

BS 1363-5:2016



BSI Standards Publication

13 A plugs, socket-outlets, adaptors and connection units

Part 5: Specification for fused
conversion plugs

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Foreword

Publishing information

This part of BS 1363 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 August 2016. It was prepared by Technical Committee PEL/23, *Electrical accessories*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 1363 supersedes BS 1363-5:2008, which remains current and will be withdrawn on 31 August 2019.

Information about this document

BS 1363 comprises five parts covering the following:

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

NOTE In order to prevent confusion with BS 1363:1984, the figure and clause numbers have been retained.

This new edition of BS 1363-5 incorporates technical changes only. It does not represent a full review or revision of the standard, which will be undertaken in due course.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *Rules for the structure and drafting of UK standards*, subclause J.1.1, which states, 'Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...''. This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Conformity with a British Standard cannot confer immunity from legal obligations.

Particular attention is drawn to the following specific regulations:

The Plugs and Sockets etc. (Safety) Regulations 1994. SI No. 1768.

1 Scope

This part of BS 1363 specifies requirements, with particular reference to safety in normal use, for 13 A, fused, conversion plugs for household, commercial and light industrial purposes.

The scope of the standard covers two-pole plus earth conversion plugs that are either reusable or non-reusable and that are suitable for the connection of non-BS 1363 type plugs, conforming to a recognized standard, to socket-outlets conforming to BS 1363-2:2016.

The scope of this standard is limited to devices with the following characteristics:

- that have insulating sleeves on line and neutral pins;
- that have one plug portion and one set of contacts intended to connect to a non-BS 1363 type plug that conforms to the dimensional requirements of a standard listed in IEC TR 60083 and not exceeding 13 A;
- that are suitable for the connection of electrical equipment in a.c. circuits only, operating at voltages not exceeding 250 V r.m.s. at 50 Hz;
- that may have the un-terminated metal earth pin replaced with a similarly dimensioned insulated shutter opening device (ISOD) designed to operate the shutter mechanism of a socket-outlet conforming to BS 1363-2:2016.

Two categories of conversion plugs are specified, covering normal and rough use.

Conversion plugs specified in this standard are intended for the connection of loads to socket-outlets; they are not intended for the connection of electrical power generators to socket-outlets.

Conversion plugs incorporating switches, transformers, thermostats, or other control means are outside the scope of this part of BS 1363.

This standard also does not cover:

- non-BS 1363 type conversion plugs, i.e. with a contact set to fit 13 A plugs, and a male plug portion suitable for a non-BS 1363 type socket-outlet;
- adaptors (see BS 1363-3:2016); or
- travel adaptors (see BS 8546:2016).

2 Normative references

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

Standards publications

BS 219:1977, *Specification for soft solders*

BS 1362:1973, *Specification for general purpose fuse links for domestic and similar purposes (primarily for use in plugs)*

BS 1363-2:2016, *13 A plugs, socket-outlets, adaptors and connection units – Part 2: Specification for 13 A switched and unswitched socket-outlets*

BS 2572:1990, *Specification for phenolic laminated sheet and epoxy cotton fabric laminated sheet*

BS 2870:1980, *Rolled copper and copper alloys – sheet, strip and foil*

BS 4662:2006+A1:2009, *Boxes for flush mounting of electrical accessories – Requirements and test methods and dimensions*

BS 4800:2011, *Schedule of paint colours for building purposes*

BS EN 10270-1:2011, *Steel wire for mechanical springs – Part 1: Patented cold drawn unalloyed spring steel wire*

BS EN 60112:2003+A1:2009, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

BS EN 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

BS EN 60695-2-11:2014, *Fire hazard testing – Part 2: Glowing/hot wire based test methods – Glow-wire flammability test method for end-products (GWEPT)*

BS EN 60695-10-2:2014, *Fire hazard testing – Part 10: Abnormal heat – Ball pressure test method*

BS EN 61032:1998, *Protection of persons and equipment by enclosures – Probes for verification*

BS EN 61180-1:1995, *Guide to high-voltage test techniques for low-voltage equipment – Part 1: Definitions, test and procedure requirements*

IEC 60038, *IEC standard voltages*

IEC TR 60083, *Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC*

3 Terms and definitions

For the purposes of this part of BS 1363, 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 conversion plug

fused device that can be engaged with a socket-outlet conforming to BS 1363-2:2016, and that is designed to enclose the non-BS 1363 type plug and enables it to be engaged with such a socket-outlet

3.2 normal use

conditions during use which:

- do not exceed the conditions intended by the manufacturer;
- are not excessive, rough use or gross misuse;
- do not exceed reasonably foreseeable conditions of misuse

3.3 normal use conversion plug

conversion plug intended for normal use

3.4 rough use conversion plug

conversion plug designed to withstand severe mechanical handling

NOTE *Rough-use conversion plugs* are identified by additional marking in accordance with 7.1c). They are not intended for gross misuse, e.g. withdrawal from a socket-outlet by pulling on the flexible cable.

3.5 reusable conversion plug

conversion plug the intended use of which is on one non-BS 1363 type plug only, and which is:

- able to be reused without damaging either the non-BS 1363 type plug which was housed in it, a new non-BS 1363 type plug or itself;
- designed such that the non-BS 1363 type plug can only be removed by the use of a tool;
- deemed as low use in terms of removal from and refitting to a non-BS 1363 type plug

NOTE Low use is less than ten removal and refitting operations during the conversion plug lifetime.

3.6 non-reusable conversion plug

conversion plug, the intended use of which is on one non-BS 1363 type plug only and which cannot be removed without rendering it unfit for use

3.7 accessible external surfaces of a conversion plug

all surfaces that can be touched by test probe B specified in BS EN 61032:1998 when a conversion plug is in full engagement with a corresponding socket-outlet

3.8 engagement surface of a conversion plug

surface that cannot be touched by test probe B specified in BS EN 61032:1998 when a conversion plug is in full engagement with a corresponding socket-outlet

3.9 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.

3.10 fuse carrier

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

3.11 type test

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

3.12 type test sample

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

3.13 fine wire thermocouple

thermocouple having wires not exceeding 0.3 mm in diameter

3.14 calibrated link

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

3.15 indicator lamp (pilot lamp)

lamp or similar device that illuminates to indicate that the conversion plug is energized

3.16 resilient material

material having the inherent capability of regaining or substantially regaining its original form when deforming loads are removed

- 3.17 creepage distance**
shortest distance along the surface of the insulating material between two conductive parts
- 3.18 clearance**
shortest distance in air between two conductive parts
- 3.19 retention**
part of the conversion plug that is deemed to have an active part in the retention of the non-BS 1363 type plug within the body of the conversion plug
- 3.20 dangerous compatibility**
unsafe condition that occurs when a conversion plug allows a non-BS 1363 type plug of a higher current rating or different voltage rating than that of the conversion plug to be fitted, and/or when a class I non-BS 1363 type plug could be fitted into a class II conversion plug
- 3.21 insulated shutter opening device (ISOD)**
protrusion from the engagement surface of the plug, in place of the brass earth pin, made of insulating material having dimensions similar to those of a brass earth pin
- 3.22 basic insulation**
insulation applied to live parts to provide basic protection against electric shock
NOTE Basic insulation does not necessarily include insulation used exclusively for functional purposes.
- 3.23 supplementary insulation**
independent insulation applied in addition to the basic insulation, in order to provide protection against electric shock in the event of the failure of basic insulation
- 3.24 reinforced insulation**
single insulation system applied to live parts, that provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in the relevant standard
- 3.25 functional insulation**
insulation between conductive parts that is necessary only for the proper functioning of the equipment
- 3.26 class I**
a method of protection against electric shock which does not rely on basic insulation only, but which includes means for the connection of exposed conductive parts to a protective conductor in the fixed wiring of the installation
- 3.27 class II**
method of protection against electric shock which does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation are provided, there being no provision for protective earthing or reliance upon installation conditions
NOTE 1 Such a method may be one of the following.
a) Equipment having double and substantially continuous enclosure of insulation material which envelopes all metal parts with the exception of small parts such as name plates, screws and rivets which are isolated from live parts by insulation at least equivalent to reinforced insulation. Such equipment is called "insulated encased class II equipment".

b) Equipment having a substantially continuous enclosure of metal, in which double insulation is used throughout, except for those parts where reinforced insulation is used. Such equipment is called "metal encased class II equipment".

c) Equipment that is a combination of types a) and b) above.

NOTE 2 The enclosure of an insulation encased class II appliance may form a part or whole of the supplementary insulation, or reinforced insulation.

NOTE 3 If an appliance with double insulation and/or reinforced insulation throughout has an earthing terminal or an earthing contact, it is of class I construction.

NOTE 4 Class II appliances may have parts in which protection against electric shock relies on operation at safety extra-low voltage (SELV).

3.28 passive device

device containing:

- components such as capacitors, inductors, resistors, filters and surge protectors;
- electromechanical components such as connectors and devices for overcurrent protection;
- mechanical relays and mechanical switches

NOTE Attention is drawn to the difference between an active and a passive device. An active device is one containing active components such as integrated circuits, transistors, diodes, rectifiers, triacs and opto-semiconductors.

3.29 non-BS 1363 plug

plug which is not suitable without adaptation or modification for connection to a mains socket conforming to BS 1363-2:2016 and suitable for use at 230 V

NOTE It should be a plug conforming fully to a standard such as IEC 60884-1 or equivalent for safety aspects.

4 Classification

A conversion plug shall be classified as follows, as appropriate:

- a) reusable or non-reusable;
- b) normal use or rough use;
- c) intended for class I applications (fitted with metal earth pin), or intended for class II applications only (fitted with un-terminated metal earth pin or ISOD).

5 General requirements

5.1 Environmental parameters

COMMENTARY ON 5.1

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

A conversion plug shall be suitable for use under the following conditions:

- a) an ambient temperature in the range $-5\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$, the average value over 24 h not exceeding $25\text{ }^{\circ}\text{C}$;

- 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.

NOTE This is equivalent to pollution degree 2 (see Annex E), and Overvoltage Category III (see Annex D).

5.2 Performance requirement

A conversion plug shall be so designed and constructed that in meeting all of the requirements of this standard it can be deemed to be reliable and to minimize the risk of danger to the user or to the surroundings.

5.3 Passive devices

Incorporated passive devices shall conform to the relevant product standard as far as it reasonably applies. Passive devices shall not be used in reusable conversion plugs.

6 Testing regime

6.1 Principle

All tests shall be type tests.

6.2 Environmental conditions

Unless otherwise specified in this standard, conversion plugs shall be tested at an ambient temperature of (20 ± 5) °C after being conditioned at normal laboratory temperature and humidity levels for at least 96 h.

6.3 Test samples

Conversion plugs used for the tests shall be representative of normal production items in respect of all details that may affect the test results.

Non-reusable conversion plugs shall be supplied with the non-BS 1363 type plug and cable which shall be at least 1 m long.

Non-reusable conversion plugs supplied with a passive device (see 5.3) shall be tested as supplied.

6.4 Conformity criteria

Conversion plugs shall be deemed to conform to this standard if no sample fails in the complete series of tests given in Table 1. A sample shall consist of a conversion plug and the fitted non-BS 1363 plug.

Table 1 Schedule of tests

Sequence	Samples	Requirements and tests	Clause number
1 ^{A)}	3	Inspection, measurement, gauging and manipulation	4, 5, 6, 7, 9.1, 9.2, 9.4, 12.1, 12.2, 12.3, 12.4, 12.6, 12.8 (12.8.1, 12.8.2, 12.8.8, 12.8.12, 12.8.13, 12.8.14 only), 13, 19.2, 19.3, 21, 8 (inc Annex C)
2	3	General	5, 9.3, 19.1, 12.8.11, 12.8.15, 12.8.16
3	3		5, 11, 16
4	3		5, 14.2, 15, 12.8.17
5	3		5, 14.1, 20.3, 20.2, 16, 12.7, 10.1, 12.8.9, 12.5, 12.8.10, 21.2
6	3*		5, 12.8.3
7 a)	9	Additional tests for a conversion plug with non-solid pins (wear to socket contacts for conversion plugs with non-solid pins)	5, 12.8.6
7 b)	6	Additional tests for a conversion plug with non-solid pins	12.8.4
7 c)	3	Additional tests for a conversion plug fitted with ISODs (wear to socket contacts for conversion plugs with ISODs)	5, 12.8.7
7 d)	3	Additional tests for a conversion plug fitted with ISODs	5, 12.8.5
8	3	Materials	5, 22
9	3		5, 23.2
10	3		5, 21.2, 24

^{A)} The order of tests given in sequence 1 is preferred but not obligatory except where required within the text of the appropriate clause.

NOTE * denotes that an additional three samples will be required for conversion plugs with non-solid pins.

If one sample fails in a complete series of tests given in Table 1, conversion plugs of that type shall be deemed to have failed to conform to this standard, unless that sample shall be shown to be not representative of normal production or design. In the latter case, a further type test sample shall be submitted to the test or tests in that particular group. If there is no failure in the retest, conversion plugs of that type shall be deemed to conform to this standard.

If more than one sample fails in the complete series of tests given in Table 1, conversion plugs of that type shall be deemed not to conform to this standard.

6.5 Inspection and test

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

All inspections and tests of any one classification (see Clause 4) shall be performed, as specified in the clauses listed in Table 1, on the number of samples in the samples column and in the order given.

References in various clauses to performing specific tests shall not be taken to indicate a sequence of testing different to that in the schedule and shall not be conducted as separate additional tests.

6.6 Gauge tolerances

Gauges in accordance with Figure 5 and Figure 11 shall be considered to conform to the dimensional requirements if the measured values are within the specified dimensions and the uncertainty of measurement at not less than 95% confidence level does not exceed ± 0.005 mm.

7 Marking and labelling

7.1 Requirements for marking

Conversion plugs 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) the name, or trademark, or identification mark of the manufacturer or responsible vendor, which may be duplicated on a removable fuse carrier;
- b) the number of this British Standard, i.e. BS 1363-5¹⁾;
- c) for rough use conversion plugs, the number of this British Standard, followed by /A, i.e. BS 1363-5/A;
- d) the words "FUSE" or "FUUSED" or the symbol (given in 7.4) on the external accessible surface of the conversion plug;
- e) the rated voltage;
- f) the maximum rating, in amperes, of the equipment, fitted with the non-BS 1363 type plug, to which the conversion plug may be fitted (as given in Table 2) or the rated current of the non-BS 1363 plug to be engaged, with a maximum current of 13 A;
- g) an instruction as to which non-BS 1363 type plugs the conversion plug was designed for use with (e.g. "Fit XXX Plugs Only", where XXX is the description of the non-BS 1363 type plug type);
- h) for conversion plugs having compatibility with plugs of a different voltage rating, a warning such as "This conversion plug does not convert voltage";

NOTE An example of dangerous compatibility would be a piece of equipment rated for a 110 V supply that might inadvertently be connected through a conversion plug to a 230 V supply. Such equipment would either need to be rated at 110 V to 230 V (switch mode power supply), or have a means to switch it to 230 V before connecting it to a 230 V supply.
- i) non-reusable conversion plugs fitted with passive devices (see 5.3) shall be marked with the identifier of any standard to which conformity of the passive device is claimed and, if applicable, the specification of the passive device, e.g. X mH (inductive load).

When tested in accordance with 7.2, the marking shall remain legible. Markings produced by an engraving or moulding process shall be deemed to conform without test.

¹⁾ Marking BS 1363-5 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity. Such a declaration is not to be confused with second or third-party certification of conformity. Further testing and conformity certification remains at the discretion of the manufacturer and is not a requirement of this standard.

Table 2 Rated current and maximum fuse rating in normal use, and load for flexing and cable grip tests related to size of flexible cable

Flex cable nominal cross-sectional area	Rated current	Test current ± 0.4 A	Fuse rating	Load for flexing test	Non-BS 1363 plug retention test	
				+2%, -0%	Load +2%, -0%	Torque ^{B)}
mm ²	A	A	A	kg	kg	Nm
0.5	3	3.5	3 (5) ^{A)}	1	3	0.15
0.75	6	7	7 (13) ^{A)}	1	3	0.20
1 (0.75) ^{C)}	10	11	10 (13) ^{A)}	2	3	0.25
1.25 (1) ^{C)}	13	14	13	2	6	0.30
1.5	13	14	13	2	6	0.35

^{A)} The figure in brackets indicates the fuse rating when a conversion plug is used with certain types of appliances where the use of the higher rated fuse-link is necessary because of their characteristics.

^{B)} The recording of a measured value of torque in accordance with this table is considered to conform to this part of BS 1363 on condition that the uncertainty of measurement at not less than 95% confidence level does not exceed $\pm 10\%$.

^{C)} The figure in brackets indicates the flexible cable size which may be used for cable sets where conversion plugs are used with a maximum flexible cable length of 2 m.

7.2 Test method

Rub the marking 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% by volume, a Kauri-butanol value of 29, initial boiling point of approximately 69 °C and relative density of approximately 0.68.

Observe whether marking is legible.


7.3 Requirements for labelling

Conversion plugs shall be provided with adequate instructions for the safe attachment, use and detachment of appropriate non-BS 1363 type plugs.

Conversion plugs shall have a label indicating the rating of the fuse-link fitted, e.g. "Fitted with X ampere fuse" (where X denotes the rating of the fuse-link) and permanent marking for the highest rated fuse that can be used in the conversion plug.

7.4 Symbols

Symbols used in marking or labelling shall be as follows:

amperes	A
volts	V
fuse	

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

8 Clearances, creepage distances, and solid insulation

8.1 General

As a minimum, conversion plug assemblies including corresponding non-UK plugs shall conform to the requirements for functional insulation and/or for basic insulation in 8.2.3 and 8.3.3. If the manufacturer declares an insulation level exceeding basic insulation then the conversion plug shall be tested accordingly.

The distance between lead wires in the pinch of a neon lamp with an external resistor shall be not less than 1 mm.

