting insulated and thermoplastic sheathed cables for voltages up to and including 450/750 V for electric power and lighting and having low emission of smoke and corrosive gases when affected by fire
SLS 733	Electric cables- PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power, lighting
SLS 734	13 A plugs, socket-outlets, adaptors and connection units Part 1: Specification for 13 Arewireable and non rewireable plugs Part 2: Specification for 13 A switched and unswitched socket-outlets Part 3: Specification for adaptors Part 5: Specification for fused conversion plugs
SLS 963	Degrees of protection provided by enclosures (IP code)
SLS 1259	Sri Lankan standard voltages
SLS 1310	Boxes for flush mounting of electrical accessories
SLS 1504	Electric cables – Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U) Part 1: General requirements Part 2-11: Cables for general applications – Flexible cables with thermoplastic PVC insulation Part 2-12: Cables for general applications – Cables with thermoplastic PVC insulation for extensible leads Part 2-21: Cables for general applications – Flexible cables with crosslinked elastomeric insulation Part 2-71: Cables for general applications – Flat tinsel cables (cords) with thermoplastic PVC insulation
SLS 1533	Specification for general purpose fuse links for domestic and similar purposes (primarily for use in plugs)

3 TERMS AND DEFINITIONS

For the purposes of this standard the following terms and definitions apply.

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 equipment may be connected, and having provision for a replaceable cartridge fuse-link

NOTE: *The device may include its dedicated enclosure.*

3.2 cable outlet connection unit: A fixed wiring device as in **3.1** having provision for a flexible cable.

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.

NOTE: *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 or similar device 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 cable and the conducting parts of the connection unit without the use of special tools.

3.12 screw-type terminals: 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 clamp type (screwless) terminal: A 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.

3.14 fuse carrier: A moveable or removable part designed to carry, retain, cover and/or remove the fuse-link.

3.15 type test: A test or series of tests made on a type test sample, for the purpose of checking conformity to the design of a given product with the requirements of the relevant standard.

3.16 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.

3.17 accessible external surface of a connection unit: All surfaces of a fused connection unit which can be touched by test probe B of **IEC 61032** connection unit is installed as in use.

3.18 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.*

3.19 fine wire thermocouple: A thermocouple having wires not exceeding 0.3 mm in diameter.

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

3.21 creepage distance: The shortest distance along the surface of the insulating material between two conductive parts.

3.22 clearance: Shortest distance in air between two conductive parts.

3.23 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*

3.24 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.

3.25 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.

3.26 functional insulation: Insulation between conductive parts which is necessary only for the proper functioning of the equipment.

3.27 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.

3.28 insignificant mass: Insufficient combustible mass to constitute a fire hazard.

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

3.29 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. (**IEC 60695-2-11**)

NOTE: *More information concerning small parts can be found in Clause **4.4** of **IEC 60695-2-1**.*

4 CONDITIONS OF USE

4.1 General

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 **SLS 734.**

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

a) an ambient temperature in the range -5 ºC to +40 ºC, the average valve over 24 h not exceeding 35 ºC.

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 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);
c) an altitude not exceeding 2 000 m above sea level;
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 **SLS 734** , the 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 ºC ± 5 ºC and after being conditioned at normal laboratory temperature and humidity levels for at least four days.

Unless otherwise stated by the manufacturer, flush-mounted connection units shall be tested when mounted on a corresponding insulated box conforming to the dimensional requirements of **SLS 1310**, the fixing screws being tightened with a torque of 0.6 Nm ±10 per cent. Other types are mounted according to the manufacturer's instructions.

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 conform to this part of **SLS 734** if no sample fails in the complete series of tests given in Table **1**.

TABLE 1 : Schedule of tests.

Sequence	Sample	Tests	Clause number
(1)	**(2)**	**(3)**	**(4)**
1	3	Inspection, measurement and manipulation	5, 6, 7, 9, 11. 1 (except 11.9), 12 (12.1, 12.2, 12.3, 12.4 and 12.8, 18 (18.2 ,18.3 and 18.4 only), 8(except Annex C), 20
2	3	General	5, 10, 18.1, 13.2, 12.5 (9.1.1 only), 19.1.3
3	3		5, 13.1, 14, 12.5(19.1.2 and 16.1.3 only), 16.1.2, 12.6,15
4	3		5, 13.1, 14, 17
5	3	Materials	5, 21
6	3		5, 22.2, 8.2 (Annex **C** only)
7	3		5, 23
8 [a)]	3	Positive break	5, 12.7
9	3	Isolation	5, 14.2
10	3	Ingress protection	5, 12.10, 13.3
11	3	Addition tests for Connection units with screwless terminals	5, 13.1, 11.9

NOTE: *The order of tests given in sequence 1 above 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 sample fails in the complete series of tests given in Table **1**, then connection units of that type shall be deemed to have failed to conform to this part of **SLS 734**, 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 retest then connection units of that type shall be deemed to conform to this part of **SLS 734**.

If more than one sample fails in the complete series of tests given in Table **1** then connection units of that type shall be deemed not to conform to this part of **SLS 734**.

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

NOTE: *Reference 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 samples in the sample column and in the order given.

6 CLASSIFICATIONS

6.1 Connection units shall be classified as follows:

6.1.1 *According to switching capability:*

a) switched; or
b) unswitched.

6.1.2 *According to method of mounting:*

a) fixed flush;
b) fixed surface; or
c) fixed panel-mounting.

6.1.2 *According to provision for outgoing flexible cable*:

a) with outgoing flexible cable; or
b) without outgoing flexible cable.

6.1.3 ***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.

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) terminals intended for the connection of the various conductors shall be identified by the symbols given in **7.2**;
c) the words "FUSE" or "FUSED" or the symbol (given in **7.2**) on the external accessible surface of a connection unit or fuse carrier;
d) all connection units shall be marked with:
   i) rated current;
   ii) rated voltage;
   iii) nature of supply;
   iv) incoming (in or supply) terminals; and
   v) outgoing (out or load) terminals.
e) for connection units with screwless terminals:
   i) an appropriate marking indicating the length of insulation to be removed before insertion of the conductor into the screwless terminal;
   ii) an indication of the suitability to accept rigid conductors only for those connection units having this restriction;
   iii) an indication of the suitability to accept flexible conductors only for those connection units having this restriction.
f) 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 Conformity shall be checked by inspection and by rubbing the markings for approximately 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 per cent 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 conform without test.

7.2 If symbols are used they shall be as follows:

Amperes	A
Volts	V
alternating current	~
line	L
neutral	N
*earth 	(preferred) or 
*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

NOTE: ***IEC 60417-DB*** *gives details of symbols marked with *.*

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 250 V ~ 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

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 conform to the relevant sub-clauses of **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 conforming to 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.

NOTES:

1) *The requirements and tests are based on **IEC 60664-1**.*

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 **SLS 734** products through specific mechanical and material tests.*

8.1 Clearances

Connection units energized directly from the low voltage supply fall into Overvoltage Category III.

The clearances shall 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.*

8.1.1 *Clearances for basic insulation*

The clearances for basic insulation shall not be less than the values given in Table **2** except as described below.

Smaller unspecified clearances (except those values marked in Table **2** with footnote "b") may be used if the connection unit 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.

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

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**.

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

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**.

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

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

TABLE 2 - Minimum clearances for basic insulation

Rated impulse withstand voltage kV[a)]	**Minimum clearances in air up to 2000 m above sea level** mm
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	3.0
6.0	5.5

a) See Annex **D**. This voltage is:

- for functional insulation: the minimum 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 connection unit;
- 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 clearances 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**.

Conformity 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.
Conformity 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.

NOTES:

1) *Moveable part are, for example, hexagonal nuts, the position of which cannot be controlled throughout an assembly.*

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	$600 \leq$ CTI/PTI
Material group II	$400 \leq$ CTI/PTI < 600
Material group IIIa	$175 \leq$ CTI/PTI < 400
Material group IIIb	$100 \leq$ CTI/PTI < 175

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

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**.

Conformity shall be checked by measurement.

TABLE 3 - Minimum creepage distances (mm) for basic insulation

Rated voltage [a] V (r.m.s.) Up to and including	Pollution degree 2[b] Material group			Pollution degree 3[b] Material group		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
---	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 **F.3a** and Table **F.3b o**f **IEC 60664-1** based on the nominal voltage of the supply system.

[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**.

Conformity 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**.

Conformity 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**.

Conformity shall be checked by measurement.

8.3 Solid insulation

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

No minimum thickness is specified for solid insulation.

8.3.1 Conformity shall be checked by tests in accordance with **14.1.3** using the values given in Table **4**.

TABLE 4 -Withstand voltages for insulation types

Insulation	Test Voltage V(r.m.s)
Functional insulation	1500
Basic insulation	1500
Supplementary insulation	1500
Reinforced insulation	3000

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 and constructed 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 Conformity shall be checked by the application of test probe II of **IEC 61032:1** to the accessible external surface of the connection unit applied with a force of 5^{0}_{-1} N in the most unfavorable position, followed by the application of test probe B. 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 Conformity shall be checked by inspection and the following:

a) for metal parts insulated from live parts, by the test described in **14.1.3**;
b) for metal parts connected to an earthing terminal by the following test. A current of 25 A ±0.75 A, derived from an a.c. source having a no-load voltage not exceeding 12 V, shall be 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 Conformity shall be checked by the test described in **10.1.1**b) 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 (see Note 2) Nm	For other metal screws and nuts Nm	For screws of insulating material Nm
(1)	(2)	(3)	(4)
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 3.0 up to and including 3.2	0.3	0.6	0.6
Over 3.2 up to and including 3.6	0.4	0.8	0.6
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

NOTES:

1) *The recording of a measured value given in this table is considered to conform to this part of **SLS 734** on condition that the uncertainty of measurement at not less than 95per cent confidence level does not exceed ±10 per cent.*

2) *This column applies to metal screws without heads if the screw when tightened does not protrude from the hole, and to other metal screws which cannot be tightened by means of a screwdriver with 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 Conformity for screw-type terminals 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 **3.13**. Separate terminals shall be provided for incoming (supply) and outgoing (load) connections.

11.2.1 Conformity shall be checked by inspection.

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 Table **4** of **SLS 733.**

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

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 **SLS 1504-2-11**.

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

11.5 Outgoing (or load) line, neutral and earth terminals shall permit the connection without special preparation of one conductor of solid or stranded cables 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 Conformity shall be checked by inspection and by fitting the appropriate conductors.

11.6 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 each side 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 cables and 0.6 mm when intended solely for the connection of fixed wiring.

11.6.1 Conformity shall be checked by inspection and measurement.

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

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

11.7.1 Conformity shall be checked by inspection and measurement.

11.8 Outgoing (or load) terminals of cable outlet connection units shall be so located or shielded that where a stray strand of a flexible conductor might 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.

11.8.1 Conformity 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 cross-sectional area of 1.5 mm^2. One strand of the flexible conductor is left free and the other strands are fully inserted and clamped in the terminal. The free strand is bent, without tearing the insulation back, in every possible direction, but without making sharp bends round barriers.

The free strand of a 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 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) *rigid (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 can 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 can be connected or disconnected either at the same time or separately;
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}_{-1} 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 $13^{0}_{-0.2}$ 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: *T h e 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, care shall be taken to ensure that the conductors and the measurement equipment are not 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 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.

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 **11.9.8** 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 screws having a nominal diameter of 3.5 mm, or other suitable fixing means specified in the manufacturer's installation instructions.

Flush or semi-flush mounted connection unit plates shall have provision for two M3.5 fixing screws at centres of 60.3 mm ±0.2 mm on the horizontal or vertical centrelines for boxes intended to accommodate 1-gang connection units, 120.6 mm ±0.3 mm on the horizontal or vertical centrelines for boxes intended to accommodate 2-gang connection units or 180.9 mm ±0.4 mm on the horizontal or vertical centrelines for boxes intended to accommodate 3-gang connection units in accordance with **SLS 1310**.

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

12.1.1 Conformity shall be checked by inspection and measurement.

12.2 Flush-mounted connection unit plates for use with boxes conforming to **SLS 1310**, either of insulating material or metal, or a combination of both, shall be 82.5 mm × 82.5 mm minimum.

12.2.1 Conformity shall be checked by inspection and measurement.

12.2.2 For flush-mounted connection units, the size of the base 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 is not less than 6mm and such that the clearance between the overall depth of the base or bases and the bottom of the 35.0 mm deep box or enclosure, or box or enclosure specified in the manufacturer's instructions and/or literature, is not less than 14 mm, when the box and the connection units are in the relative positions they will occupy in use, except that encroachments on these clearances shall be permissible provided that there is no interference with at least one conduit or cable entry on each face of the box or enclosure.

There shall be no live metal parts protruding from or flush with the connection unit base. Any exposed live metal parts shall be recessed to give the necessary clearance distance from any flat earthed metal or with the lugs of a mounting box as described in **SLS 1301** which could come into contact with the base when the connection unit is installed in accordance with the manufacturer's instructions. The terminals shall be fitted with the conductors described in **11.5** and with terminal screws tightened to the values given in Table **5**.

NOTE: *I f the terminals are arranged for front wiring after fixing the base then the 14 mm clearance need not apply.*

For connection units for use in other boxes or enclosures, the clearance between the connection unit and the appropriate box or enclosure shall provide adequate wiring space according to the method of entry of all the necessary cables.

Where it is intended that the fixed supply wiring conductors pass through holes in the base of the connection unit to the terminals, each hole shall be large enough to accept satisfactorily three 2.5 mm^2 cable cores with their insulation, the sheath, if any, having been removed.

12.2.3 Conformity shall be checked by inspection and measurement.

12.3 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.

12.3.1 Conformity shall be checked by inspection and manipulation.

12.4 Provision shall be made for a fuse-link conforming to **SLS 1533** 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 cannot be displaced accidentally during use or be left in incorrect contact when the fuse cover or fuse carrier is replaced in its correct position.

It shall be possible to remove and replace the fuse-link whilst passing current without dismantling the connection unit and no parts which are live shall become accessible

during its removal or replacement.

The connection 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.

12.4.1 Conformity shall be checked by inspection and by the application of test probe B and test probe 13 of **IEC 61032** applied with a maximum force of 5 N, applied in accordance with **9.1.1**.

Fuse-link contacts 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-link contacts shall be checked by the test described in **16.1.3** after which the temperature-rise test described in **15** shall be carried out.

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

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

12.5.1 Conformity shall be checked by inspection and by the following test: Following the test described in **16.1.2**, the circuit is broken a further ten 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 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 or adequate 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.

12.6.1 Conformity shall be checked by inspection and by the test of **12.6.2**.

12.6.2 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 to provide the most onerous condition.

The method for fixing the contacts shall not unduly affect the test result. The test

sample may 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 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
(1)	**(2)**	**(3)**	**(4)**
Switch actuator	3F	50	150

F is the normal operating force in new condition. The test force shall be 3*F* with the stated minimum and maximum values applied.

NOTE: *The use of grease and the like is not considered to be a mechanical fixing 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 IP 20 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.

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

NOTE: *Drain holes, small gaps between cables and conduits, or between enclosure and operating means are neglected.*

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.

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

NOTE: *A drain hole in the back of the enclosure is deemed to be effective only if the design of the enclosure ensures a clearance of at least 5 mm from the mounting surface or provides a drainage channel of at least the size specified.*

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 Conformity shall be 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 are tested after having been mounted and assembled as specified in **13.3.2**.

For connection units having a lid, the lid is closed during the tests. The temperature in the cabinet is kept at 70 °C ±5 °C.