NOTE 1 The requirements and tests given in this clause are based on BS EN 60664-1:2007.

NOTE 2 Product insulation consists of basic insulation and protective earthing as required by BS EN 61140:2016 for class I equipment.

8.2 Clearances

8.2.1 Requirements

Conversion plugs energized directly from the low voltage supply shall be deemed to fall into Overvoltage Category III, as defined in Annex D.

Clearances shall withstand the rated impulse voltage declared by the manufacturer considering the rated voltage and the Overvoltage Category, and the pollution degree declared by the manufacturer as given in Annex E.

8.2.2 Test method

Remove all parts that can be removed without the use of a tool. Place all movable parts that can be assembled in different orientations in the most unfavourable position.

Check conformity with 8.2.1.

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

8.2.3 Clearances for basic insulation

8.2.3.1 Requirements

Clearances for basic insulation shall be either:

- a) not less than the values given in Table 3; or
- b) unspecified and less than the values given in Table 3, except those values marked with footnote B), where the accessory conforms to 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.

8.2.3.2 Test method

Check by inspection, and if necessary by measurement in accordance with Annex B, or by the impulse voltage test specified in Annex F.

8.2.4 Clearances for functional insulation

8.2.4.1 Requirements

The clearances for functional insulation shall be not less than the values specified for basic insulation in Table 3.

8.2.4.2 Test method

Check by inspection, and if necessary by measurement in accordance with Annex B, or by the impulse voltage test specified in Annex F.

8.2.5 Clearances for supplementary insulation

8.2.5.1 Requirements

The clearances for supplementary insulation shall be not less than the values specified for basic insulation in Table 3.

8.2.5.2 Test method

Check by inspection, and if necessary by measurement in accordance with Annex B, or by the impulse voltage test specified in Annex F.

8.2.6 Clearances for reinforced insulation

8.2.6.1 Requirements

The clearances for reinforced insulation shall be not less than the values specified for basic insulation in Table 3 but using the next higher step for rated impulse withstand voltage given therein. Plug pins shall not be included in this requirement.

8.2.6.2 Test method

Check by inspection, and if necessary by measurement in accordance with Annex B, or by the impulse voltage test specified in Annex F. Observe whether test samples conform to 8.2.1.

Table 3 Minimum clearances for basic insulation

Rated impulse withstand voltage kV ^{A)}	Minimum clearances in air up to 2 000 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 maximum impulse voltage expected to occur across the clearance;
- for basic insulation directly exposed to or significantly influenced by transient overvoltage from the low voltage mains: the rated impulse withstand voltage of the conversion plug;
- for other basic insulation: the highest impulse voltage that can occur in the circuit.

^{B)} Minimum clearance values are based on BS EN 60664-1:2007.

8.3 Creepage distances

8.3.1 Requirements

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

A creepage distance shall be not less than the associated clearance.

8.3.2 Test method

Remove all those parts that can be removed without the use of a tool. Place movable parts which can be assembled in different orientations in the most unfavourable position.

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

Measure creepage distances in accordance with Annex B and comparative tracking index (CTI) values or proof tracking index (PTI) in accordance with Annex C.

The relationship between material group and between (CTI) values and (PTI) values is as follows:

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

NOTE 2 For glass, ceramics and other inorganic materials that do not track, creepage distances need not be greater than their associated clearance.

8.3.3 Creepage distances for basic insulation

8.3.3.1 Requirements

The creepage distances for basic insulation shall be not less than the values given in Table 4.

8.3.3.2 Test method

Check by inspection, and if necessary by measurement in accordance with Annex B.

Table 4 Minimum creepage distances (mm) for basic insulation

Rated voltage ^{A)} V (r.m.s.) Up to and including	Pollution degree 2 ^{B)}			Pollution degree 3 ^{B)}		
	Material group			Material group		
—	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 BS EN 60664-1:2007, Table F.3a and Table F.3b based on the nominal voltage of the supply system.

^{B)} Details of pollution degrees are given in Annex E.

8.3.4 Creepage distances for functional insulation

8.3.4.1 Requirements

The creepage distances for functional insulation shall be not less than the values specified for basic insulation in Table 4.

8.3.4.2 Test method

Check by inspection, and if necessary by measurement in accordance with Annex B.

8.3.5 Creepage distances for supplementary insulation

8.3.5.1 Requirements

The creepage distances for supplementary insulation shall be not less than the values specified for basic insulation in Table 4.

8.3.5.2 Test method

Check by inspection, and if necessary by measurement in accordance with Annex B.

8.3.6 Creepage distances for reinforced insulation

8.3.6.1 Requirements

The creepage distances for reinforced insulation shall be not less than those derived from twice the distance specified for basic insulation in Table 3. This requirement shall not be applied to the sleeves of the plug pins.

8.3.6.2 Test method

Check by inspection, and if necessary by measurement in accordance with Annex B.

8.4 Solid insulation

8.4.1 Requirements

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

NOTE No minimum thickness is specified for solid insulation.

8.4.2 Test method

Check by inspection, and if necessary by measurement in accordance with Annex B, or by the impulse voltage test specified in Annex F.

8.4.3 Basic and supplementary solid insulation

8.4.3.1 Requirements

Basic and supplementary solid insulation shall withstand the required impulse voltage declared by the manufacturer of the conversion plug, as specified in 8.2.1 for Overvoltage Category III.

8.4.3.2 Test method

Following the impulse withstand voltage test, observe whether the insulation continues to conform to the electrical strength test in 15.2 using the values given in Table 5.

Table 5 Withstand voltages for insulation types

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

8.4.4 Reinforced solid insulation

8.4.4.1 Requirements

Reinforced insulation shall be dimensioned to withstand the required impulse voltage, but one step higher than that for basic and supplementary insulation in Table 5.

8.4.4.2 Test method

Following the impulse withstand voltage test, observe whether the insulation continues to conform to the electrical strength test in 15.2 using the values given in Table 5.

9 Accessibility of live parts

9.1 Accessibility of live parts

9.1.1 Requirements

Live parts of conversion plugs shall not be accessible when correctly fitted with an associated non-BS 1363 type plug and in full engagement with a corresponding 13 A socket-outlet.

9.1.2 Test method

Apply a force of 5_{-1}^0 N with test probe 12, as specified in BS EN 61032:1998, to a conversion plug fitted with appropriate non-BS 1363 type plug and flexible cable, to all apertures.

Check whether the conversion plug with its associated non-UK plug has deformed to such an extent that live parts can be touched with the probe.

9.2 Construction to protect against accidental contact with live parts

9.2.1 Requirements

Conversion plugs shall be designed and constructed to protect the user against accidental contact with live parts during insertion and withdrawal from corresponding socket-outlets, and in intended use.

9.2.2 Test method

Check the dimensions, gauging, and construction of the samples for conformity to 12.2.

9.3 Construction of resilient covers

9.3.1 Requirements

Resilient covers of conversion plugs shall be so designed and constructed that when assembled with a non-BS 1363 type plug as in normal use there is no risk that, as a result of undue pressure, live parts could penetrate the cover or become so disposed as to reduce creepage distances and clearances below those given in Clause 8.

During the test no flashover or breakdown shall occur.

9.3.2 Test method

Apply a steady force of 240_{-10}^0 N through a metal test pressure block as illustrated in Figure 2 at each place where the possibility of failure exists in turn. During each application of force, apply a test voltage of $(2\ 000 \pm 60)$ V, 50 Hz of substantially sinusoidal waveform for 60 s between all live parts bonded together and the metal test pressure block.

Observe whether it is possible to touch live parts with test probe 11 as specified in BS EN 61032:1998, when applied with a force of 30_{-2}^0 N.

9.4 Supply of an assembly

9.4.1 Requirements

Other than in the case of assemblies supplied to equipment manufacturers for incorporation into their equipment, a conversion plug supplied fitted with a non-BS 1363 type plug with a flexible cable shall have the free end of such an assembly encapsulated in insulating material.

9.4.2 Test method

Check by inspection.

10 Provision for earthing

10.1 Requirements

All accessible metal parts (including those having a surface coating of lacquer or enamel) of conversion plugs shall be in effective electrical contact with the earthing socket contact, earthing plug pin and accessible metal parts of the of the non-BS 1363 plug with the following exception.

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 are not required to be in such contact.

The resistance between the earthing plug pin or earthing terminal and any other nominated part shall not exceed $0.05\ \Omega$.

10.2 Test method

- a) For metal parts insulated from live parts, by the test described in 15.2.2.
- b) For metal parts connected to an earthing terminal or earthing plug pin, by the following test.
 - 1) Pass a current of (25 ± 0.75) A, derived from an a.c. source having a no-load voltage not exceeding 12 V, for 60 s between the earthing plug pin [cut flexible cable to a length of (150 ± 5) mm measured from the nearest edge of the earthing pin] and;

- i) the terminal, or terminations, of a plug earthing pin inserted into the earthing socket contact, and
 - ii) any accessible metal part intended to be earthed.
- 2) Check conformity of samples to **10.1**.

11 Contacts in conversion plugs

11.1 Requirements

Contacts shall provide for effective connection between a conversion plug and a non-BS 1363 type plug without the use of special tools, so that efficient electrical connection is made and relevant safety requirements are met.

Contacts shall not be provided on an un-terminated metal earth pin or ISOD.

11.2 Test method

Insert an appropriate non-BS 1363 type plug, as listed in IEC TR 60083, 20 times in to a non-energized reusable conversion plug. Test to ensure good fitting and electrical conductivity.

Check conformity of samples to **11.1** by the temperature rise test in Clause **16**.

12 Construction of conversion plugs

12.1 Disposition of the conversion plug pins

12.1.1 Requirements

The disposition of the conversion plug pins (including ISODs where applicable) shall be as shown in Figure 4a.

No part of a line or neutral pin shall be less than 9.5 mm from the periphery of the conversion plug measured along the engagement surface.

12.1.2 Test method

Examine and measure the test samples for conformity to **12.1.1**.

12.2 Conversion plug dimensions

12.2.1 Requirements

The outline of the conversion plug shall not exceed the dimensions shown in Figure 4a for a distance of not less than 6.35 mm from the engagement surface. Within these dimensions there shall be no axial projection from the engagement surface of the conversion plug, except that at a distance more than 6.35 mm from the engagement surface the outline of the conversion plug may exceed the dimensions shown in Figure 4a in the plane of the earth pin and in the plane of the cable entry to facilitate the removal of the conversion plug from the socket.

Pin and sleeve dimensions shall conform to Figure 4a, except for non-solid pins and ISODs where the chamfers shall generally fall within the profiles of Figure 4a.

When subjected to the procedure specified in **12.2.2a**), the conversion plug shall enter the gauge fully without any additional force being applied to the pins to bring them into alignment.

Conversion plugs fitted with ISODs shall conform to all the dimensions specified in Figure 4a with the exception of the ISOD dimensions, which shall be:

width: 3.90 mm min / 4.05 mm max;

height: 7.75 mm min / 8.05 mm max.

When tested in accordance with 12.2.2b), the maximum withdrawal force from the socket-outlet conforming to BS 1363-2:2016 shall not exceed 36 N. ISODs shall be of generally rectangular cross-section. 'I' sections are not permitted, although castellated cross-sections shall be permitted provided that their dimensions conform to Figure 4b.

12.2.2 Test method

- a) Measure the pin and sleeve dimensions. Check the pin disposition, length and body outline by use of the gauge shown in Figure 5.

Place the gauge in a vertical position parallel to the engagement surfaces of the conversion plug. Insert the line and neutral pins into the gauge for a distance not exceeding 2 mm. Apply a force not greater than 10 N to the centre of the conversion plug at a right angle to the engagement surface.

- b) In the case of conversion plugs fitted with ISODs, due to the flexibility of plastic materials some additional alignment of the ISOD is allowed when inserting into the gauge. Where alignment cannot be maintained, apply the test given in BS 1363-2:2016, 13.8.

12.3 Provision of fuses – contact details

12.3.1 Requirements

A fuse-link conforming to BS 1362:1973 shall be provided within the body of the conversion plug and the fuse-link shall be mounted in appropriate contacts only between the line contact and the corresponding plug pin in such a way that it cannot be displaced when the conversion plug is in use. The design shall be such that the fuse-link cannot be left in inadequate contact when the fuse cover or fuse carrier is replaced and firmly secured in position.

NOTE Conversion plugs may be supplied in part assembled form, with or without the appropriate fuse, for incorporation in other equipment, provided that when assembled the completed conversion plug conforms to this part of BS 1363.

It shall be impossible to replace the fuse-link in a conversion plug unless the conversion plug is completely withdrawn from the socket-outlet.

Internal electrical connections shall be reliable and be of low resistance. Screwed or riveted joints shall not loosen in normal service. Internal electrical connections to fuse-clips shall not be made by means of screws.

12.3.2 Test method

Examine the test samples for conformity to 12.3.1 and by the tests specified in Clause 20.

12.4 Provision of fuses – fuse-carrier details

12.4.1 Requirements

In conversion plugs where the fuse-link is retained by means of a fuse-carrier, this device shall be either:

- non-detachable during normal replacement of the fuse-link; or
- readily identifiable in relation to its conversion plug by means of marking.

12.4.2 Test method

Examine the test samples for conformity to 12.4.1.

12.5 Attachment of base and cover

12.5.1 Requirements

12.5.1.1 The base and cover of conversion plugs shall be firmly secured to each other.

12.5.1.2 The base and cover of a non-reusable conversion plug shall be permanently attached to each other, such that:

- a) the non-BS 1363 type plug cannot be removed without making the conversion plug permanently useless, and
- b) the conversion plug cannot be opened by hand or using a general purpose tool, e.g. a screwdriver used as such.

A conversion plug shall be considered permanently useless when, for reassembling, parts or materials other than the original have to be used.

12.5.1.3 It shall not be possible to remove the cover unless the reusable conversion plug is completely withdrawn from the socket-outlet. Any fixing screws shall be captive.

12.5.1.4 After the test any screw thread shall be serviceable and any insert shall not have moved to such an extent that correct assembly of the plug is prevented.

12.5.1.5 After the test it shall not be possible to touch live parts with the test pin shown in Figure 1 applied with a force of 5_{-1}^0 N.

12.5.1.6 After the test the conversion plug cover shall be in place and show no damage.

12.5.2 Test method

12.5.2.1 Examine the test samples for conformity to 12.5.1.1 to 12.5.1.5.

12.5.2.2 Heat the test sample in an oven to a constant temperature of (70 ± 5) °C for the duration of the test.

12.5.2.2.1 For reusable conversion plugs having covers fixed by screws, tighten the retention screw to the appropriate torque value specified in Table 7. Apply to each cover fixing screw a pull of 60_{-2}^0 N exerted upon it for 60_{+5}^0 s. Perform the test using apparatus similar to that shown in Figure 6.

Examine the test samples for conformity to 12.5.1.4.

12.5.2.2.2 For non-reusable conversion plugs, and those having covers fixed by means other than screws, clamp all the conversion plug pins together in a suitable jig and subject them to a pull of 60_{-2}^0 N whilst suspending the cover by means of a "nest" to suit the profile of the conversion plug cover. Apply the pull for 60_{+5}^0 s after the temperature has been attained. Test the accessibility to live parts with the test pin shown in Figure 1 applied with a force of 5_{-1}^0 N.

Examine the test samples for conformity to 12.5.1.5.

12.5.2.2.3 For conversion plugs with covers retained by means other than screws, and with this as the only means of retaining the non-BS 1363 type plug in place, test with the non-BS 1363 type plug and cable supplied. Ensure that the lead

fitted to the non-BS 1363 type plug is suitably fitted with a cable totalling 1 m in length in such a way that any joint has negligible effect, with a weight of $3.0^{+0.06}_0$ kg fixed to the end.

Using a suitable jig, clamp the conversion plug pins in the vertical position with the conversion plug pins uppermost. Hold the weight initially (0.5 ± 0.05) m from the end of the non-BS 1363 type plug cable retention, and at the same height.

Allow the weight to fall freely five times.

Examine the test samples for conformity to **12.5.1.6**.

12.6 Non-BS 1363 type plug removal

12.6.1 Requirements

Reusable conversion plugs shall be so designed and constructed that the non-BS 1363 type plug can only be removed by the use of a tool (see **3.5**). It shall not be possible to remove a plug from the conversion plug unless the conversion plug is completely withdrawn from the socket-outlet. Any fixings that secure external parts together shall provide reliable attachment.

12.6.2 Test method

Examine the test samples for conformity to **12.6.1**.

12.7 Conversion plug deformation

12.7.1 Requirements

Conversion plugs shall be so designed and constructed that they cannot readily be deformed to allow access to live parts.

It shall not be possible to touch live parts.

12.7.2 Test method

Immediately after the test prescribed in Clause **16**, apply test probe 11 of BS EN 61032:1998 to the accessible surface of the conversion plug with a force of 30^{+0}_5 N.

Examine the test samples for conformity to **12.7.1**.

12.8 Conversion plug pin construction

12.8.1 General

12.8.1.1 Requirement

Materials other than those specified in **21.2.1** shall not be used in the construction of line and neutral conversion plug pins except for sleeves of pins as specified in **12.8.14.1**.

All exposed surfaces of plug pins shall be smooth and free from burrs or sharp edges and other irregularities that would cause damage or excessive wear to corresponding socket contacts or shutters.

12.8.1.2 Test method

Examine the test samples for conformity to **12.8.1.1**.

12.8.2 Seams and joints of non-solid plug pins

12.8.2.1 Requirement

Those surfaces of the non-solid plug pins that are visible when the conversion plug is correctly assembled shall be free of apertures.

All seams and joints of non-solid plug pins shall be closed over their entire length.

12.8.2.2 Test method

Push a 0.2 mm diameter steel test probe into all seams and joints. Check that the test probe does not enter into any seam or joint to a depth greater than the thickness of the material from which the plug pin is formed.

Examine the test samples for conformity to **12.8.2.1**.

12.8.3 Strength of solid plug pins

12.8.3.1 Requirement

Plug pins shall have adequate strength to withstand the stresses of normal use.