The samples are kept in the cabinet for 168^{+2}_{0} h.

NOTES:
1) *The use of an electrically heated cabinet is recommended.*
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; following which they are examined and shall show no damage which:

- would lead to non-conformity with this standard;
- would impair safety; or
- would prevent further use.

13.2 Resistance to humidity

Connection units shall be resistant to humid conditions which may occur in normal use.

13.2.1 Conformity shall be checked by the humidity treatment described below followed within 20 min by the measurement of the insulation resistance and by the electric strength test specified in **14**.

Vitrified ceramic material, which after 24 h immersion in water has not increased in mass by more than 0.5 per cent 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 depend on glaze 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* °C and (*T* +4) °C and then placed in a humidity cabinet containing air with a relative humidity maintained between 85 per cent and 95 per cent. The temperature of the air where the samples are placed shall be kept within ±2 °C of the chosen value *T*. The sample is kept in the cabinet for 48^{+1}_{0}h.

NOTES:

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.*

2) *A relative humidity of between 85 per cent and 95 per cent can be obtained by placing in the humidity cabinet a saturated solution of potassium nitrate (KNO_2) 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 **14** shall be made in the humidity cabinet or immediately after removal of the sample 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 **SLS 734.**

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 **SLS 963** under the conditions specified below.

Connection units shall be mounted as in normal use in accordance to 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.

- One sample shall be tested fitted with 2-core 0.5 mm^2 flexible cable as given in **SLS 1504 -2-11**.

- One sample shall be tested fitted with 3-core 1.5 mm^2 flexible cable as given in **SLS 1504 -2-11**.

- 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 a code H07RN-F and a cross-sectional area of 1.5 mm^2 as given in **SLS 1504-2-21**. 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 gland

Gland size mm	Metal glands Nm	Glands of insulating material Nm
(1)	(2)	(3)
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 can be removed without the aid of a tool shall be removed.

13.3.2.2. Protection against access to hazardous parts

The appropriate test according to **SLS 963** shall be performed.

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

The appropriate test according to **SLS 963** shall be performed. For connection units classified as IP5X, the enclosure shall be deemed to be category 2.

Test probes shall be not 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 **SLS 963** 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 code H07RN-F and a cross-sectional area of 1.5 mm^2 as given in **SLS 1504 -2-21**.

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

- One sample shall be tested fitted with 2-core 0.5 mm^2 flexible cable as given in **SLS 1504 -2-11**.

- One sample shall be tested fitted with 3-core 1.5 mm^2 flexible cable as given in **SLS 1504 -2-11**.

- 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 a code H07RN-F and a cross-sectional area of 1.5 mm^2 as given in **SLS 1504-2-21**. 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 can be removed 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 or greater than IPX5 is designed with drain holes, they shall be not 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:

a) be sufficient to interfere with the correct operation of the equipment or impair safety;
b) deposit on parts of insulating material where it could lead to tracking along the creepage distances;
c) reach live parts or windings not designed to operate when wet;
d) 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 Conformity shall be checked by the tests given in **14.1.2** and **14.1.3**.

14.1.2 The insulation resistance is measured using a d.c. voltage of 500^{+250}_{0} V, the measurement being made for 60^{+5}_{0}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:
   i) a metal foil in contact with the entire accessible external surface;
   ii) the earthing terminals;
   iii) any metal part of a cable 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,including earthed metal, intended to be insulated from them;
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 1000V is applied, the voltage then being raised to 2000 V ±60v for 60^{+5}_{0}s and is then short- circuited, the output current is not less than 200 mA. Any over current 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 61180-1**, Figure **1** is applied between the line terminals connected together and the load terminals connected together with the contacts in the open position.

The impulses are 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:

- ±5% for the peak value;
- ±30% for the front time;
- ±20% for the time to half value.

The shape of the impulses is 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 per cent of the peak value.

For oscillations on the first half of the front, amplitude up to 10 per cent of the peak value are 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.

NOTES:

1) *T h e surge impedance of the test apparatus should be 500 Ω.*

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 V	**Test voltage (kV) and corresponding altitudes above sea level m**				
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
-	Sea level	200	500	1000	2000
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 Conformity shall be checked by the following test.

The test shall be carried out at the rated voltage $^{+10}_{-20}$ per cent.

For the test, 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 test temperature rises are measured at the terminals and where overheating might result in a hazard. Values measured shall not exceed the appropriate 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 are bridged by solder.*

TABLE 9 - Permitted temperature rises

Measurement point	Temperature rise K
Terminals	**52**
Accessible external surface	**52**

NOTES:

1) *The recording of a measured value up to and including the specified maximum permissible limit for temperature rise is considered to conform to the requirements of the standard on condition that the uncertainty of measurement at not less than 95% confidence level does not exceed ±2 °C.*

2) *The temperature rise values and test arrangements are for socket-outlets connected to conductors intended to operate at a temperature not exceeding 70 °C.*

Surface-mounted connection units are mounted as in use, with their accompanying mounting block or back plate 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 boxes as shown in Figure **1b**) of **SLS 1310** 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 5 mm below the front surface of the block. The size of the block 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 Table **4** of **SLS 733.**

The incoming (supply) cable shall enter on the horizontal axis on one side of the enclosure and the outgoing (supply) 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 1.5 mm^2 3-core flexible cable as given in **SLS 1504-2-11** 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 cable

grips are wired as intended in normal use with the cable grip device operative.
For surface-mounted connection units the length of each of the cables within its 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, incorporated in the connection units is replaced by a calibrated link which shall be 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: 14 A ±0.4 A;
c) balance of load on supply terminals: 6 A ±0.4 A.

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

The connection unit is subjected to the loading given 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 connection unit switches and fuse contacts shall be adequate.

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

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) A ±0.4 A] in a substantially non-inductive a.c. circuit at 275 V ±5 V, ten 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 fuse contacts shall make and break a current by insertion and removal of a fuse in a substantially non-inductive a.c. circuitat 275 ±5 V, ten 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) A ±0.4 A]. Standard 13 A fuse-links, conforming to **SLS 1533**, shall be used for this test and, where necessary, shall be replaced 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 units 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 Conformity shall be checked by the following test.

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 per cent of the rated voltage.

The switch shall then make and break a rated 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. The switch shall be in accordance with **15** and the voltage drop across each pole, measured as above, shall not exceed 75 mV. The leakage current across open poles shall not exceed 6.0 mA at test voltage of 110 per cent of the rated voltage.

The switch shall also be in accordance with **14.1**, the test voltages of **14.1.3** being reduced by 25 per cent.

18 CONNECTION OF FLEXIBLE CABLES AND CABLE ANCHORAGE

18.1 For connection units with cable outlets

Provision shall be made for the entry and effective clamping of 2-core or 3-core circular flexible cables as given in **SLS 1504 -2-11**and **SLS 1504 -2-21**, having nominal conductor cross-sectional areas not exceeding 1.5 mm^2.

The cable anchorage shall be such that the conductors are relieved from strain, including twisting, where they are connected to the terminals.
The cable anchorage shall contain the sheath. Cable 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 cable into a knot or tying the ends with string, or the like, shall not be used.

18.1.1 Conformity shall be checked by inspection and by the following test.

Connection units are fitted with a 2-core circular flexible cable having a nominal conductor cross-sectional area of 0.5 mm^2 as given in **SLS 1504 -2-11.** The conductors are introduced into the terminals and the terminal screws tightened to one third of the torque values listed in Table **5**. The cable 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 **5**.

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

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

The flexible cable is then subjected 25 times to the pull given in Table 10. The pulls are applied in one smooth and continuous motion in the most unfavorable position momentarily. Immediately afterwards, the flexible cable is subjected for 60^{+5}_{0} s to the appropriate torque shown in Table 10, at a minimum starting distance of 150 mm from the cable entry measured along the length of the cable.