After testing, the conversion plug shall fit the gauge specified in Figure 5 when used in the manner described in **12.2.2**.

12.8.3.2 Test method

Position solid pins on the fixed anvil of the apparatus shown in Figure 32, with its contact surfaces in the horizontal plane. Apply a force of $1\ 100_{-10}^0$ N to the movable anvil by any convenient method such that the pin is strained at a rate not exceeding 10 mm/min. Separately test the line, neutral and earth pins applying the load perpendicular to the major axis surfaces of the pins.

Examine the test samples for conformity to **12.8.3.1**.

12.8.4 Strength of non-solid plug pins

12.8.4.1 Requirement

After testing, the pins shall conform to **12.8.2.1** and the conversion plug shall fit the gauge specified in Figure 5 when used in the manner described in **12.2.2**.

12.8.4.2 Test method

Position a pin on a fixed anvil of the apparatus shown in Figure 32, with its contact surfaces in the horizontal plane. Bring the movable anvil to rest against the upper surfaces of the pin. Apply a force of 800^{+10}_0 N to the movable anvil 50 times without impact.

Separately test the line, neutral and earth pins applying the load perpendicular to the major axis surfaces of the pins. If there is a joint or seam in one of the major axis surfaces of a pin perform the test twice, with the seam or joint facing the moving anvil for the first test and facing the fixed anvil for the second test.

Examine the test samples for conformity to **12.8.4.1**.

Position a pin on the fixed anvil of the apparatus, as shown in Figure 32, with the widest surface in the horizontal plane. Bring the movable anvil to rest against the upper surface of the pin. Take this quiescent position as the datum point. Apply a force of not less than 1 000 N to the movable anvil by any convenient method such that the pin is strained at a rate not exceeding 10 mm/min. Measure the applied force when the movement of the anvil from the datum point reaches $1.5_{0,1}^0$ mm. Separately test the line, neutral and earth pins, applying the load perpendicular to the major axis surfaces of the pins. If there is a joint or seam in one of the major axis surfaces of a pin perform the test twice, with the seam or joint facing the moving anvil for the first test and facing the fixed anvil for the second test.

Examine the test samples for conformity to **12.8.4.1**.

12.8.5 Strength of ISODs

12.8.5.1 Requirement

Conversion plug ISODs after test shall fit the gauge specified in Figure 5 when used in the manner described in **12.2.2** with a force not exceeding 20 N.

ISODs shall have adequate strength to withstand the stresses of normal use.

The ISOD shall not be deflected more than 1.5 mm and shall not be broken nor show cracks that are visible with normal or corrected vision without additional magnification.

12.8.5.2 Test method

Position the ISOD on the fixed anvil of the apparatus shown in Figure 32 with the widest surface in the horizontal plane. Bring the movable anvil to rest against the upper surface of the ISOD. Take this quiescent position as the datum point. Apply a force of 400_{0}^{+10} N to the movable anvil by any convenient method such that the ISOD is strained at a rate of (10 ± 2) mm/min and measure the deflection.

Examine the test samples for conformity to **12.8.5.1**.

When testing a conversion plug fitted with an ISOD, due to the flexibility of plastic materials some additional alignment of the ISOD is allowed when inserting into the gauge specified in Figure 5. Where alignment cannot be maintained, apply the test given in BS 1363-2:2016, **13.8**. The maximum withdrawal forces from a socket-outlet conforming to BS 1363-2:2016 shall not exceed 36 N.

12.8.6 Wear to socket contacts for conversion plugs with non-solid pins

12.8.6.1 Requirement

Conversion plugs with non-solid pins shall not cause excessive wear to socket contacts or shutters of socket-outlets that conform to BS 1363-2:2016.

After testing in accordance with **12.8.6.2**:

- shutters of the socket-outlets shall operate satisfactorily;
- the socket contacts shall be safely shielded;
- the socket-outlets shall be in accordance with BS 1363-2:2016, **9.1**, Clause **16**, Clause **15**, **13.4.1a**), **10.2**, **13.6**, **13.7** and **13.8**;
- the voltage drop shall not exceed 37 mV at (13 ± 0.4) A; and
- the pins of the conversion plug shall remain intact, with no openings in the surface, joints or seams.

12.8.6.2 Test method

Perform the test using a combination of conversion plugs with non-solid pins and three different types of new and unused single unswitched socket-outlets that conform to BS 1363-2:2016. Two types of the socket-outlet shall have the shutters operated by the earth pin, one of which is preferably operated by all three pins and one of which is preferably operated by line and neutral pins only.

NOTE The combination of conversion plugs having non-solid pins and each type of socket-outlet as described should make and break a current of (13 ± 0.4) A.

Test conversion plugs 15 000 times (30 000 movements) at (250 ± 10) V a.c. in a substantially non-inductive circuit with the rated current appropriate to the non-BS 1363 type plug and cable given in Table 2.

Insert each conversion plug into, and withdraw from, the socket-outlet at a rate of six insertions and six withdrawals per minute, at a speed of travel of approximately 150 mm/s, the periods during which the conversion plug is inserted and withdrawn being approximately equal. Renew the conversion plug pins or use a new conversion plug after each 5 000 insertions and withdrawals. Do not apply lubrication to the pins of the conversion plug or the socket-outlet contacts prior to or during the test.

Examine the test samples for conformity to 12.8.6.1 and test with the probe specified in 12.8.2.2.

12.8.7 Wear to socket contacts for conversion plugs with ISODs

12.8.7.1 Additional requirements

Conversion plugs with ISODs shall not cause excessive wear to socket contacts or shutters of socket-outlets that conform to BS 1363-2:2016.

After testing in accordance with 12.8.7.2:

- the socket-outlet shall show no sign of damage that would impair further use;
- the conversion plugs under test shall show no damage and shall conform to the dimensional requirements of this standard;
- the shutters of the socket-outlet shall operate satisfactorily; and
- the socket contacts shall be safely shielded.

12.8.7.2 Test method

Use a selection of three different makes of rewirable plugs conforming to this standard and three different makes of unswitched socket-outlets conforming to BS 1363-2:2016, selected to represent different earth contact designs.

Ensure all socket-outlets are of the type where the earth pin or ISOD of a plug inserted into the socket-outlet operates the shutter mechanism.

Establish the earth resistance between the earthing plug pin and the earthing socket contact of the socket-outlets in accordance with BS 1363-2:2016, 10.2.1b).

Test separate samples of conversion plugs with ISOD for each type of socket-outlet, each sample being inserted into and withdrawn from the socket-outlet at a rate of six insertions and six withdrawals per minute, the speed of travel of the plug being approximately 150 mm/s, the insertion and withdrawal period for the conversion plug being approximately equal. Do not apply lubrication to the plugs or sockets either prior to or during the test.

After 5 000 insertions and withdrawals, reinsert the standard rewirable plug used prior to the test into each type of socket-outlet and repeat the earth resistance test. Observe whether the earth resistance between the earthing plug pin and the earthing socket contact of the socket-outlets is in accordance with BS 1363-2:2016, 10.2.1b).

Examine the test samples for conformity to 12.8.7.1.

12.8.8 Distortion of pins and ISODs

12.8.8.1 Requirements

Conversion plug pins and ISODs shall have adequate strength to ensure that they cannot be distorted by twisting.

After each plug pin has been separately twisted the conversion plug shall fit the gauge shown in Figure 5.

12.8.8.2 Test method

Clamp the conversion plug in a block as shown in Figure 33. Twist each pin about its longitudinal axis by applying a torque of (1 ± 0.1) Nm for 60^{+5}_0 s. Ensure that the torque tube and its position on the plug are as shown in Figure 33. Repeat the test with each plug pin being twisted in the opposite direction to that of the first test. In each case use the gauge in the manner as described 12.2.2.

Examine the test samples for conformity to 12.8.8.1.

12.8.9 Internal contacts

12.8.9.1 Requirements

The neutral and earth contacts for the non-BS 1363 type plug shall be formed as one piece with, or shall be permanently connected to, the pin in such a way that efficient electrical connection is made that cannot work loose in use. The connection shall not be made by means of a screw.

The contact for the fuse-link connected to the line pin shall be formed in one piece and be permanently connected to the pin in such a way that efficient electrical connection is made that cannot work loose in use.

The line contact for the non-BS 1363 type plug shall be formed as one piece. It shall be constructed and fitted into the conversion plug in such a manner that an efficient electrical connection is made between the non-BS 1363 type plug and the fuse and so that it cannot work loose in normal use. The connection shall not be made by means of screws, except that a screw may be used to secure the contact clip to the body of the conversion plug, which shall in turn conform to all the relevant parts of this standard.

12.8.9.2 Test method

Examine the test samples for conformity to 12.8.9.1 and the tests described in Clause 16 and Clause 20.2.

12.8.10 Conversion plug pin retention

12.8.10.1 Requirement

A conversion plug shall be so designed that when fully assembled the pins are adequately retained in position such that there is no likelihood of them becoming detached from the conversion plug during normal use.

The conversion plug pin shall fit the gauge shown in Figure 5 when used in the manner described in 12.2.2.

12.8.10.2 Test method

After the test described in Clause 20, mount the conversion plug using a steel plate similar to that shown in Figure 7. Place the apparatus in an oven. 1 h after the conversion plug body has attained the test temperature of $(70 \pm 5) ^\circ\text{C}$, subject each pin for 60^{+5}_0 s to a pull, in one smooth and continuous motion, of 100^{+0}_-2 N in the direction of the major axis, while maintained at the test temperature.

Examine the test samples for conformity to 12.8.10.1.

12.8.11 Flexibility of conversion plug pin mountings

12.8.11.1 Requirements

The degree of flexibility of mounting of the conversion plug pins or the angular movement of the pins in the base shall be not greater than $3^\circ 30'$ in the directions shown in Figure 8 from an axis which is perpendicular to the conversion plug engagement surface when the pins are subjected to a force as shown in Figure 8.

NOTE Conversion plugs may be checked using an apparatus similar to that shown in Figure 8. Other methods of measuring the $3^\circ 30'$ deflections may be used.

After all tests have been completed the conversion plug shall fit the gauge shown in Figure 5 when used in the manner described in 12.2.2.

12.8.11.2 Test method

Clamp the conversion plug in the mounting block by means of any two of its pins in such a manner as to ensure that:

- the surface of the conversion plug, from which its pins project, is supported and in contact with the corresponding flat surface of the mounting block;
- the back of the conversion plug is not supported and does not come into contact with the fixture;
- the axis of the clamped pins is horizontal.

Test the unclamped pin for declination from the horizontal by applying a force of (4.4 ± 0.2) N, $25^{+0}_{-0.5}$ mm from the engagement surface of the conversion plug and parallel with it in the four directions shown in Figure 8. Repeat the test in turn on the other two pins of the conversion plug.

During the test observe whether the declination from the horizontal measured on the scale exceeds $3^\circ 30'$.

Examine the test samples for conformity to 12.8.11.1.

12.8.12 Withdrawal of the conversion plug from a socket-outlet

12.8.12.1 Requirement

Suitable means shall be provided for withdrawing the conversion plug from a socket-outlet without subjecting the non-BS 1363 type plug cable to stress.

12.8.12.2 Test method

Examine the test samples for conformity to 12.8.12.1.

12.8.13 Safety of conductive components

12.8.13.1 Requirement

Conductive component parts of conversion plugs 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 conversion plug.

12.8.13.2 Test method

Subject the test samples to manual manipulation and examine them for conformity to 12.8.13.1.

12.8.14 Insulating sleeves**12.8.14.1 Requirement**

Line and neutral conversion plug pins shall be fitted with insulating sleeves. The dimensions of the pin and sleeve shall fall within those given in Figure 4. Sleeves shall not be fitted to any earthing pin.

12.8.14.2 Test method

Examine the test samples for conformity to 12.8.14.1 by measurement for pin and sleeve dimensions and use of the gauge shown in Figure 5 as described in 12.2.2 for socket-outlet compatibility.

12.8.15 Conversion plug pin electric strength**12.8.15.1 Requirements**

Conversion plug pin sleeves shall have adequate electric strength, resistance to abrasion and resistance to deformation due to overheating of pins.

During the test no breakdown of flashover shall occur.

12.8.15.2 Test method

Wrap a thin metal strip, of between 5.5 mm and 6 mm width, around the base of the sleeve of each line and neutral pin adjacent to the base of the conversion plug. Apply a 50 Hz voltage of substantially sinusoidal waveform between the strip and the corresponding pin. Initially not more than 500 V is applied, the voltage then being raised to $(1\ 250 \pm 30)$ V, which is maintained for 60^{+5}_0 s.

Examine the test samples for conformity to 12.8.15.1.

12.8.16 Conversion plug pin resistance to abrasion**12.8.16.1 Requirement**

After being tested in accordance with 12.8.6.2, the sleeve of the conversion plug pin shall show no damage that might impair the further use of the conversion plug. The sleeve shall not have been penetrated or creased and shall pass the tests described in 12.8.15.2, any abraded brass contamination on the sleeve having been removed.

12.8.16.2 Test method

The test apparatus for resistance to abrasion comprises a horizontally disposed beam pivoted about its centre point (see Figure 9). A short length of steel wire, (1 ± 0.02) mm in diameter and bent into a "U" shape, the base of the "U" being straight, with no surface defects, is rigidly attached at both ends to one end of the beam so that the straight part of the wire projects below the beam and is parallel to the axis of the beam pivot.

Hold the conversion plug in a suitable clamp, as shown in Figure 9, in such a position that the straight part of the steel wire rests upon the conversion plug pin at right angles to it and the pin slopes downward at an angle between 5° and 10° to the horizontal. Load the beam so that the wire exerts a force of $4^{+0}_{-0.1}$ N on the pin.

Move the conversion plug backwards and forwards in a horizontal direction in the plane or the axis of the beam so that the wire rubs along the pin, with the length of pin thus abraded being approximately 9 mm of which approximately 7 mm is over the insulating sleeve.

Move the conversion plug 10 000 times in each direction (20 000 movements) at a rate of 25 to 30 movements per minute.

Perform the test on one pin of each conversion plug.

Examine the test samples for conformity to 12.8.16.1.

12.8.17 Conversion plug pin insulation temperature resistance

12.8.17.1 Requirements

After testing in accordance with 12.8.17.2, insulation of the conversion plug pins shall have been reduced by not more than 50% at the point of impression.

12.8.17.2 Test method

Take a set of three sample pins for testing by means of the apparatus shown in Figure 10, which has a blade $0.7^{+0.05}_0$ mm wide and a radius of (3 ± 0.1) mm. Perform the test on one pin of each conversion plug not used for the test described in 12.8.16.2.

Position a sample as shown in Figure 10 and load the apparatus so that the blade exerts a force of $2.5^{+0.1}_0$ N on the sample. Place the apparatus, complete with sample, in a heating cabinet at 200^{+8}_0 °C for a period of 120^{+5}_0 min, after which the sample is removed and immediately cooled by immersion in water at approximately room temperature.

Measure the thickness of the test samples' insulation remaining at the point of impression for conformity to 12.8.17.1.

13 (Not used)

14 Resistance to ageing and to humidity

14.1 Resistance to ageing

14.1.1 Requirement

Conversion plugs shall be resistant to ageing such that, when tested in accordance with 14.1.2 they shall show no damage that would:

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

14.1.2 Test method

Prepare a heating cabinet with an atmosphere having the composition and pressure of the ambient air and ventilated by natural circulation at a temperature maintained at (70 ± 5) °C.

Place the samples in the cabinet for 168^{+2}_0 h.

NOTE The use of an electrically heated cabinet is recommended. Natural circulation may be provided by holes in the walls of the cabinet.

At the end of the test period, remove the samples from the cabinet and restore them to ambient temperature and relative humidity for at least 1 h.

Examine the test samples for conformity to **14.1.1**.

14.2 Resistance to humidity

14.2.1 Requirement

Conversion plugs shall be resistant to humid conditions that can occur in normal use, such that, when tested in accordance with **14.2.2**, there shall be no breakdown in insulation resistance and electric strength as specified in Clause **15**.

When tested in accordance with Clause **15**, inspection shall not reveal any damage to the sample that would impair its use or safety within the requirements of this part of BS 1363.

14.2.2 Test method

Choose a convenient temperature, T (in °C), between 20 °C and 30 °C as a reference temperature, to suit the ambient conditions at the time of test.

Bring the sample to a temperature of between T and $T + 4$ °C and then place in a humidity cabinet containing air with a relative humidity maintained between 85% and 95% for 48^{+1}_0 h. Maintain the temperature of the air where the samples are placed within ± 2 °C of the chosen value T .

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

NOTE 2 A relative humidity of between 85% and 95% can be obtained by placing in the humidity cabinet a saturated solution of potassium nitrate (KNO_3) or sodium sulphate (Na_2SO_4) in water having a sufficiently large contact surface with the air.

NOTE 3 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.

Examine the test samples for conformity to **14.2.1**.

15 Insulation resistance and electric strength

15.1 Insulation resistance

15.1.1 Requirement

The insulation resistance of conversion plugs shall be adequate such that, when tested in accordance with **15.1.2** the insulation resistance shall be not less than the following:

- a) 5 M Ω between parts of opposite polarity;
- b) 5 M Ω between parts of opposite polarity connected together and other parts insulated there from, including earthed metal.

When tested in accordance with **15.1.2** no breakdown shall occur.

15.1.2 Test method

Perform the test in the humidity cabinet in accordance with **14.2.2**, or immediately after removal of the sample from the cabinet in a room where the specified temperature is maintained. Having disconnected one pole of any neon indicator, or the like, measure the insulation resistance using a d.c. voltage of 500^{+250}_0 V. Make the measurement for 60^{+5}_0 s after application of the voltage.

Measure the insulation resistance consecutively between:

- a) line and neutral plug pins;

- b) line and neutral plug pins connected together and:
- 1) a metal foil, or conducting foam, in contact with the entire accessible external surface;
 - 2) the earthing pin;
 - 3) any metal part of the non-BS 1363 type plug retention.

Examine the test samples for conformity to **15.1.1**.

15.2 Electric strength

15.2.1 Requirement

The electric strength of conversion plugs shall be adequate such that when tested in accordance with **15.2.2** no flashover or breakdown shall occur.

Glow discharges without drop in voltage shall be ignored.

15.2.2 Test method

Having disconnected one pole of any neon indicator, or the like, initially apply a 50 Hz voltage of substantially sinusoidal waveform of not more than 1 000 V then raise the voltage to $(2\ 000 \pm 60)$ V.

Use a high voltage source such that when the output is adjusted to $(2\ 000 \pm 60)$ V for 60^{+5}_0 s, and is then short-circuited, the output current is not less than 200 mA. Any overcurrent protection shall not operate at a current of less than 100 mA.

Examine the test samples for conformity to **15.2.1**.

16 Temperature rise

16.1 Requirement

Conversion plugs fitted with an appropriate non-BS 1363 type plug shall have a flexible cable of $(1\ 000 \pm 50)$ mm of appropriate insulated cable as supplied by the manufacturer, to suit the maximum current rating of the non-BS 1363 type plugs and selecting the minimum associated conductor cross-section (e.g. 13 A rating with 1.25 mm² conductor cross-section).

If screws are used to retain the non-BS 1363 type plug in position or to exert contact pressure, they shall be tightened with a torque equal to two thirds of the values given in Table 3.

Conversion plugs and their surroundings shall not attain excessive temperatures in normal use that might result in a hazard.

When tested in accordance with **16.2**, temperature rise values shall not exceed those given in Table 6.

The tests shall be performed at rated voltage +10%, -20%.

The test current shall be equal to 1.1 times the respective current rating of the non-BS 1363 type plug (with a tolerance of ± 0.4 A) but shall not exceed 14.4 A.

Table 6 Permitted temperature rises

Measurement point	Temperature rise K
Line pin spacer [see Figure 17b)]	37
Neutral pin spacer [see Figure 17b)]	37
L and N terminations	52
Accessible external surface	52

NOTE The recording of a measured value up to and including the specified maximum permissible limit for temperature rise is considered to 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.

16.2 Test method

Measure temperature rises of the line and neutral pins of the conversion plugs and where overheating might result in a hazard by means of thermocouples using the apparatus shown in Figure 17. Determine temperature rises by means of fine wire thermocouples so chosen and positioned that they have minimum effect on the temperature of the part under test. Attach the thermocouples 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 conversion plug and that no electrical connections are bridged by solder.

If, in order to fix thermocouples, a conversion plug is dissected to give access to the appropriate positions, replace removed parts and, if necessary, cement them in place so that no additional air spaces are created.

Fit the conversion plugs with a calibrated link constructed and calibrated in accordance with Annex A. Mount the plug in a flat insulating plate as shown in Figure 17a and Figure 17b. Attach the supply conductors to the line and neutral pins of the conversion plug by means of clamps, which also serve to retain the conversion plug in position. Tighten the clamp screws to a torque of between 0.8 Nm and 1.2 Nm. Mount the test sample, by means of screws, in a standard steel flush-mounted socket-outlet box as shown in BS 4662:2006+A1:2009, Figure 1, having a nominal internal depth of 35 mm. Mount the complete assembly in a test cabinet as shown in Figure 17a.

Pass the incoming cable and outgoing flexible cable(s) through holes in the top surface of the test cabinet, and then seal the holes to prevent circulation of air. Ensure that the length of cable and flexible cable within the enclosure is not greater than 600 mm and 850 mm respectively. Position the cable and flexible cable away from the reference temperature measuring point so as not to influence the derivation of plug temperature rise values.

Pass the incoming 2.5 mm² PVC insulated and sheathed cable in to the socket-outlet mounting box through the standard knockout provided. Fit the knockout with a suitable rubber grommet, the point of entry being sealed to prevent the circulation of air. Ensure that the length of cable within the socket-outlet box is (150 \pm 5) mm and that the outer sheath and the circuit protective conductor are removed to within 20 mm of the point of entry. Place the test cabinet [see Figure 17a)] in an environment having an ambient temperature of (20 \pm 5) °C.

Pass the test current through the conversion plug and through a load(s) connected to the flexible cable of the test plug(s) for a continuous period of not less than 4 h and not greater than 8 h until stability is reached, stability being taken as less than 1 K rise within 1 h.

Calculate the temperature rise by deducting the reference point temperature from the measurement point temperature recorded (see Figure 17a and Figure 17b respectively).

Examine the test samples for conformity to **16.1**.

17 (Not used)

18 (Not used)

19 Connection of the non-BS 1363 type plug and non-BS 1363 type plug retention in conversion plugs

19.1 Retention of the non-BS 1363 type plug

19.1.1 Requirement

Provision shall be made for the entry and adequate retention of the non-BS 1363 type plug with which the conversion plug is supplied or is to be fitted.

The entry for the non-BS 1363 type plug shall be between the current-carrying pins at the side of the conversion plug opposite the earth pin or ISOD.

It shall not be possible to push the non-BS 1363 type plug into the conversion plug to such an extent as to impair safety or so that the non-BS 1363 type plug retention is loosened.

When tested in accordance with **19.1.2**, the insulation of the non-BS 1363 type plug and cable shall not be damaged, and it shall not be possible for the non-BS 1363 type plug to be displaced by more than 2 mm longitudinally.

When the variety of non-BS 1363 type plugs dimensionally vary in a way that would not meet the requirements of this clause then the manufacturer shall include in the fitting instructions a guide to correct selection and fitting of the applicable non-BS 1363 plugs which match the conversion plug.

19.1.2 Test method

Use a non-BS 1363 type plug representative of the type normally used with the particular conversion plug.

For the measurement of the longitudinal displacement make a mark on the cable or non-BS 1363 type plug at a point adjacent to the entry into the conversion plug or as close as possible whilst the cable is subjected to the load given in Table 2, before starting the tests.

Test reusable and non-reusable conversion plugs using the following respective procedures.

a) Reusable conversion plugs

Fit a reusable conversion plug with a non-BS 1363 type plug correctly, with any screws tightened to a torque of that given in Table 7. Leave the assembly untouched for not less than 24 h.

Check conformity to **19.1.1**.

Complete the following two tests in order.

1) Test one

Subject the non-BS 1363 type plug 25 times to the pull given in Table 2; the pulls are applied momentarily, in one smooth and continuous motion, in the most unfavourable position. Immediately afterwards, subject the non-BS 1363 type plug cable for 60^{+5}_0 s to the appropriate torque shown in Table 2, at a minimum starting distance of 150 mm from the non-BS 1363 type plug cable retention measured along the length of the cable.

Apply a voltage of $(3\,750 \pm 75)$ V for 60^{+5}_0 s between the conductors.

Breakdown or flashover is considered to indicate damage to the non-BS 1363 type plug cable.

After the test, measure the displacement of the mark in relation to the original starting position whilst it is subjected to the load given in Table 2.

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

2) Test two

Mount the conversion plug with non-BS 1363 plug in the apparatus shown in Figure 7. Subject the non-BS 1363 plug to the force as shown in Table 8 applied in one smooth and continuous motion, first for 1 min in the longitudinal direction, then for 1 min in the most unfavourable direction but not exceeding 45° from the normal direction. Check conformity to 19.1.1.

b) Non-reusable conversion plugs

Perform the test with the non-BS 1363 type plug with which the conversion plug is supplied and sever the conductors of the non-BS 1363 type plug cable at a minimum distance of 150 mm from the non-BS 1363 type plug cable retention prior to the test.

Perform the two tests specified in 19.1.2a).

Table 7 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
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

NOTE 1 The recording of a measured value given in this table is considered to conform to this part of BS 1363 on condition that the uncertainty of measurement at not less than 95% confidence level does not exceed $\pm 10\%$.

NOTE 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.

Table 8 Plug displacement test loads

Rated current A	Force N	
	Normal direction	Most unfavourable direction
Up to and including 4	50	25
Over 4	100	50

19.2 Non-BS 1363 type plug retention

19.2.1 Requirement

Non-BS 1363 type plugs shall be retained securely in the conversion plug. The construction shall ensure the following, where applicable:

- the non-BS 1363 type plug retention cannot be released whilst engaged in a socket and without the use of a tool;
- it shall not be possible to touch non-BS 1363 type plug retention screws, if any, with test probe B of BS EN 61032:1998 when the accessory is energized;
- the non-BS 1363 type plug is not clamped by a metal part bearing directly on the non-BS 1363 type plug;
- at least one part of the retention device is securely fixed to the conversion plug;
- for reusable conversion plugs, clamping the non-BS 1363 type plug does not require the use of a special purpose tool;
- tightening the non-BS 1363 type plug retention screws, if any, to the torque specified in Table 7 does not distort the engagement surface of the conversion plug to such an extent that conformity to 12.2.1 is affected;
- the conversion plug can be correctly assembled without damage when it is fitted with the largest specified non-BS 1363 type plug and all screws are tightened to the torque specified in Table 7 and no deformity of the conversion plug is displayed;
- the non-BS 1363 type plug remains in effective contact, when confirmed visually or in case of doubt by testing in accordance with Clause 16, with the conversion plug contacts when tested in accordance with 19.1.2a)1).

19.2.2 Test method

Examine the test samples for conformity to 19.2.1.

19.3 Clamping screws

19.3.1 Requirement

Screws that are used when clamping the non-BS 1363 type plug shall not serve to fix any other components unless the conversion plug 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.

19.3.2 Test method

Examine the test samples for conformity to 19.3.1.

19.4 Cable stress relief

19.4.1 Requirement

Conversion plugs shall be so designed that the flexible cable is not subjected to excessive bending where it enters the plug. If the construction of the conversion plug might affect the entry of the cable to the non-BS 1363 plug, or if the non-BS 1363 plug is unproven, conformity shall be checked by the following test.

19.4.2 Test method

Fix the plug to the oscillating member of the apparatus shown in Figure 18 so that when the assembly is vertical the axis of the flexible cable at the point of entry is vertical and passes through the axis of oscillation.

Mount samples with flat flexible cables so that the major axis of the section is parallel to the axis of oscillation.

Load the flexible cable with a weight as given in Table 2.

Adjust the distance between the point of entry to the plug and the axis of oscillation so that the weight makes the minimum lateral movement as the oscillating member moves. Pass a current appropriate to the flexible cable fitted, as given in Table 2, through the line and neutral conductors, the voltage between them being (250 ± 10) V a.c. If an earthing conductor is incorporated in the flexible cable, connect it at one end to the neutral conductor.

Move the oscillating member backwards and forwards through an angle of $(45 \pm 3)^\circ$ on either side of the vertical, the number of flexings being 10 000 at a rate of 60_{-10}^0 flexings per minute. After 5 000 flexings, turn plugs with cables of circular section through $(90 \pm 5)^\circ$ about the cable entry centreline.

NOTE A flexing is one movement through 90° , either backwards or forwards.

Observe whether there are interruptions of the current passing through the conductors and/or short-circuits between them.

Observe whether, after the test, the sample shows damage. Ignore breakage of no more than 10% of the total number of conductor strands in any core provided they have not pierced the insulation.

20 Mechanical strength

20.1 General requirement

When tested in accordance with 20.2 and 20.3, conversion plugs shall have adequate mechanical strength and construction to withstand the handling that might be expected in normal use.

20.2 Tumbling barrel test

20.2.1 Performance requirements

The conversion plug shall show no damage that might affect safety. No component parts shall have become detached, and the pins of the conversion plug shall not have been unduly distorted as checked using the gauge shown in Figure 5 when used in a manner as described in 12.2.2 but with a force not exceeding 20 N.

Screws shall remain tight to a torque not less than 70% of the original tightening torque and current-carrying joints shall not have become loose and shall make satisfactory contact.

20.2.2 Test method

Prepare test samples such that the flexible cable of the appropriate non-BS 1363 type plug is cut to a length of (150 ± 5) mm, measured from the nearest edge of the earthing pin (pre-coiled flexible cables being extended before measurement).

Place a test sample (separate from that used in the test specified in 20.3.2) in a tumbling barrel such as is illustrated in Figure 20. Rotate the barrel at approximately 5 r/min (i.e. to cause approximately ten drops per minute). Test only one conversion plug at a time.

Subject test samples marked "1363-5" to 1 000 drops.

Subject test samples marked "1363-5/A" to 5 000 drops.

Examine the test samples for conformity to 20.3.1, 12.4.1 and the temperature rise test of Clause 16.

For the repeat test given in Clause 16 retain the fitted plug without disturbing the connections, but remove the conductor insulation and sheath only as far as is necessary for the attachment of a $(1\ 000 \pm 50)$ mm length of flexible cable of the same type as that already attached to the non-BS 1363 type plug. The connection shall be made by means of a connector having a current rating appropriate to that of the flexible cable.

20.3 Fuse-link test

20.3.1 Performance requirement

When tested in accordance with 20.2.2, a standard fuse-link conforming to BS 1362:1973 shall be retained correctly.

20.3.2 Test method

Using a separate test sample from that used in the test specified in 20.2.1, insert and withdraw a solid link of stainless steel, as shown in Figure 19, in the fuse clips of a fused conversion plug 20 times in succession in a normal manner (i.e. not in misuse conditions), at a rate not exceeding ten times per minute.

Fit a standard fuse-link conforming to BS 1362:1973 and complete the appropriate mechanical strength specified in 20.2.2.

21 Screws, current-carrying parts and connections

21.1 Mechanical stress

21.1.1 General requirements

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 any soft metal that is liable to creep.

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

Contact pressure in electrical connections within the conversion plug between the conversion plug and the non-BS 1363 type plug pins 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. The suitability of the material shall be 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.

Thread cutting and/or thread-forming screws, shall not be used for the making of current-carrying or earth continuity connections, except where thread-forming screws are used to provide earthing continuity in a situation in which it is not necessary to disturb the connection in normal use and where at least two screws are used for each connection.

Screws that make a mechanical connection between different parts of the conversion plug shall be locked against loosening if the connection carries current.

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

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

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

Screws and nuts that are intended to be tightened during installation or use, or during replacement of the fuse-link, shall remain secure.

21.1.2 Test method

Using smooth, continuous actions, tighten screws or nuts to the appropriate torque specified in Table 7, then loosen them, as follows:

- ten times for screws in engagement with a thread of insulating material, the screw being completely removed and replaced each time;
- five times for nuts and other screws.

21.2 Resistance to corrosion

21.2.1 Requirements for current-carrying components

Current-carrying components, earthing plug pins and components of the earthing circuit shall be of brass, copper, phosphor-bronze, or other metal at least equivalent with regard to its conductivity, resistance to abrasion and resistance to corrosion, except for screws, nuts, washers, ISODs, clamping plates and similar parts or contacts, nor to parts of conversion plugs used for earth continuity purposes.

21.2.2 Test method

Examine the test samples for conformity to 20.2.1, and to the relevant provisions specified in Clauses 10, 16 and 24.

22 Resistance to heat

22.1 Distortion

22.1.1 Performance requirements

A conversion plug shall be resistant to heat, such that, when tested in accordance with 22.1.2, it shall not undergo any change impairing its further use, and sealing compound shall not flow to such an extent that live parts are exposed.

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

After the test, the test sample shall still be able to satisfy the requirements of 9.2.1 and 15.2.1.

22.1.2 Test method

Maintain test samples at $(70 \pm 5)^\circ\text{C}$ in a heating cabinet for 60^{+5}_0 min.

Examine the test samples for conformity to 22.1.1.

22.2 Resilience

22.2.1 Performance requirement

After testing in accordance with 22.2.2, conversion plugs shall still satisfy the requirements of 12.2.1, 15.1.1 and 15.2.1.

22.2.2 Test method

Subject the test samples with external parts of resilient material (e.g. thermoplastics, rubber) to a pressure test by means of an apparatus similar to that shown in Figure 23, the test being made in a heating cabinet at a temperature of $(70 \pm 5)^\circ\text{C}$.

Clamp a test sample between the jaws in such a way that these press against it in the area where it is gripped in normal use, the centre line of the jaws coinciding as nearly as possible with the centre of this area.

Apply a force through, and including the effect of, the jaws of 20_{-1}^0 N.

After 60^{+5}_0 min, remove the jaws and the test samples.

Examine the test samples for conformity to 22.2.1.

22.3 Insulating material

22.3.1 Performance requirement

Components constructed of insulating material shall be sufficiently resistant to heat, having particular regard for their location and function in the complete conversion plug.

Components constructed of ceramic material shall be deemed to conform without testing.

External components of conversion plugs tested in accordance with 22.1.1 shall be deemed to conform without further testing.

All other parts of insulating material, including the ISOD, if fitted, shall be subjected to the ball pressure test using the apparatus shown in Figure 24. The diameter of the impression caused by the ball is measured and shall not exceed 2 mm.

22.3.2 Test method

Place the component to be tested in a heating cabinet for a period of at least 10 min before the test load is applied.

Using the apparatus illustrated in Figure 24, perform the test in accordance with BS EN 60695-10-2:2014, at a temperature of (75 ± 5) °C.

Examine the test samples for conformity to 22.3.1.

23 Resistance to abnormal heat and fire

23.1 Performance requirement

A conversion plug shall be resistant to abnormal temperature or fire such that, when tested in accordance with 23.2:

- a) there is no visible flame and no sustained glowing; or
- b) the 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.

23.2 Glow-wire test

23.2.1 Principle

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.

23.2.2 Test conditions

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

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

Small components unlikely to be subjected to abnormal heat and the failure of which to pass these tests would not materially affect the safety of the conversion plug shall not be subjected to the glow-wire test.

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

The test shall be made on one sample.

23.2.3 Test procedure

Perform the test in accordance with BS EN 60695-2-11:2014 at the test temperature specified in Table 9.

Apply the tip of the glow-wire, once only, to the specified surface of the sample, taking into account the conditions of the intended use under which a heated or glowing element might come into contact with the sample.