NOTE: *It is not intended that the dimension of 150 mm is maintained during the application of the test torque.*

TABLE 10 - Cable grip tests related to size of flexible cable

Flexible cable or cable size outgoing **mm^2**	**Cable grip tests**	
	Load +2%, −0% **kg**	**Torque** a) **Nm**
(1)	**(2)**	**(3)**
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 conform to this part of **SLS 734** on condition that the uncertainty of measurement at not less than 95 per cent confidence level does not exceed ±10 per cent.

The above tests are repeated but with the connection unit fitted with a 3-core flexible cable having a nominal conductor cross-sectional area of 1.5 mm^2 as given in **SLS 1504 -2-11**.

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

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

18.2 Cable anchorages shall anchor the cable securely to the connection unit, when installed as in normal use. The design shall ensure the following:

a) the cable anchorage cannot be released from the outside without the use of a tool;
b) it shall not be possible to touch cable anchorage screws, if any, with test probe B of **IEC 61032** when the connection unit is energized;
c) the cable is not clamped by a metal part bearing directly on the flexible cable;
d) at least one part of the anchorage is securely fixed to the connection unit;
e) clamping the flexible cable does not require the use of a special purpose tool.

18.2.1 Conformity shall be checked by inspection and test.

18.3 Screws which are used when clamping the flexible cable shall not serve to fix any other components unless the 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 Conformity shall be checked by inspection.

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

18.4.1 Conformity 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 Conformity shall be checked by the tests given in **19.1.2** and **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 **1** is inserted and withdrawn from the fuse clips 20 times in succession in a normal manner at a rate not exceeding ten per minute. A standard fuse-link conforming to **SLS 1533** is then fitted and the test given in **19.1.3** is completed.

19.1.3 Connection units are tested with the impact test apparatus shown in Figure **2**. 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.

The striking element has a hemispherical face made of polyamide having a Rockwell hardness of $85 \leq HRR \leq 100$,or hornbeam, and a radius of 10 mm ±0.5 mm(see Figure **3**) 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.

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 **4**), 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.

The design of the mounting assembly shall be such that:

a) the sample can be so placed that the point of impact lies in the vertical plane through the axis of the pendulum pivot;
b) the sample 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 sample and the face of the hammer at the point of release. Ten blows are applied to points evenly distributed over the connection unit. The fuse carrier and any lens incorporated in a connection unit receives one blow of the hammer at a point approximately at its centre. One of the ten blows of the hammer is applied to the actuating member, if any. For connection units that have an IP classification higher than IPX0 the test is carried out with any lid open. The lid is then closed, and an additional three blows in total applied to the most onerous points of the lid.

After the test the connection unit shall still conform to **8**, **9** and **14** and, for connection units having an IP classification greater than IP20, shall show no damage which impairs its ingress protection. 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 test probe 13 of **IEC 61032** applied with a maximum force of 5 N, and 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 cable 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 other materials is 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 Conformity 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) ten 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 solid conductor is placed in the terminal in the case of fixed wired connection units, or a 1.5 mm^2 flexible conductor in the case of flexible cable outlet connection units. The conductor is moved each time the screw is loosened.

The test is made by means of a suitable test screwdriver, applying a torque as given in Table **5** 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.

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

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 Conformity shall be checked by inspection and by manual test.

NOTES:
1) *Spring washers and the like may provide satisfactory locking.*
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, and resistance to corrosion, except for screws, nuts, washers, clamping plates and similar parts of terminals, nor to parts of connection units used for earth continuity purposes.

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

21 RESISTANCE TO HEAT

21.1 Connection units shall be resistant to heat.

21.1.1 Conformity 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, samples are kept for 60^{+5}_{0} min in a heating cabinet maintained at the following temperature:
a) 100 °C ±5 °C for connection units;
b) 70 °C ±5 °C for mounting boxes, separate covers and separate cover plates.

During the test they shall not undergo any change impairing their further use and sealing compound shall not flow to such an extent that live parts are exposed. A slight displacement of the sealing compound shall be disregarded.

After the test the connection unit shall conform to **9.1.1** and **14.1.3**, and it shall not be possible to touch live parts with test probe 11 of **IEC 61032** 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 Conformity shall be checked as follows:

a) parts of ceramic material are deemed to conform without testing;
b) all other parts of insulating material shall be subjected to the ball pressure test in accordance with **IEC 60695-10-2**.

The test temperature shall be as given below.

For parts of insulating material necessary to retain current-carrying parts in position, the test temperature shall be 125 °C ±5 °C.

For parts of insulating material not necessary to retain current-carrying parts in position, even though they may be in contact with them, the test temperature shall be 75 °C ±5 °C.

22 RESISTANCE TO ABNORMAL HEAT AND FIRE

22.1 General

Connection units shall be resistant to abnormal heat and fire.

22.1.1 Conformity shall be checked by the test described in **22.2**. 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 60695-2-11** 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 ±10
Parts not necessary to retain live parts in position (although they may be in contact with live parts)	650 ±10

NOTE: *If the test specified is required to be made at more than one place on the same sample, 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.*

Small parts (see **3.29**), parts of insignificant mass (see **3.28**), parts unlikely to be subjected to abnormal heat and parts whose failure to pass these tests would not materially affect the safety of the connection unit are not subjected to this glow-wire 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 sample 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 is made on one sample.

In case of doubt, the test shall be repeated on two further samples. The test shall be made, applying the glow-wire once.
The samples shall be positioned during the test in the most unfavourable position of its intended use (with the surface test in a vertical position).

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

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

a) there is no visible flame and no sustained glowing; or
b) flames and glowing of the sample 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 per cent of copper shall be resistant to failure in use due to stress corrosion.

23.1.1 Conformity 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 $Hg_2(NO_3)_2$ and 10 moles 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 is 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 Conformity shall be checked by the following test.

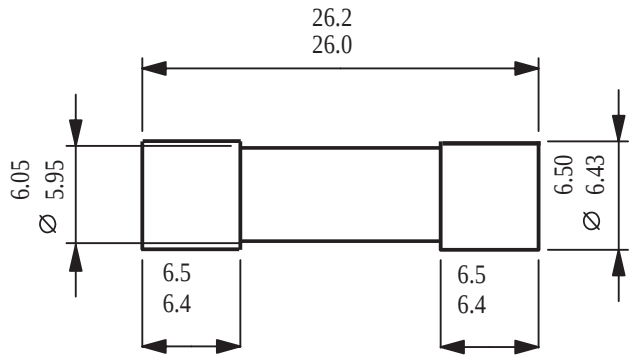
The sample is degreased in a suitable alkaline degreasing solution or organic solvent, the parts are then immersed for 10 min ±0.5 mm in a 10 per cent solution of ammonium chloride in water at a temperature of 20 °C ±5 °C.

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.