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.

Examine the test samples for conformity to 23.1.

Table 9 Application of glow-wire test

Component	Temperature of glow-wire °C
Components necessary to retain live parts and ISODs in position	750 ±10
Components not necessary to retain live parts in position (although they may be in contact with live components)	650 ±10

In case of doubt, repeat the test on two further samples.

24 Resistance to excessive residual stresses and to rusting

24.1 Copper alloy components

24.1.1 Performance requirement

When tested in accordance with 24.1.2, press-formed or similar current-carrying components constructed of copper alloy containing less than 80% of copper shall be resistant to failure in use due to stress corrosion.

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

24.1.2 Test method

Degrease the sample in a suitable alkaline degreasing solution or organic solvent, then immerse the sample in an aqueous solution of mercurous nitrate containing 10 g of $\text{Hg}_2(\text{NO}_3)_2$ and 10 ml of HNO_3 (relative density 1.42) per litre of solution for (30 ± 1) min at a temperature of (20 ± 5) °C.

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

After treatment wash the sample in running water, wipe off any excess mercury, and immediately visually examine the sample for conformity to 24.1.1.

24.2 Ferrous components

24.2.1 Performance requirement

Ferrous components, the rusting of which might cause the conversion plug to become unsafe, shall be adequately protected against rusting.

When tested in accordance with 24.2.2, ferrous components shall show no signs of rusting.

24.2.2 Test method

Degrease the sample in a suitable alkaline degreasing solution or organic solvent, then immerse the sample for (10 ± 0.5) min in a 10% solution of ammonium chloride in water at a temperature of (20 ± 5) °C.

Shake off any drops without drying and place the samples for (10 ± 0.5) min in a box containing air saturated with moisture at a temperature of (20 ± 5) °C.

Dry the samples for at least 10 min in a heating cabinet at a temperature of (100 ± 5) °C. Visually inspect their surfaces for signs of rust.

Examine the test samples for conformity to 24.2.1.

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

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

Figure 1 Test pin (see Clause 12)

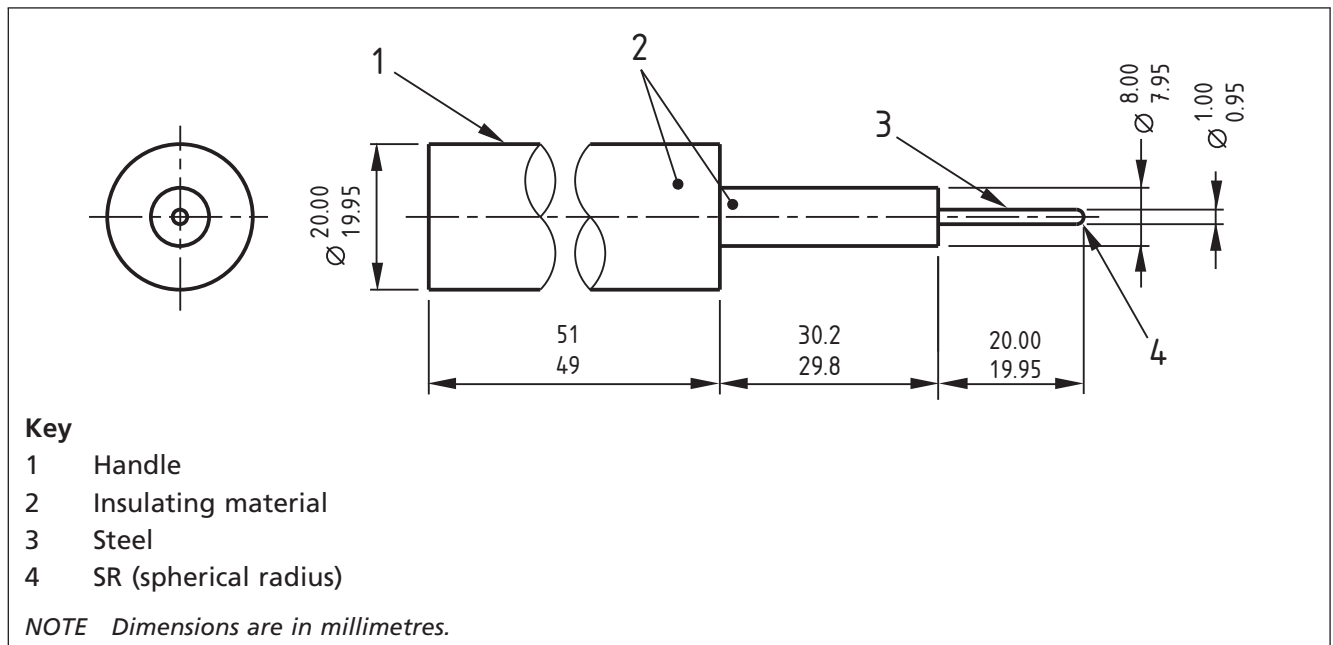


Figure 2a Apparatus for mechanical strength test on resilient covers (see Clause 9)

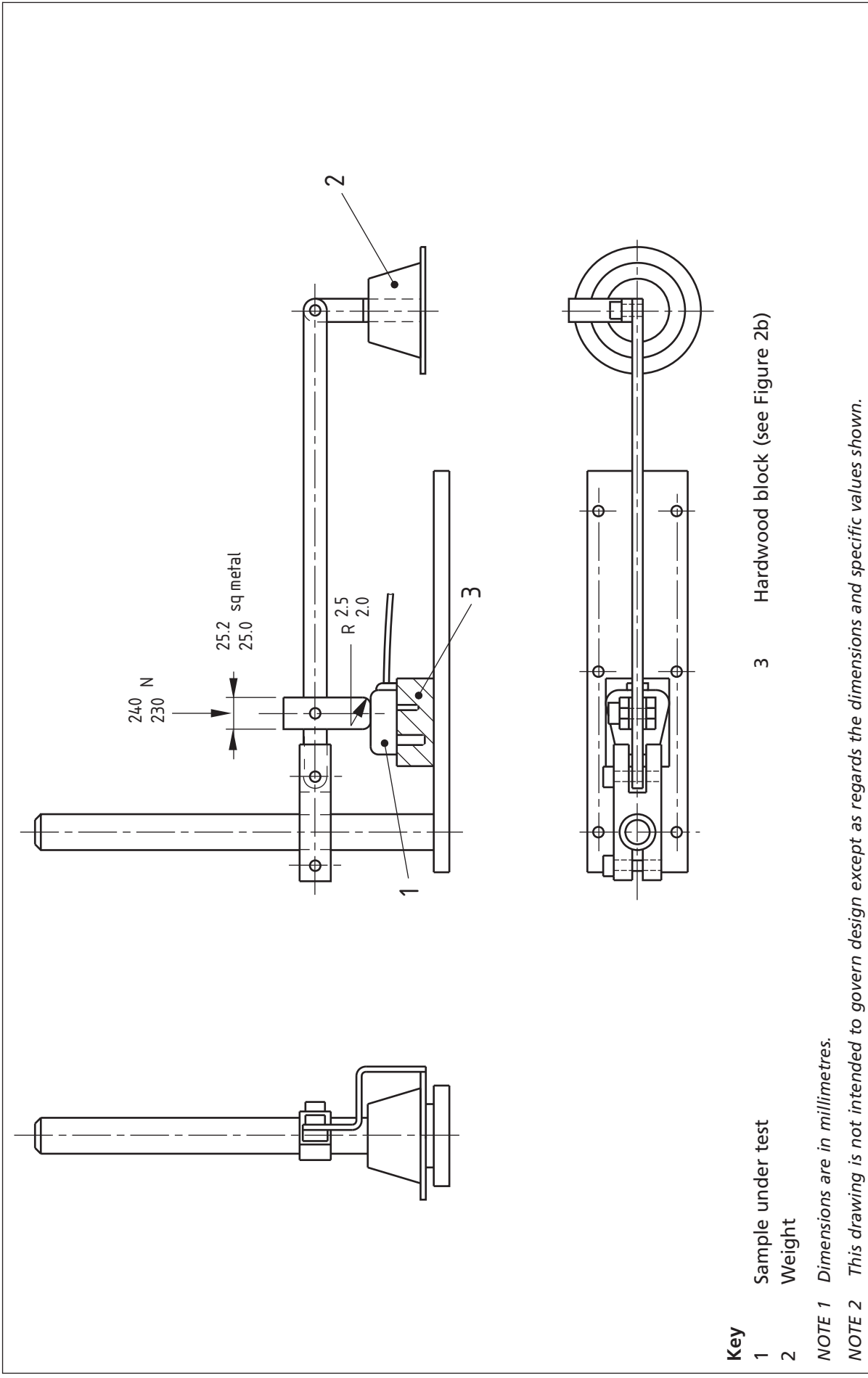
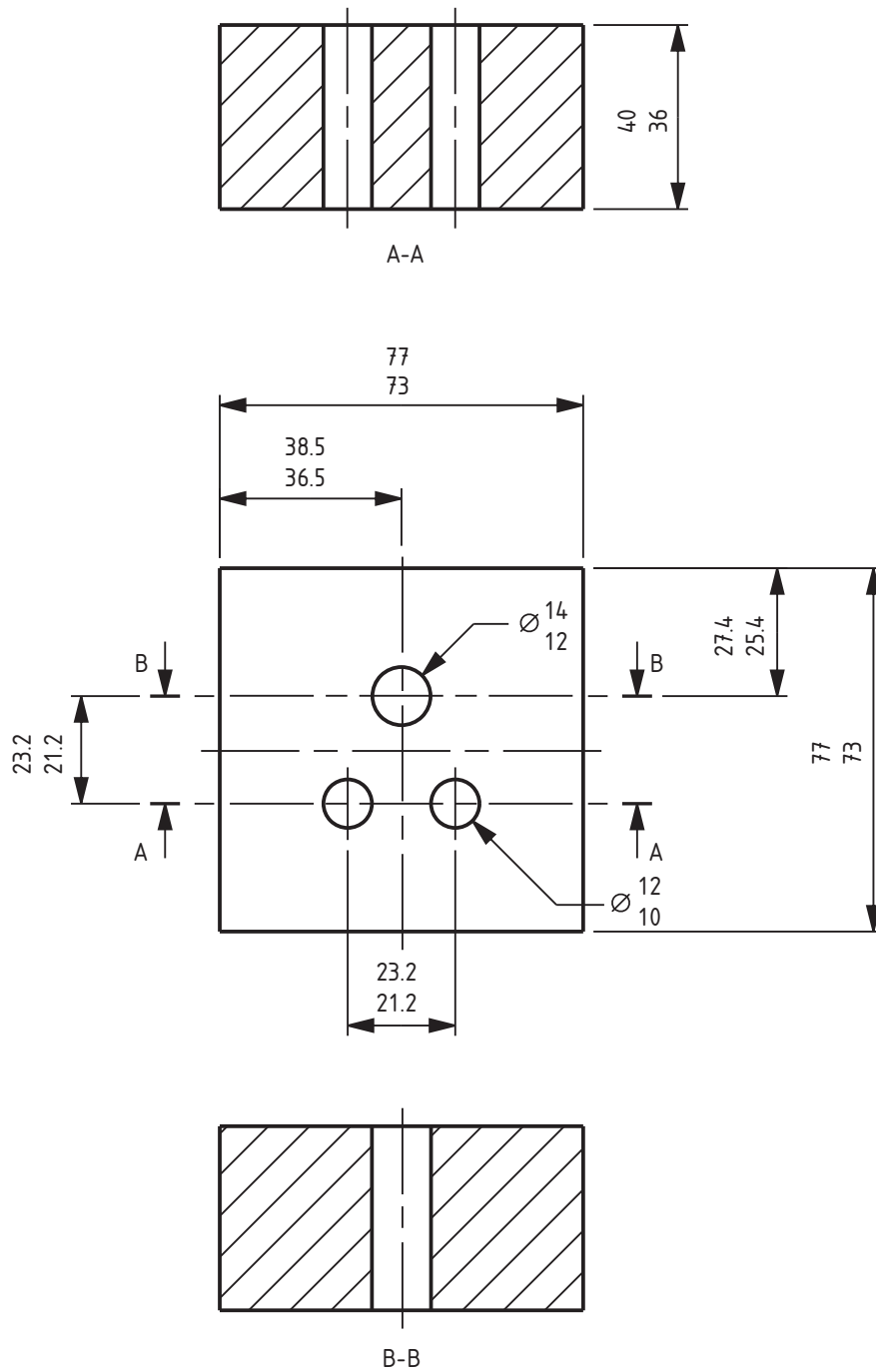


Figure 2b Hardwood block for Figure 2a



NOTE Dimensions are in millimetres.

Figure 4a Dimensions and disposition of pins (see Clause 12) (1 of 2)

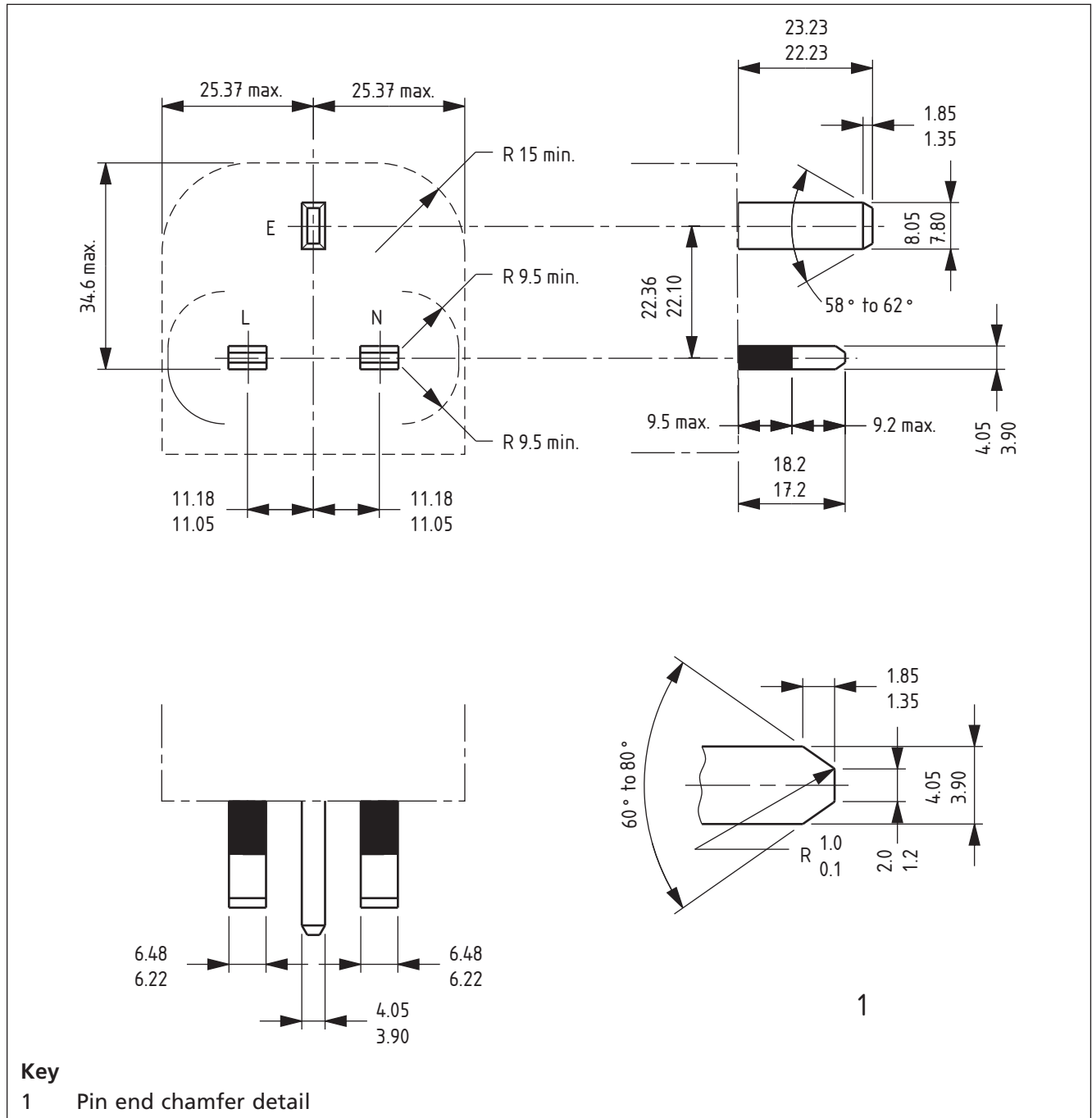


Figure 4a Dimensions and disposition of pins (see Clause 12) (2 of 2)

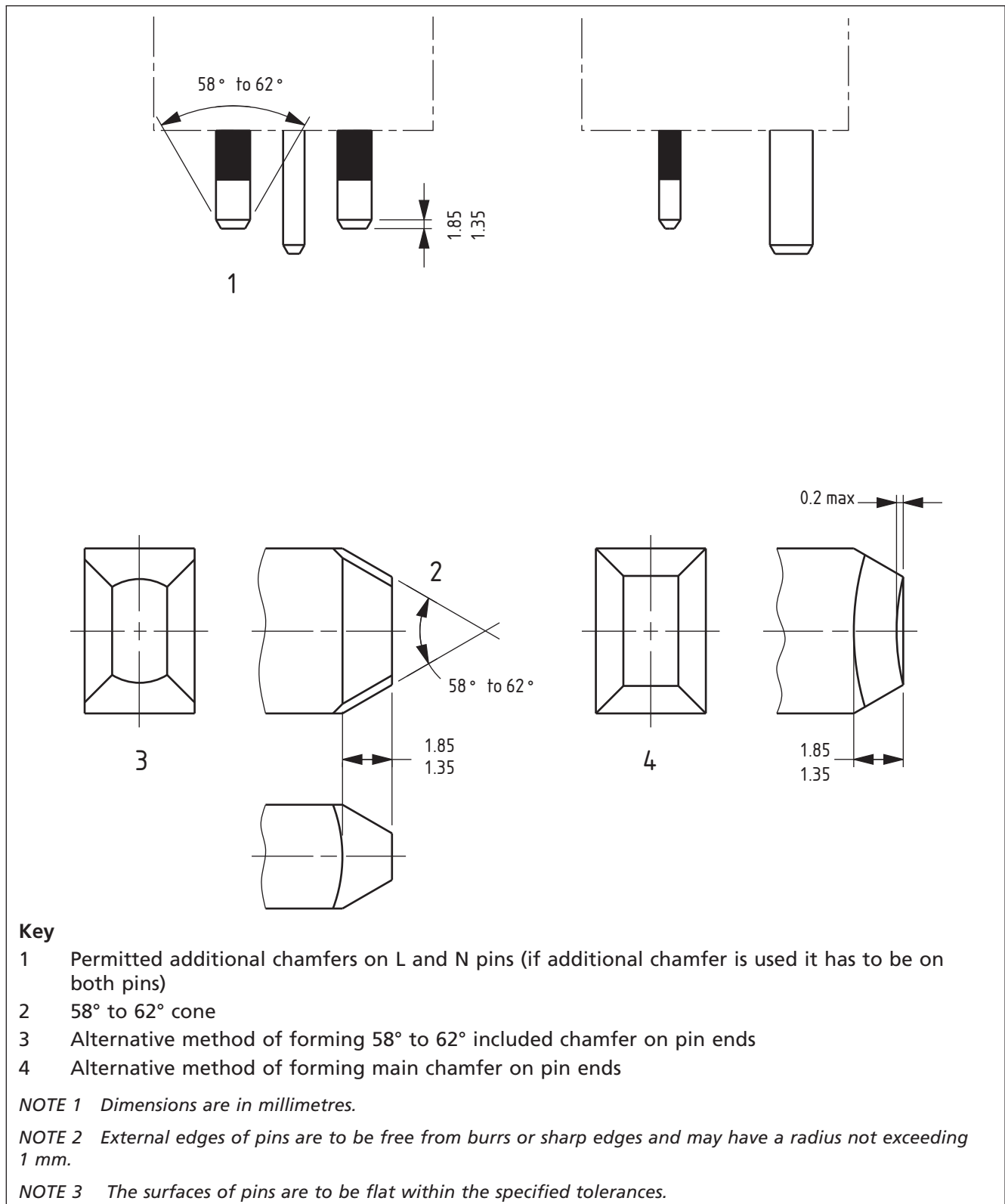


Figure 4b Concave shrinkage allowance for ISODs (1 of 2)

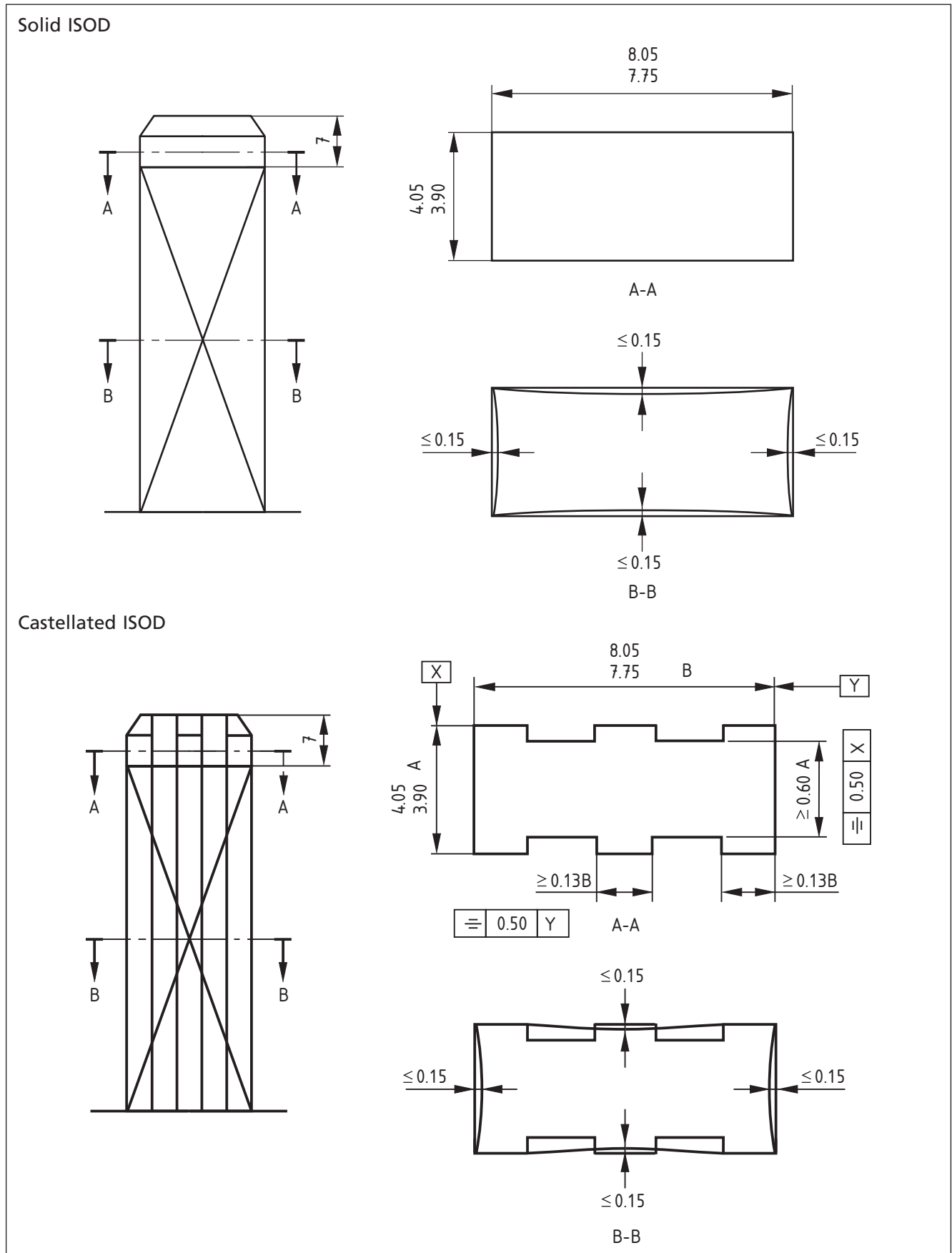


Figure 4b Concave shrinkage allowance for ISODs (2 of 2)

NOTE 1 Dimensions are in millimetres.

NOTE 2 Section A-A to be measured away from the chamfer as shown.

Figure 5 Gauge for plug pins (see Clause 12, Clause 20 and Clause 22) (1 of 2)

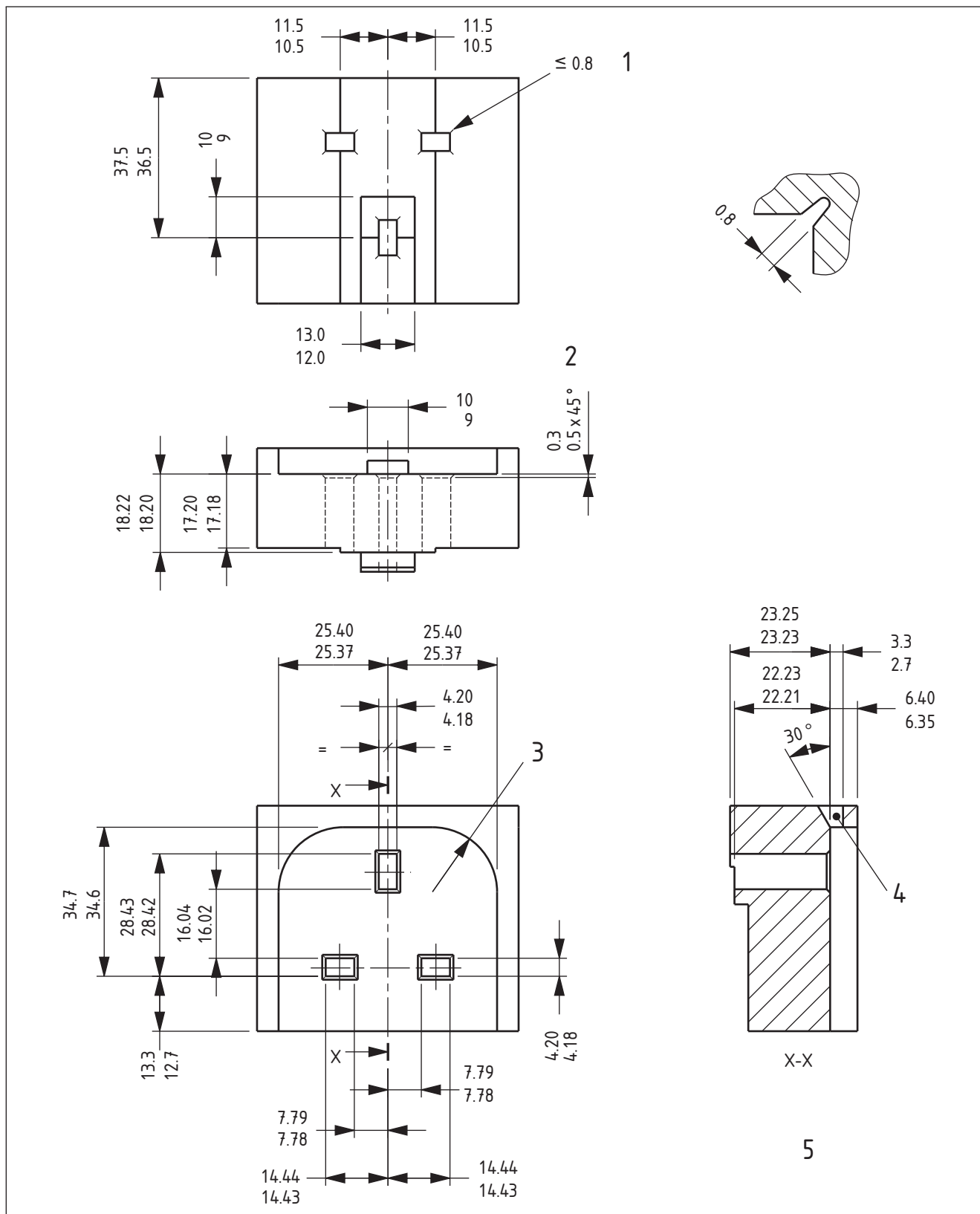


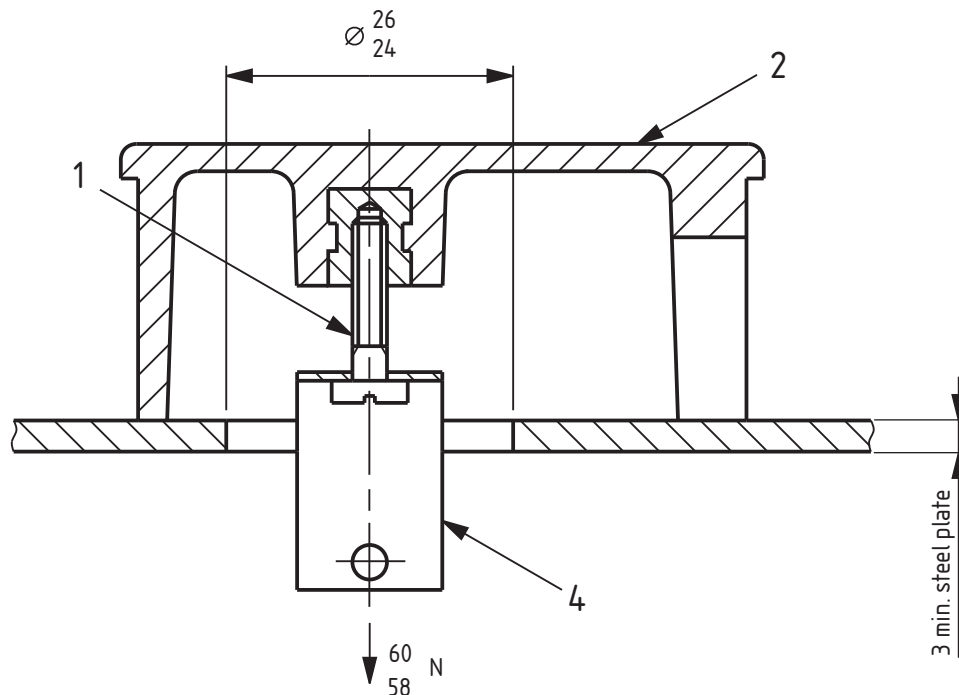
Figure 5 Gauge for plug pins (see Clause 12, Clause 20 and Clause 22) (2 of 2)

Key

- | | | | |
|---|--|---|--|
| 1 | Corners may be relieved up to width of 0.8 as shown | 2 | Chamfer all round |
| 3 | Radius = 15.088 TP (true profile) with a tolerance zone 0.100 wide, ± 0.050 from the TP; the form of this contour is to blend smoothly with the sides. | 4 | Slot optional |
| | | 5 | Gauge may be fabricated in several component parts, providing assembly is within dimensions shown. |

NOTE Dimensions are in millimetres.

Figure 6 Apparatus for testing plug cover fixing screws (see Clause 12)

**Key**

- | | |
|---|---|
| 1 | Cover retaining screw positioned as in service |
| 2 | Sample plug/adaptor cover supported with cover fixing screw axis vertical |
| 4 | Light metal stirrup |

NOTE 1 Dimensions are in millimetres.

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

Figure 7 Mounting plate (see Clause 12)

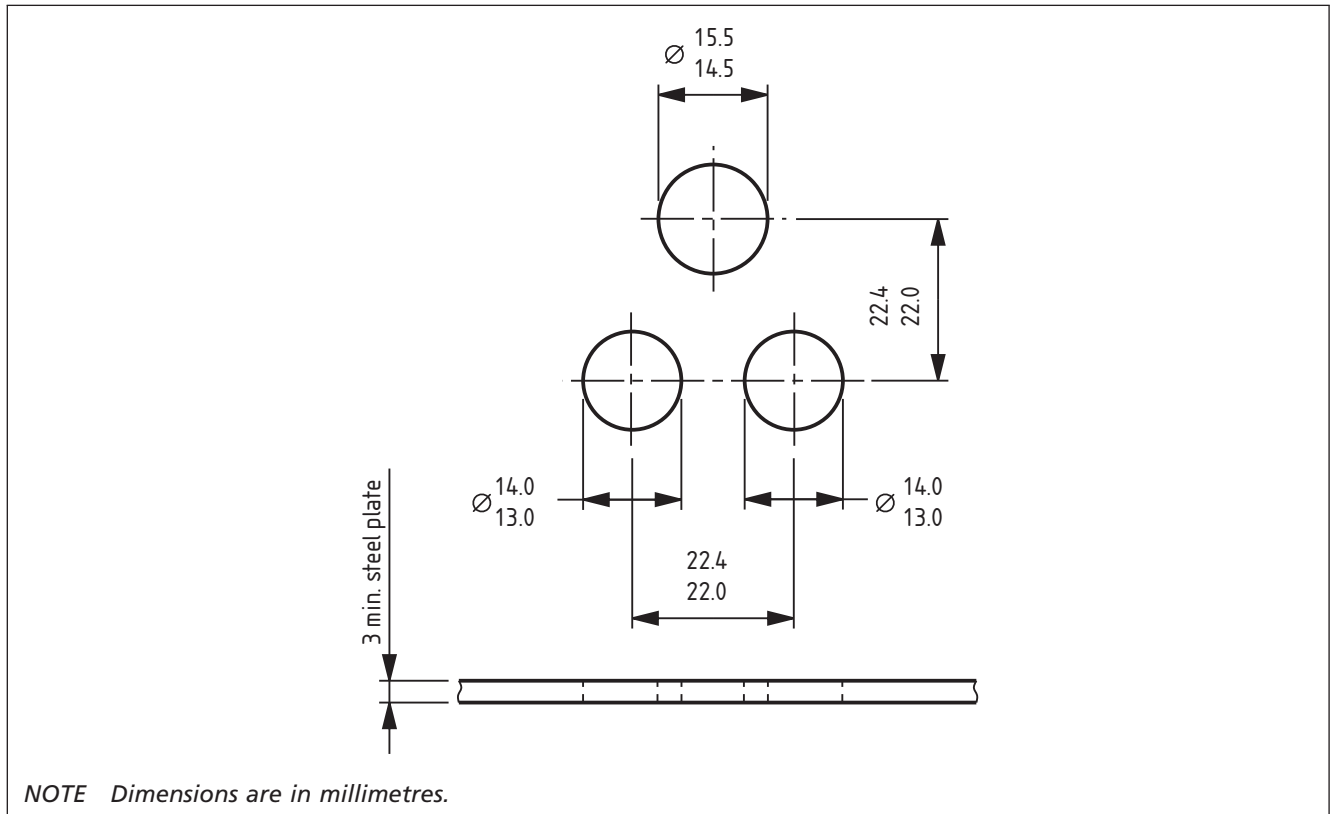


Figure 8 Plug pin deflection test apparatus for resilient plugs (see Clause 12) (1 of 2)