NOTES:

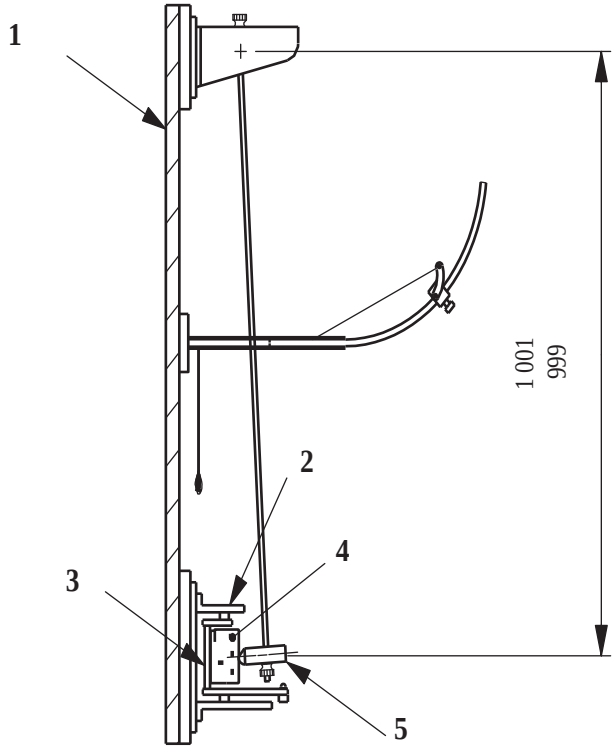
1) *Traces of rust on sharp edges and any yellowish film removable by rubbing should be ignored.*

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 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.*



NOTES: 1 *Dimensions are in millimetres.*
2 *Finish: polished and sharp corners removed.*

FIGURE 1 - Solid link for test on fuse clips (see 19)



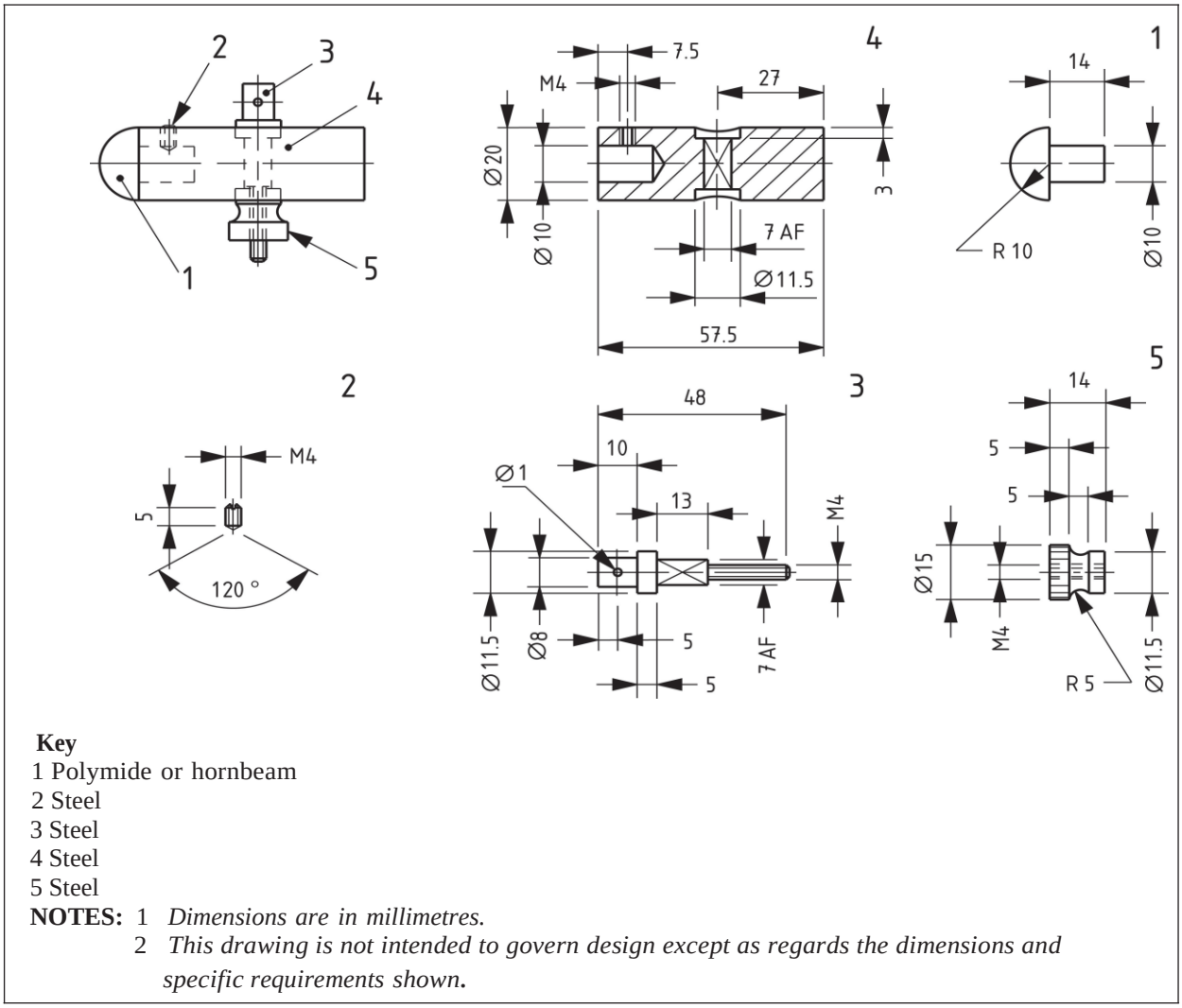
Key

1 Frame
2 Bracket for mounting support
3 Mounting support [see Figure 4)]
4 Samples
5 Striking element [see Figure 3)]

NOTES: 1 *Dimensions are in millimetres.*

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

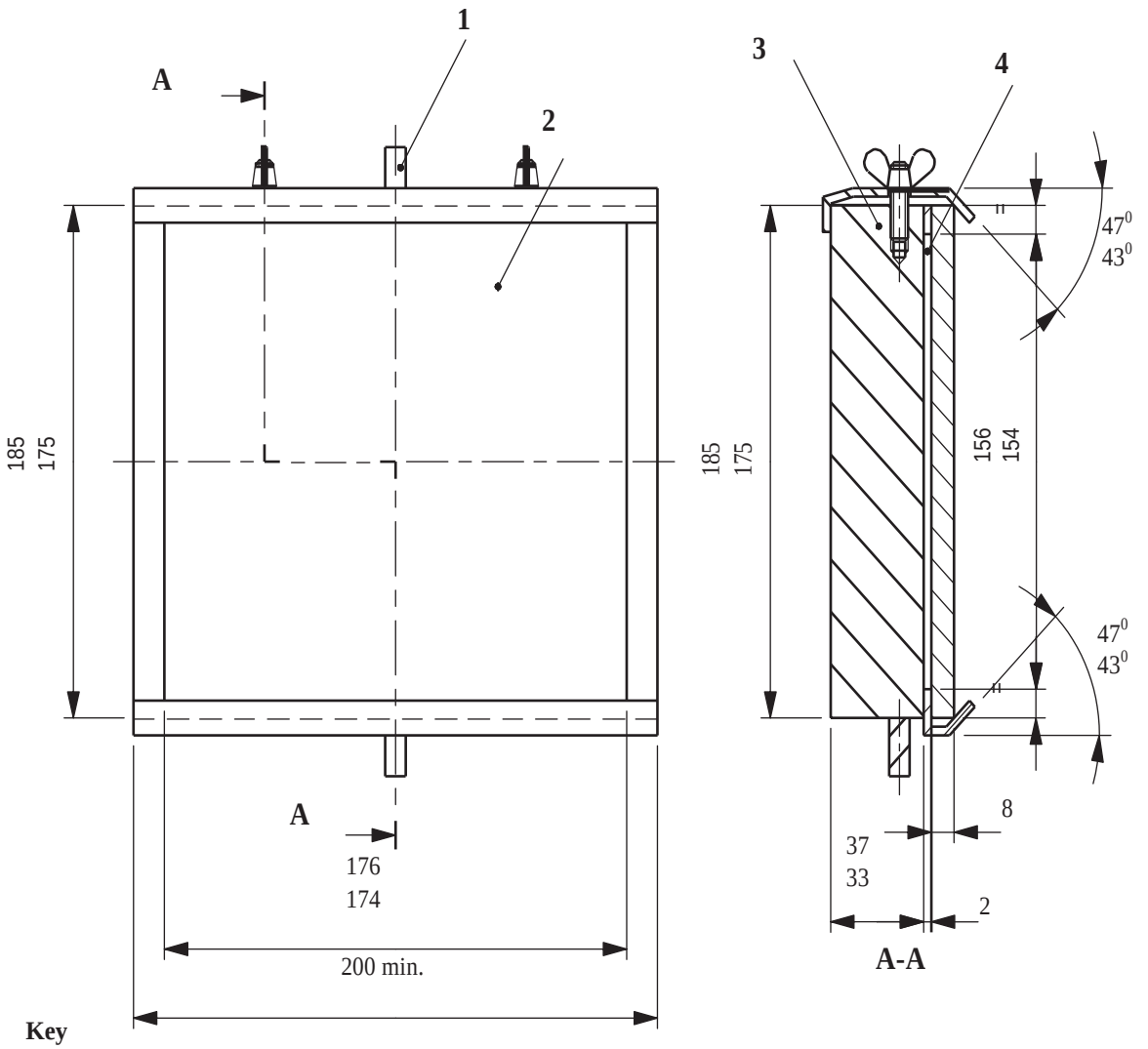
FIGURE 2 - Pendulum impact test: General view of apparatus (see 19)



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

NOTES: 1 *Dimensions are in millimetres.*
2 *This drawing is not intended to govern design except as regards the dimensions and specific requirements shown.*

FIGURE 3 - Pendulum impact test: Constructional details of striking elements (see 19)



Key

1 Pivot

2 Sheet of plywood

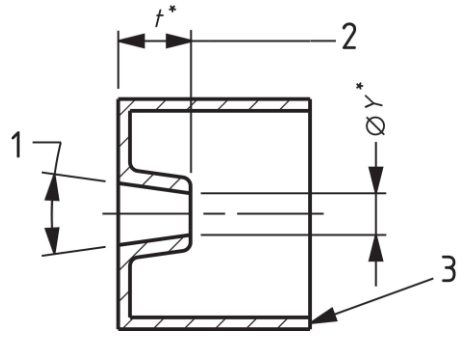
3 Cast iron or steel

4 Air gap

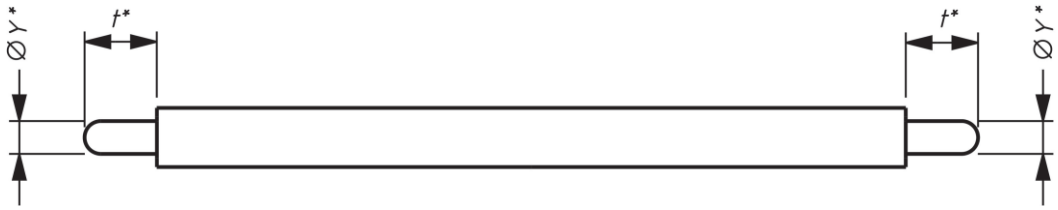
NOTES: 1 *Dimensions are in millimetres.*

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

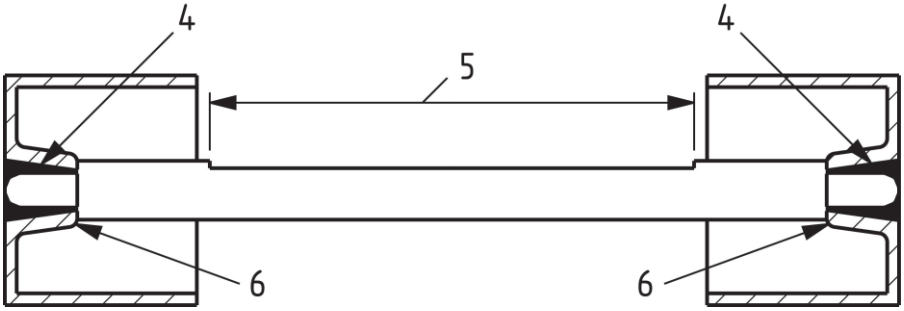
FIGURE 4 - Pendulum impact test: Constructional details of mounting support for test samples (see 19)



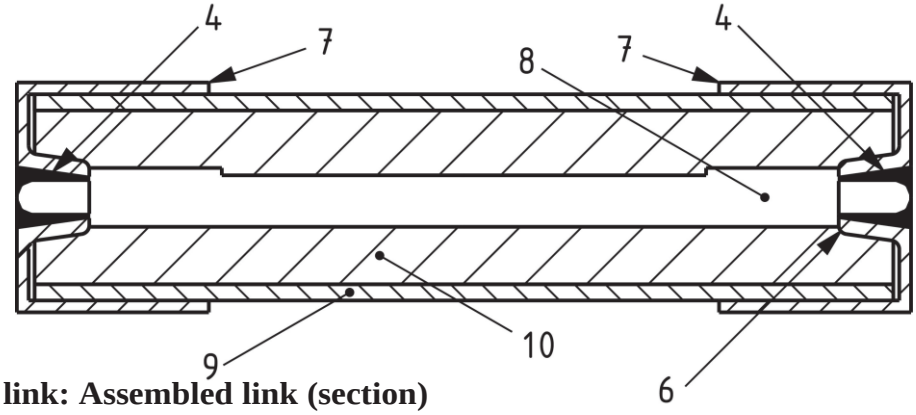
a) Modified standard end cap (section)



b) Calibrated link: Resistive element Cu Ni



c) Calibrated link: Assembly for calibration (section)



Calibrated link: Assembled link (section)

Key

Taper ream to facilitate soldering		6	End caps butt to element shoulders
End wall thickness		7	End caps
Hard-bright silver plated 0.025 thick		8	Resistive element
Solder		9	Standard ceramic tube
Filing length for watt-loss adjustment		10	Standard filling

NOTE *This drawing is not intended to govern design except as regards the dimensions and specific requirements shown.* **(* See Annex A.)**

FIGURE 5 - Calibrated link (see A.1)