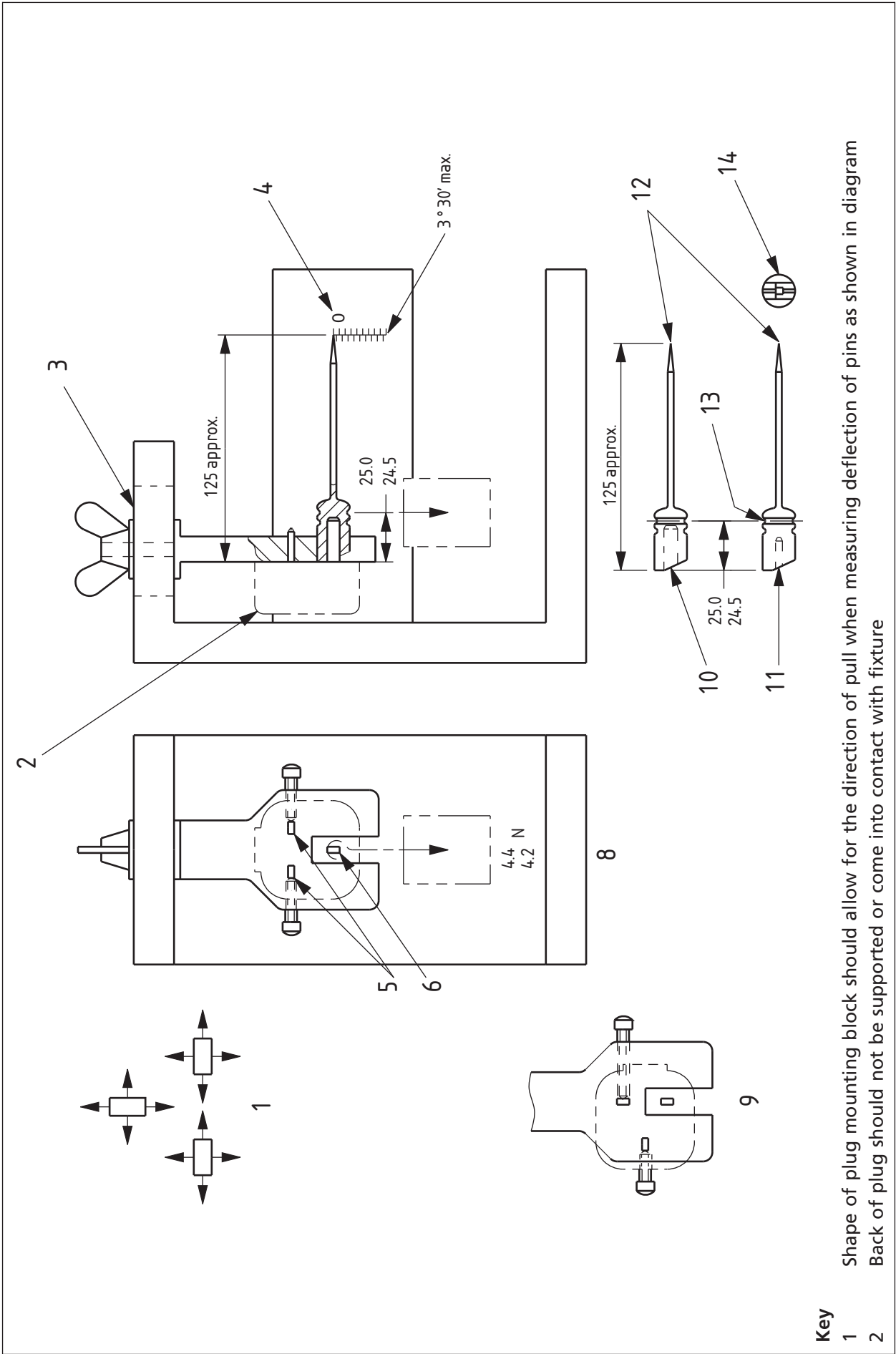


Figure 8 Plug pin deflection test apparatus for resilient plugs (see Clause 12) (2 of 2)

- 3 Mounting block clamped in slot which gives adjustment to allow for various plugs
- 4 Zero on scale = horizontal axis of pin under test
- 5 Clamped pins
- 6 Pin under test for deflection measurement
- 8 Elevation of fixture shows disposition of plug pins for deflection test on earth pin
- 9 Diagrams show disposition of plug pins in typical mounting block for deflection test on current-carrying pins
- 10 Spring fit on to earth pin or ISOD
- 11 Spring fit on current-carrying pin
- 12 Indicating point
- 13 Groove for weight
- 14 Slot to ensure spring fit

NOTE 1 Dimensions are in millimetres.

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

NOTE 3 Indicators manufactured from material of negligible weight, such as aluminium.

Figure 9 Apparatus for abrasion test on insulating sleeves of plug pins (see Clause 12)

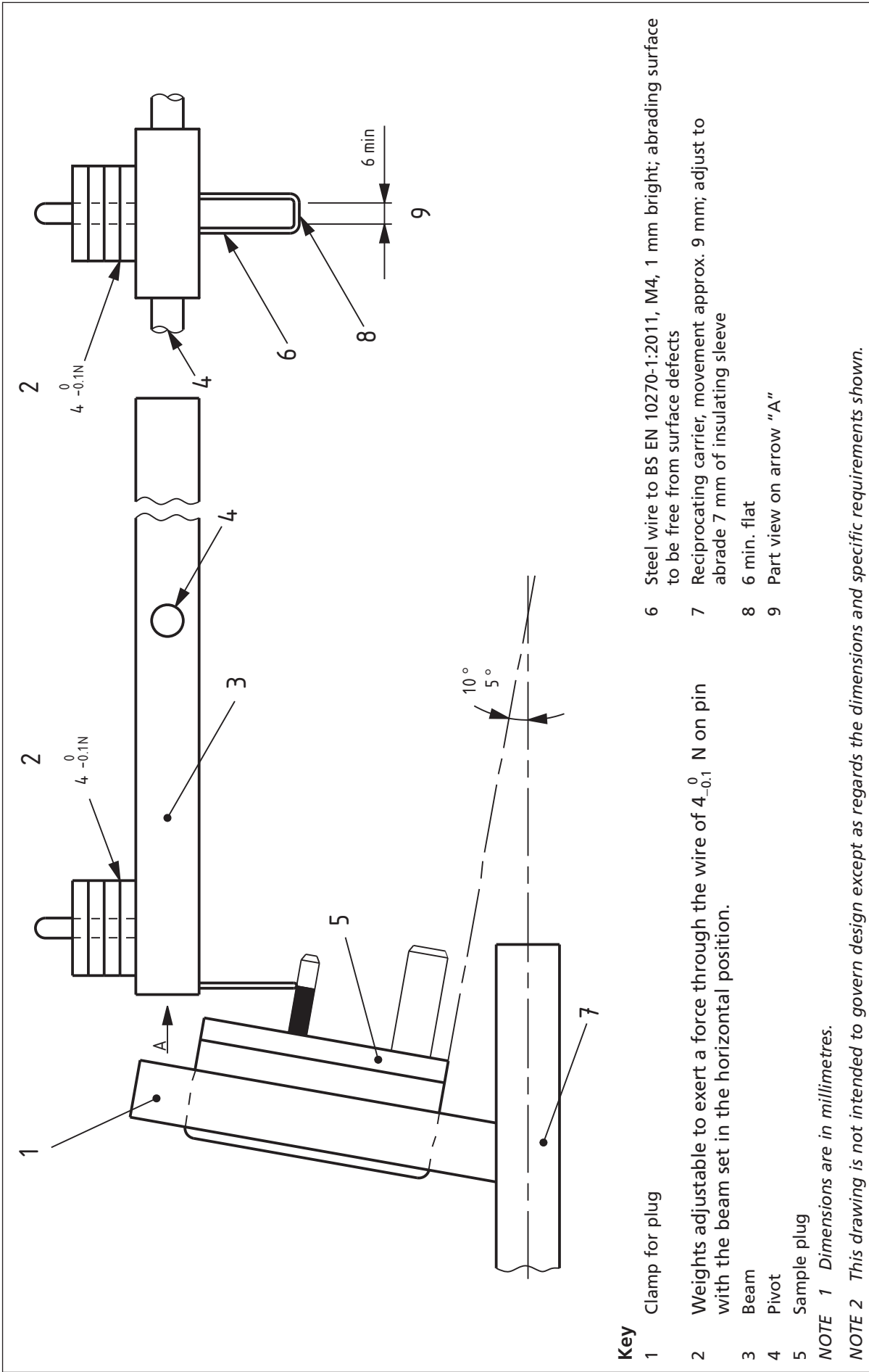


Figure 10 Apparatus for pressure test at high temperature (see Clause 12)

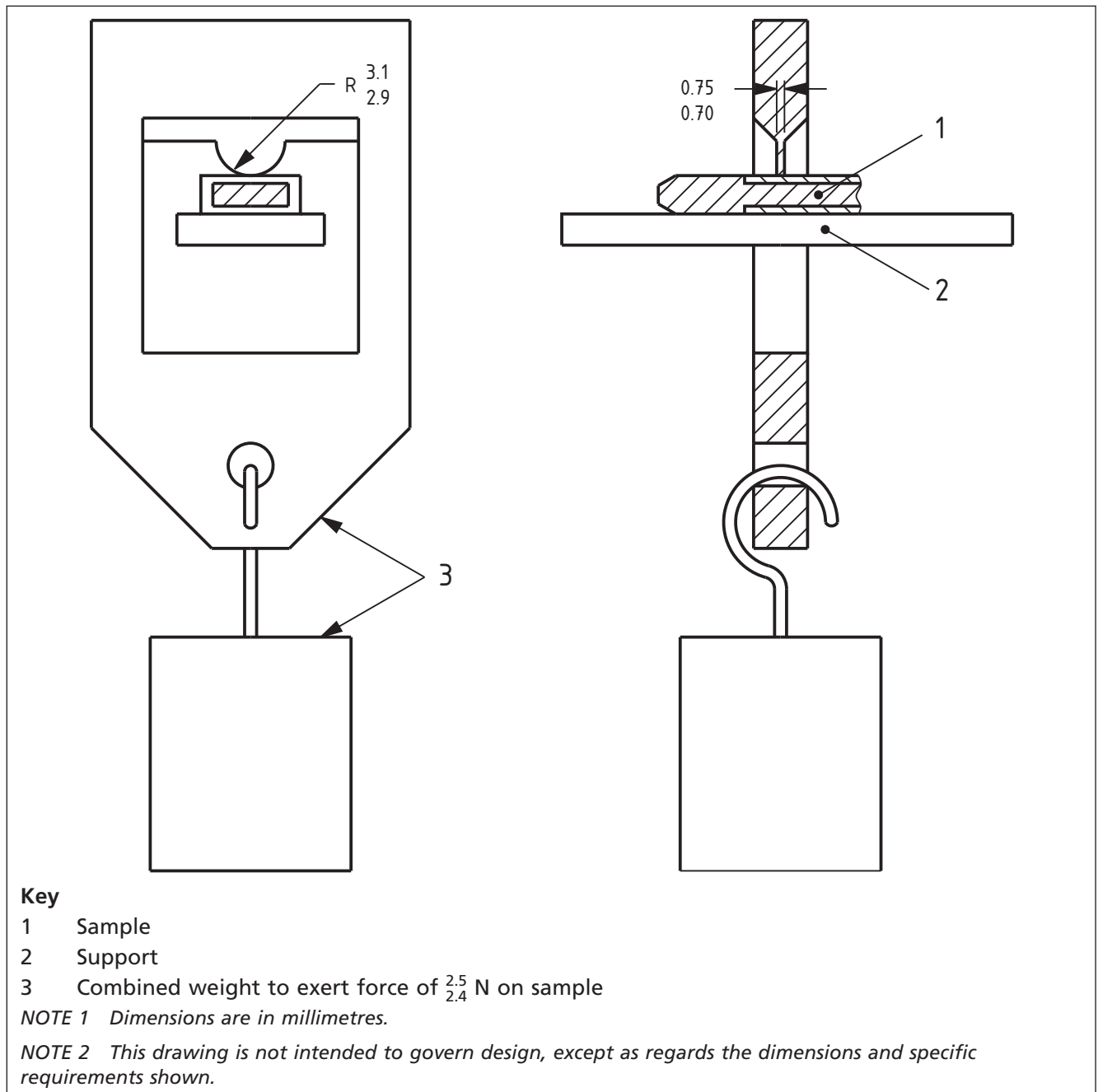


Figure 11 GO gauge for socket-outlet (see Clause 13)

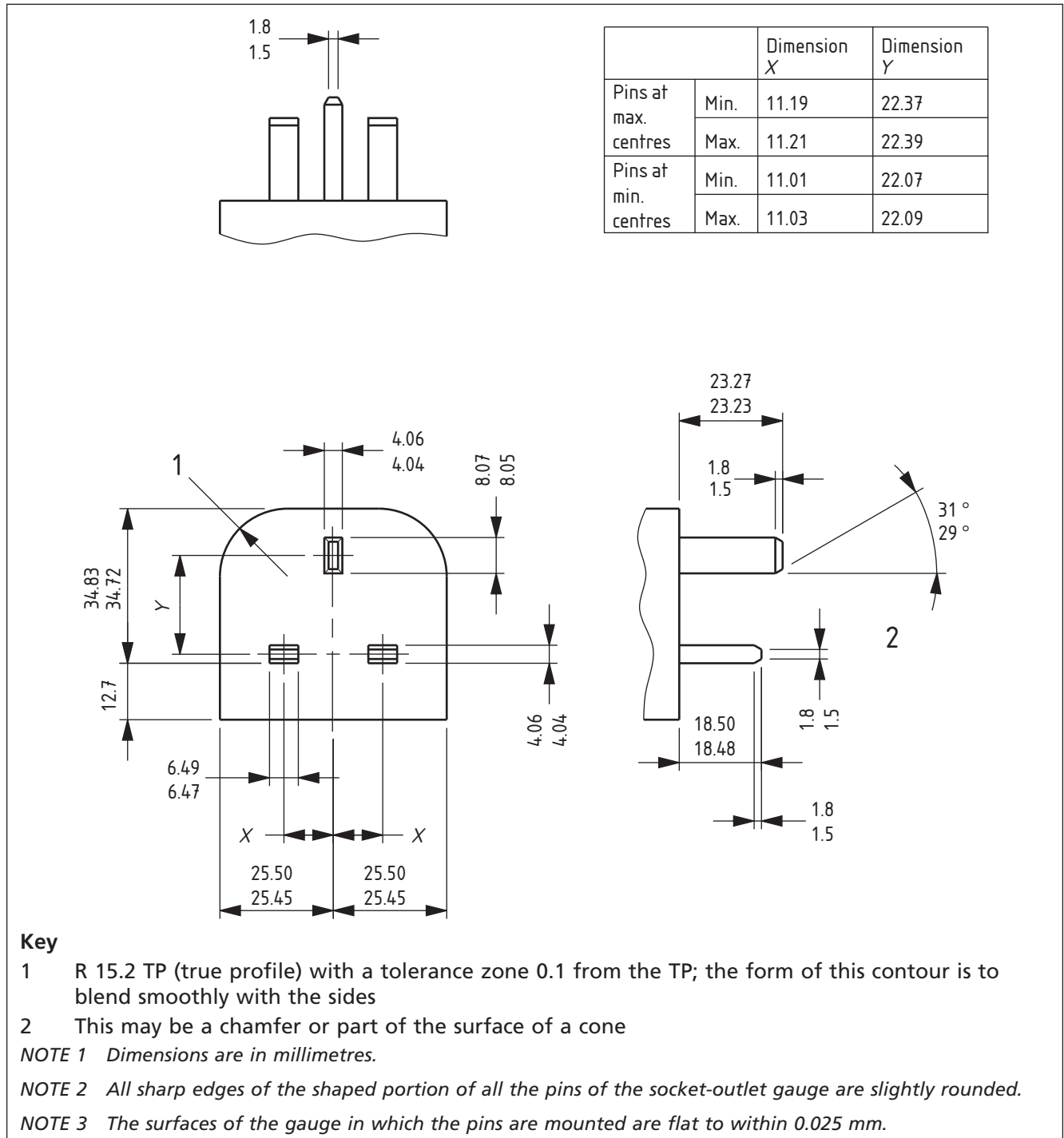
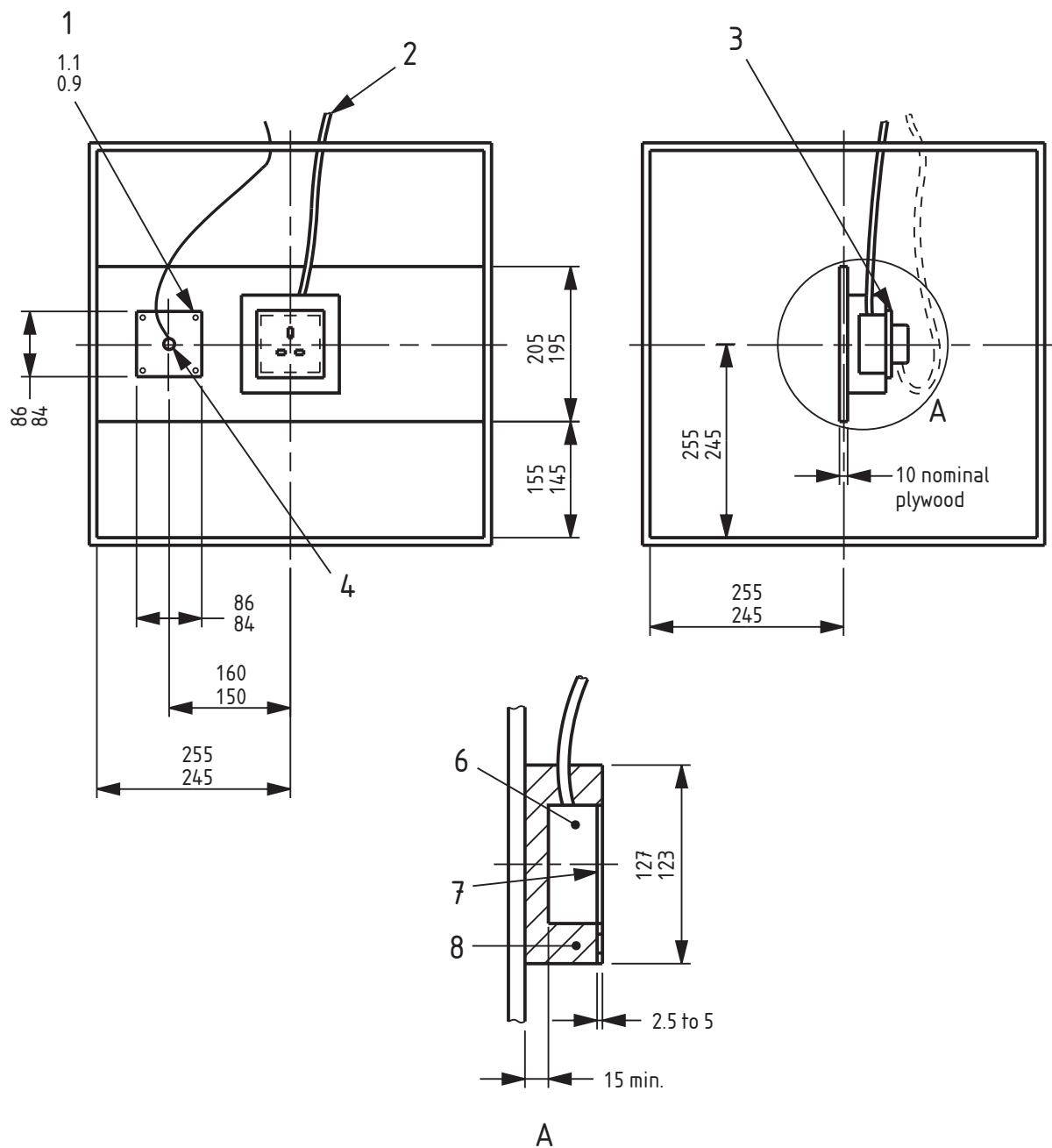


Figure 17a Test apparatus for temperature rise test (see Clause 16)



Test cabinet

Material: 10 mm nominal plywood.