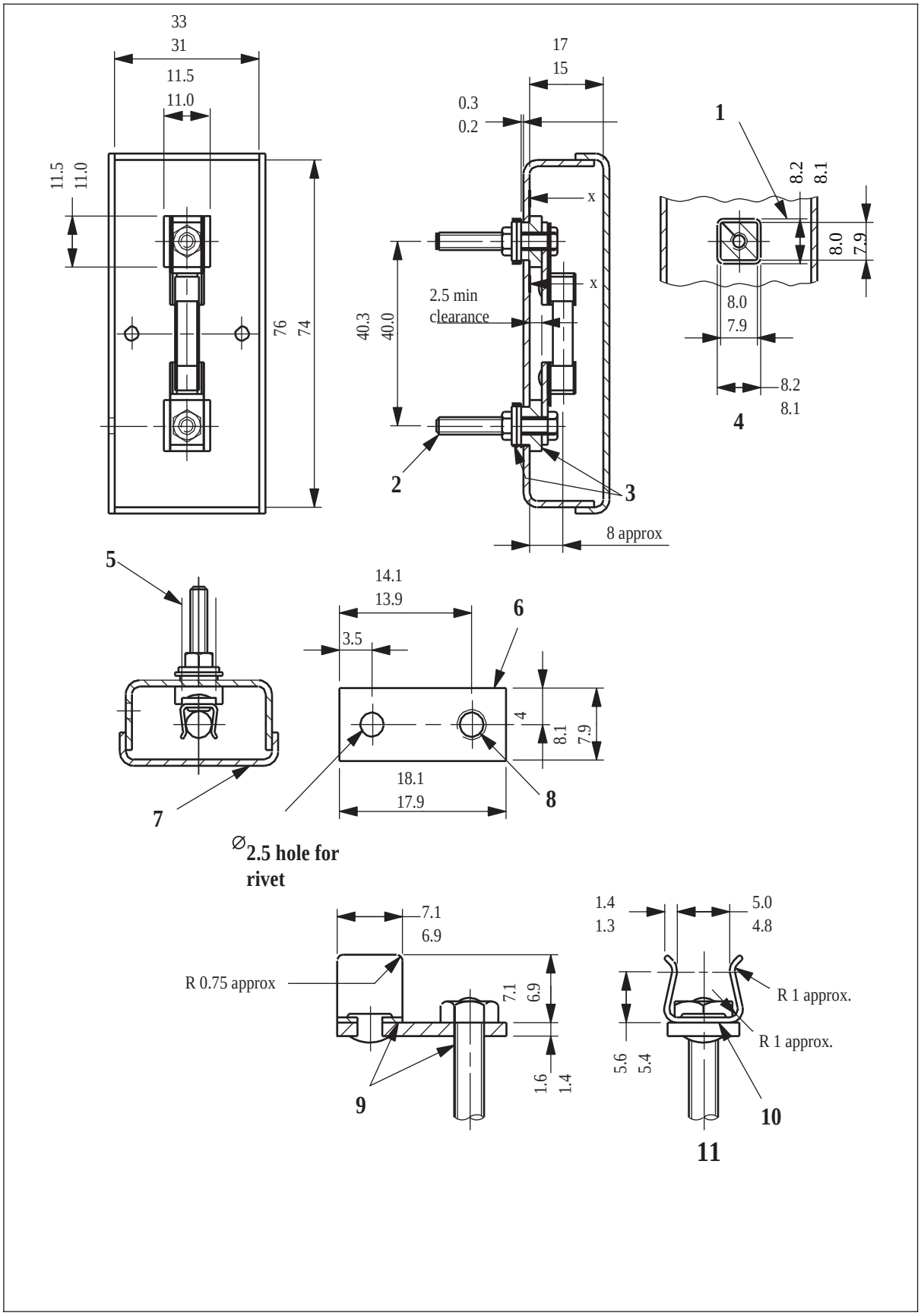


FIGURE 6 - Calibration jig for calibrated link (Continued) (see A.2)

KEY

1	Flot [a)]	7	Cover [b), c)]
2	Terminal stem M3 x 25	8	Hole tapped M3 for terminal stem
3	Insulating material	9	Joints between clip, contact plate and terminal stem to be soldered
4	Part section X-X[a)]	10	Fuse clip [d)]
5	Groove to fit contact plate	11	Contact assembly
6	Contact plate, brass		

[a)] The end float and clearance between the insulation and the box is to allow the contacts to be self-aligning.

[b)] Box and cover made from 1.25 mm brass sheet, clean natural finish.

[c)] Cover shall be a push fit on box and shall not be rigidly attached.

[d)] Fuse clip made from beryllium copper 0.45 mm thick and heat-treated (170 HV minimum). Base of clip to be flat; finish, silver-plated.

NOTE: *Dimensions are in millimetres.*

FIGURE 6 - Calibration jig for calibrated link (see A.2) (Concluded)

ANNEX A
(Normative)
THE CONSTRUCTION AND CALIBRATION OF A CALIBRATED LINK

A.1 CONSTRUCTION

The calibrated link (see Figure **5**) shall employ the following components used to produce fuses conforming to **SLS 1533**.

a) Ceramic body (as standard);
b) filing (as standard);
c) end caps[modified standard cap as shown in Figure **5**a)].

The resistive element shall be of copper nickel wire having a resistivity value between 44 μΩ.cm and 49 μΩ.cm. The overall length shall be $25.4^{+0.8}_{-0.4}$ mm and the diameter such as to allow a small reduction in the cross-sectional area to adjust the watts loss to be required value. The ends are turned down so that the distance between the shoulders so formed shall be $25.4^{+0.8}_{-0.4}$ mm less twice the end cap end wall thickness "***t***" (see Figure **5b**).

The resistive element shoulders shall be firmly butted to the inside faces of the end caps and soldered using at in silver solder, grade 96S, as specified in **BS 219**. The assembly thus formed (see Figure **5c**) shall be checked for watts loss in accordance with **A.2**. Metal shall then be filed carefully from the resistive element over as long as 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 of the end cap; the ceramic body shall not interfere with this condition [see Figure **5d**)].

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 **SLS 1533**.

A.2 CALIBRATION

The calibration jig shown in Figure **6** 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 2.5mm^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 1m to 2 m from

the standard link shall be in the range of 15 °C to 25 °C. The standard link shall be inserted into the clips provided in the calibration jig and the cover replaced. A current of 13A ±0.1 A is then passed continuously through the calibrated link for 60 min ±5min. At the end of this time the temperature 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.

Alternating 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.

ANNEX B
(Normative)

MEASUREMENT OF CLEARANCES AND CREEPAGE DISTANCES

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	0.25
2	1.0
3	1.5

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

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

The following assumptions are made:

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

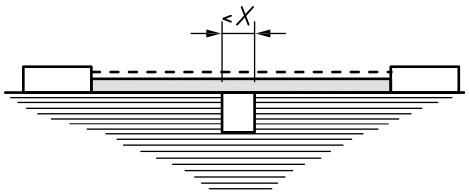
Explanation for examples 1 to 11

---------- clearance

creepage distance

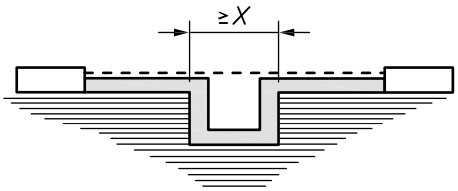
All dimensions are in millimeters.

Example 1



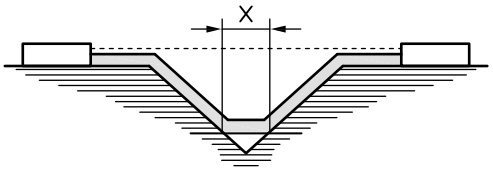
Condition: Path under consideration includes a parallel- or converging sided groove of any depth and with a width less than "X" mm.
Rule: Creepage distance and clearance are measured directly across the groove as shown.

Example 2



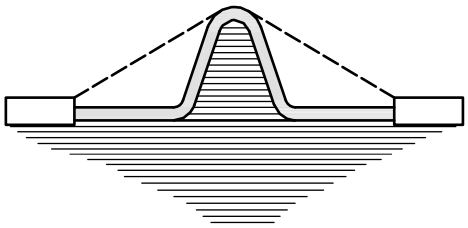
Condition: Path under consideration includes a parallel- sided groove of any depth and with a width equal to or greater than "X" mm.
Rule: Clearance is the "line of sight" distance. Creepage path follows the contour of the groove

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.

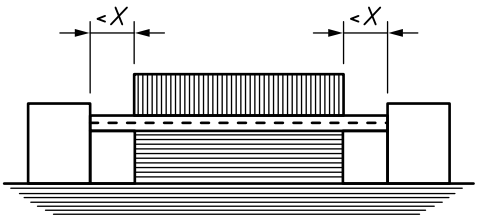
Example 4



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

.

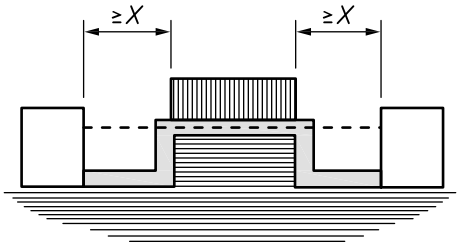
Example 5



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.

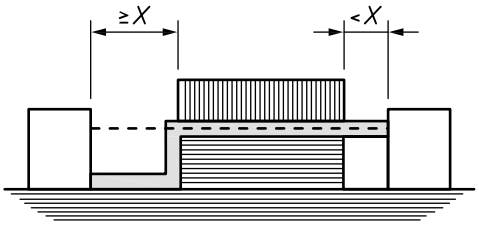
.

Example 6



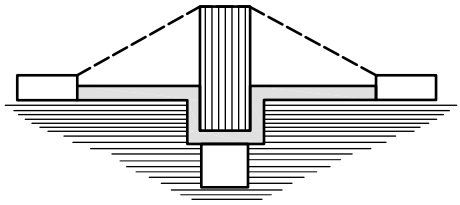
Condition: Path under consideration includes an uncemented joint with grooves equal to or more than "X" mm wide on each side.
Rule: Clearance path is the "line of sight" distance. Creepage follows the contour of the grooves

Example 7



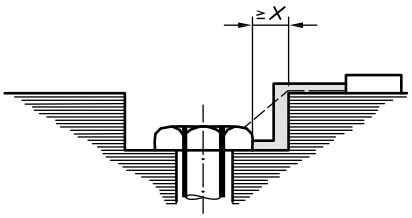
Condition: Path under consideration includes an uncemented joint with groove on one side less than "X" mm wide and the groove on the other side equal to or more than "X" mm wide.
Rule: Clearance and creepage paths are as shown.

Example 8



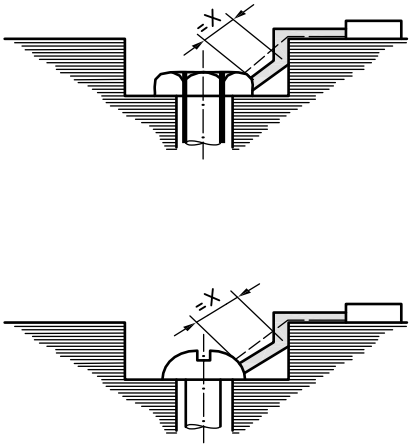
Condition: Path under consideration includes a barrier with an uncemented joint. The creepage distance through the uncemented joint is less than the creepage distance over the barrier.
Rule: Clearance is the shortest direct air path over the top of the barrier. The creepage path follows the contour of the joint.

Example 9



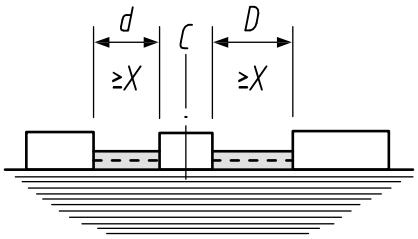
Condition: Gap between head of screw and wall of recess wide enough to be taken into account (greater than or equal to "X" mm).
Rule: Clearance and creepage paths are as shown.

Example 10



Condition: Gap between head of screw and wall of recess too narrow to be taken into account (less than "X" mm).
Rule: Measurement of clearance and creepage distance is from the screw head to the point on the wall which is at a distance equal to "X" mm (as shown).

Example11



Condition: Path under consideration includes a floating part, *C*, with different sized grooves either side, each greater than or equal to "X" mm.
Rule: Clearance and creepage distance are both distance *d+D*.

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) In Clause **5** of **IEC 60112**, Test sample:
   i) Note **3** and the last paragraph also apply to PTI;
   ii) If the surface 15 mm x15 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 Clause **7.3** of IEC **60112** shall be used.

c) In Clause **8** of **IEC 60112**, procedure, either CTI or PTI is determined.

   i) CTI is determined in accordance with Clause **11** of **IEC 60112.**
   ii) The PTI test of Clause **10** of **IEC 60112** is performed on five samples at the voltage referred to in Clause **10.1** of **IEC 60112** 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 D.1 – Rated impulse withstand voltage for connection units energized directly from the low-voltage mains

Nominal voltage of the supply system based on SLS 1259 [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
(1)	(2)	(3)	(4)	(5)
230/400	300	1 500	2 500	4 000

NOTES:

1) *For more information concerning supply systems see **IEC 60664-1.***
2) *For more information concerning Overvoltage Category see **IEC 60664-1.***
3) *Connection units fall into Overvoltage Category III. Parts of connection units 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, shall be taken in to 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 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 with stand specified transient overvoltage. The impulses withstand voltage test shall be carried out with a voltage having a 1.2/50 µs waveform as specified in **IEC 61180-1** Section **6** and is intended to simulate overvoltage of atmospheric origin. It also covers overvoltage 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. There shall be no discharges during the test. Glow discharges without a drop in voltage shall be ignored.

For solid insulation and for clearances not checked by measurement, the impulses withstand voltage shall be applied between:

a) line and neutral terminals/terminations;
b) line and neutral terminals/terminations connected together and:
   i) a sheet of metal foil in contact with the entire accessible external surface;
   ii) the earthing terminal/termination;
   iii) any metal part of a cable anchorage;
c) each switched pole terminal of a switched connection unit, with the switch contacts open.

NOTES:

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

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

The impulse shall have the following characteristics:

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

3) *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 wave form 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

NOTES:

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 with stand voltage, solid insulation will have to be designed accordingly. These results in an increased impulse withstand capability of the solid insulation.*

2) *The test may be 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.*

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

Amendment No. 1 Approved on 2019-05-08 to SLS 734: Part 4: 2017

SRI LANKA STANDARD SPECIFICATION FOR 13 A PLUGS, SOCKET-OUTLETS, ADAPTORS AND CONNECTION UNITS PART 4: SPECIFICATION FOR 13A FUSED CONNECTION UNITS SWITCHED AND UNSWITCHED

1) Replace the existing Table 1 with the following Table.

TABLE 1 : Schedule of tests.

Sequence	Sample	Tests	Clause number
(1)	**(2)**	**(3)**	**(4)**
1	3	Inspection, measurement and manipulation	5, 6, 7, 9, 11. 1 (except 11.9), 12 (12.1, 12.2, 12.3, 12.4 and 12.8), 18 (18.2 ,18.3 and 18.4 only), 8 (except Annex C), 20
2	3	General	5, 10, 18.1, 13.2, 12.5 (9.1.1 only), 19.1.3
3	3		5, 13.1, 14, 12.5(19.1.2 and 16.1.3 only), 16.1.2, 12.6, 15
4	3		5, 13.1, 14, 17
5	3	Materials	5, 21
6	3		5, 22.2, 8.2 (Annex **C** only)
7	3		5, 23
8 A)	3	Positive break	5, 12.7
9	3	Isolation	5, 14.2
10	3	Ingress protection	5, 12.9 and 12.10
11	3	Addition tests for Connection units with screwless terminals	5, 13.1, 11.9

NOTE: *The order of tests given in sequence 1 above 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.

SLS CERTIFICATION MARK

The Sri Lanka Standards Institution is the owner of the registered certification mark shown below. Beneath the mark, the number of the Sri Lanka Standard relevant to the product is indicated. This mark may be used only by those who have obtained permits under the SLS certification marks scheme. The presence of this mark on or in relation to a product conveys the assurance that they have been produced to comply with the requirements of the relevant Sri Lanka Standard under a well designed system of quality control inspection and testing operated by the manufacturer and supervised by the SLSI *which includes surveillance inspection of the factory, testing of both factory and market samples.*

Further particulars of the terms and conditions of the permit may be obtained from the Sri *Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.*

Printed at SLSI (Printing Unit)

SRI LANKA STANDARDS INSTITUTION

The Sri Lanka Standards Institution (SLSI) is the National Standards Organization of Sri Lanka established under the Sri Lanka Standards Institution Act No. 6 of 1984 which repealed and replaced the Bureau of Ceylon Standards Act No. 38 of 1964. The Institution functions under the Ministry of Science, Technology and Research.

The Principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote Standardization and quality control by educational, consultancy and research and research activity.

The Institution is financed by Government grants, and by the income from the sale of its publications and other services offered for Industry and Business Sector. Financial and Administrative control is vested in a Council appointed in accordance with the provisions of the Act.

The development and formulation of National Standards is carried out by Technical Experts and representatives of other interest groups, assisted by the permanent officers of the Institution. These Technical Committees are appointed under the purview of the Sectoral Committees which in return are appointed by the Council. The Sectoral Committees give the final Technical approval for the Draft National Standards prior to the approval by the Council of the SLSI.

All members of the Technical and Sectoral Committees render their services in an honorary capacity. In this process the Institution Endeavours to ensure adequate representation of all view points.

In the International field the Institution represents Sri Lanka in the International Organization for Standardization (ISO), and participates in such fields of Standardization as are of special interest to Sri Lanka.

Printed at the Sri Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08