Finish: Internal. Two coats of matt paint. BS 4800:2011, colour no. 08 C 35.

Dimensions: Internal. (500 × 500 × 500) mm with a tolerance of ±10 mm for each dimension. One wall to be removable to provide access.

Location: Minimum clearance from adjacent surfaces, measured horizontally 150 mm on all sides, measured vertically 300 mm above, 500 mm below.

Key

- | | | | |
|---|--|---|---|
| 1 | Brass plate $\frac{1.1}{0.9}$ mm thick screwed to plywood board | 2 | Cable and thermocouple wire outlet to be sealed |
| 3 | Plate as Figure 17b) | 4 | Thermocouple for reference point temperature |
| 6 | Mounting box to BS 4662:2006+A1:2009, Figure 1, 35 mm deep (nominal) | 7 | Front edge recessed as shown |
| 8 | Wooden mounting block | | |

NOTE Dimensions are in millimetres.

Figure 17b Dummy front plate for temperature rise (see Clause 16) (1 of 2)

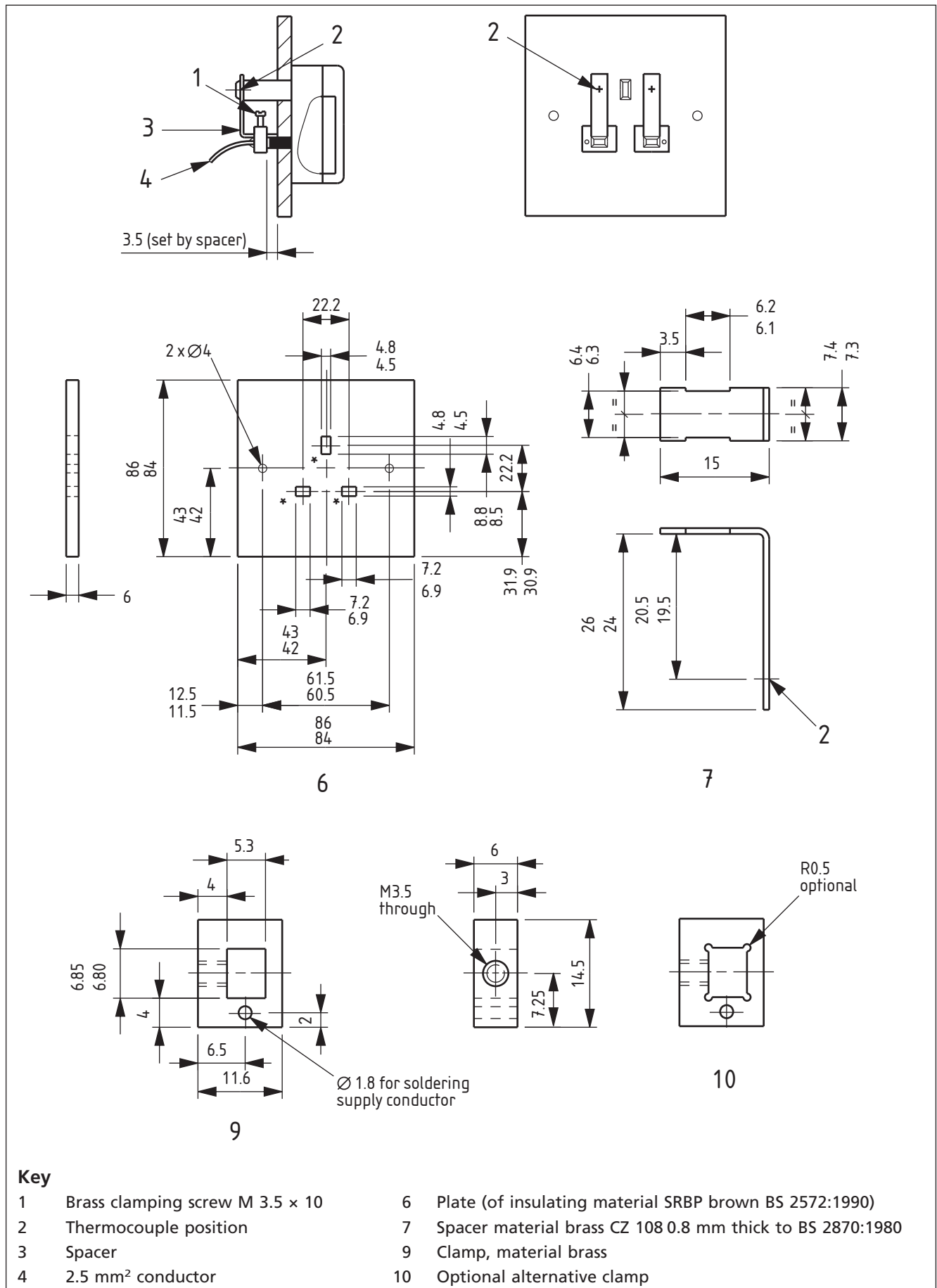


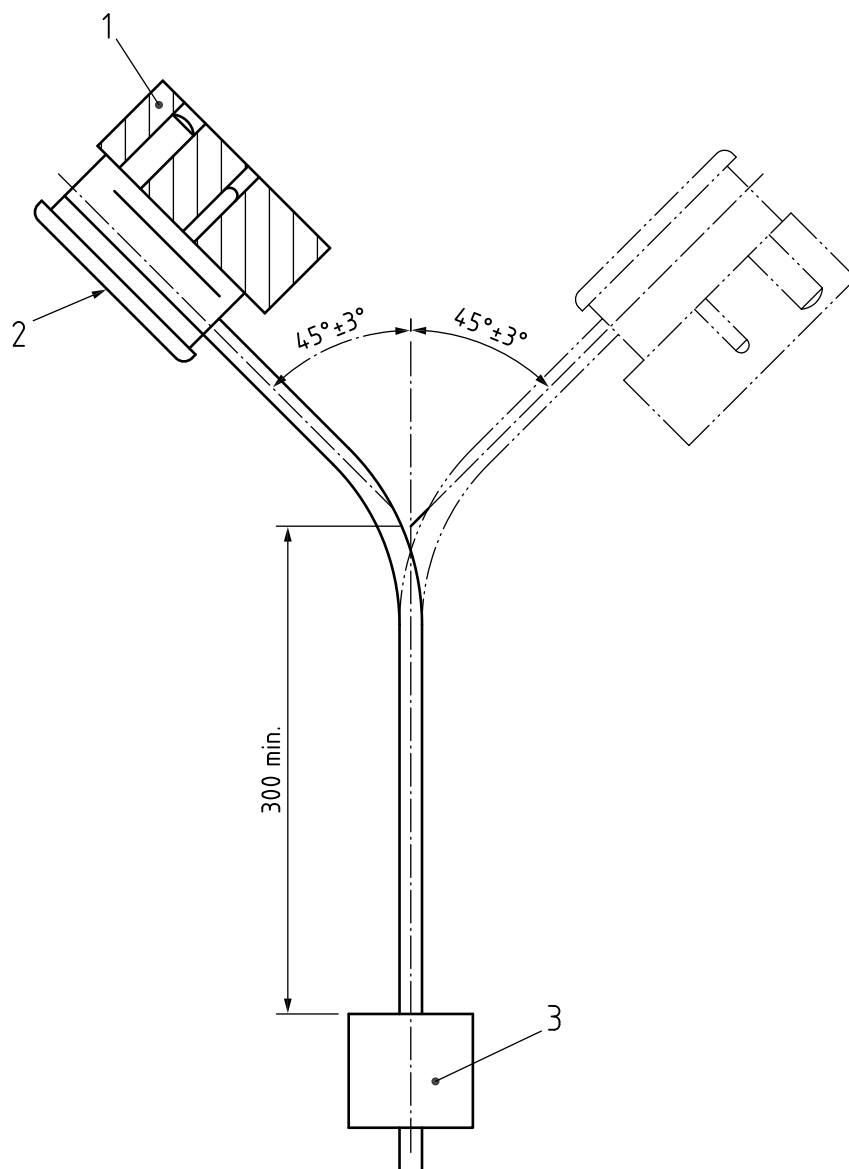
Figure 17b Dummy front plate for temperature rise (see Clause 16) (2 of 2)

NOTE 1 Dimensions are in millimetres.

NOTE 2 Tolerance ± 0.2 mm except where otherwise shown.

* The positional tolerance of the three pin apertures shall be proved by the use of gauges in accordance with Figure 11.

Figure 18 Apparatus for flexing test (see Clause 19)



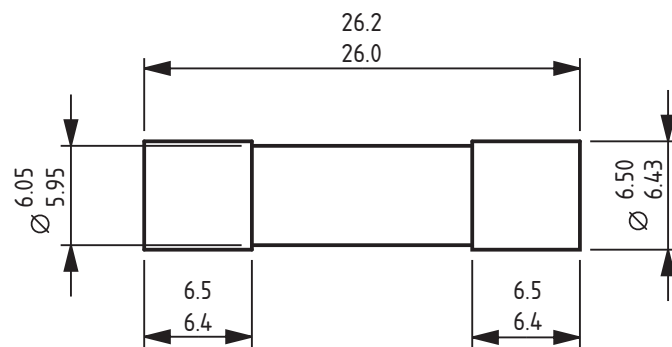
Key

- 1 Device for fixing sample
- 2 Sample
- 3 Mass

NOTE 1 Dimensions are in millimetres.

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

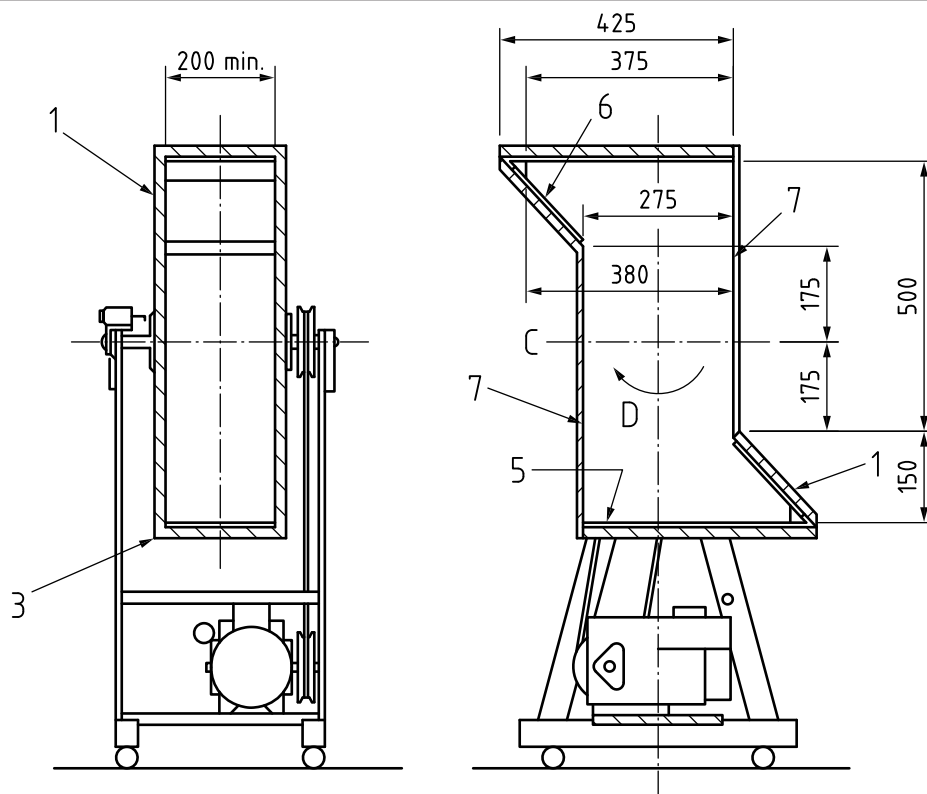
Figure 19 Solid link for test on fuse clips (see Clause 20)



NOTE 1 Dimensions are in millimetres.

NOTE 2 Finish: polished and sharp corners removed.

Figure 20 Tumbling barrel (see Clause 20)



Key

- C Centre of axis
- D Direction of rotation
- 1 19 mm nominal thick blockboard or suitable alternative
- 3 19 mm nominal thick blockboard can be removable for the replacement of the impact plates
- 5 Impact base 9 mm nominal thick plywood to be replaceable (both ends)^{A)}
- 6 Shelf faced with non-grip material
- 7 Transparent sheet for observation purposes; may be removable for loading

NOTE 1 Dimensions are in millimetres.

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

NOTE 3 All dimensions subject to tolerance ± 3.0 except for material thickness

^{A)} 9 mm nominal plywood having an impact face of birch, 1.4 mm nominal thickness and of 5 ply construction.

Figure 23 Apparatus for pressure test (see Clause 22) (1 of 2)

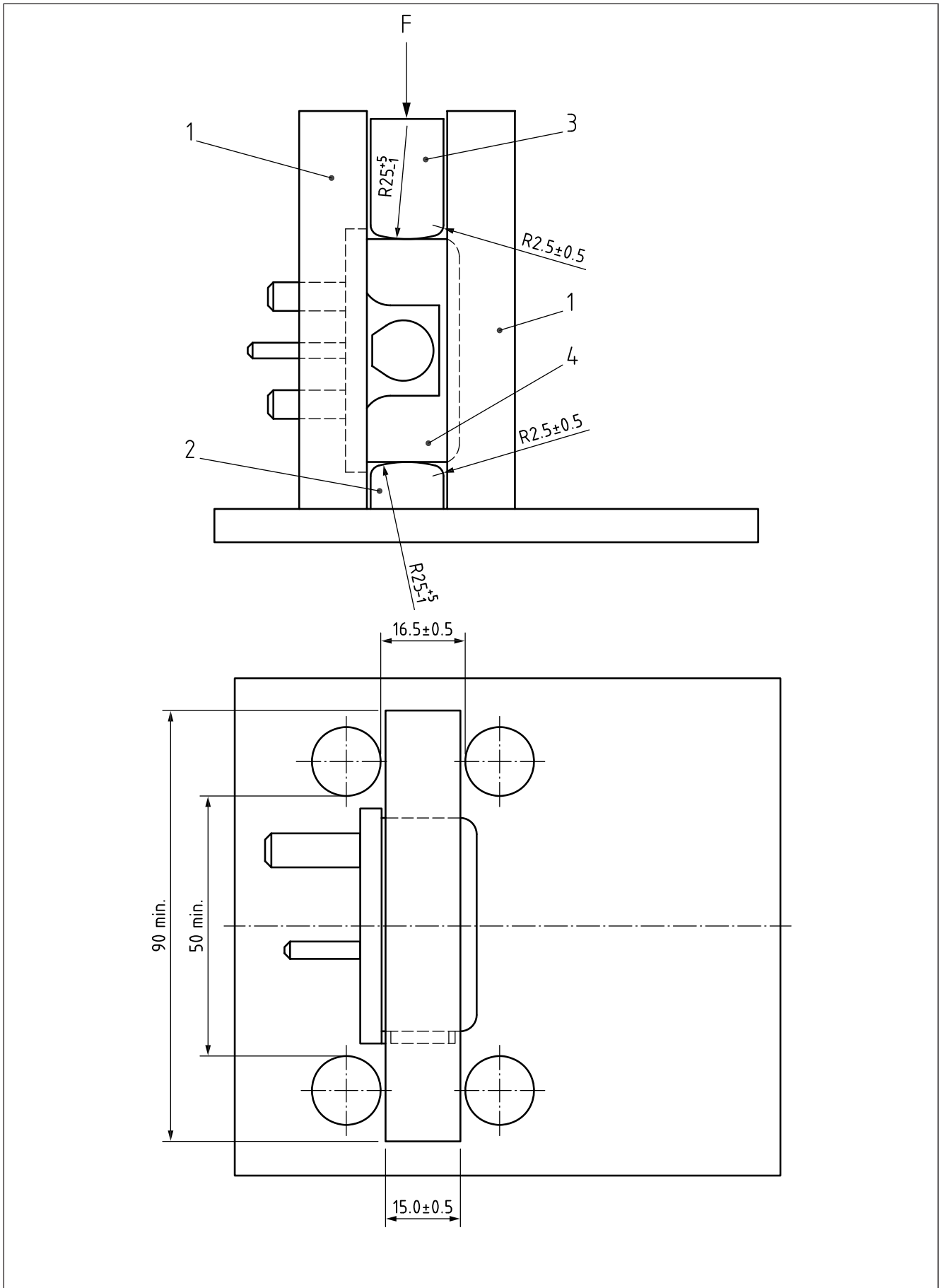


Figure 23 Apparatus for pressure test (see Clause 22) (2 of 2)

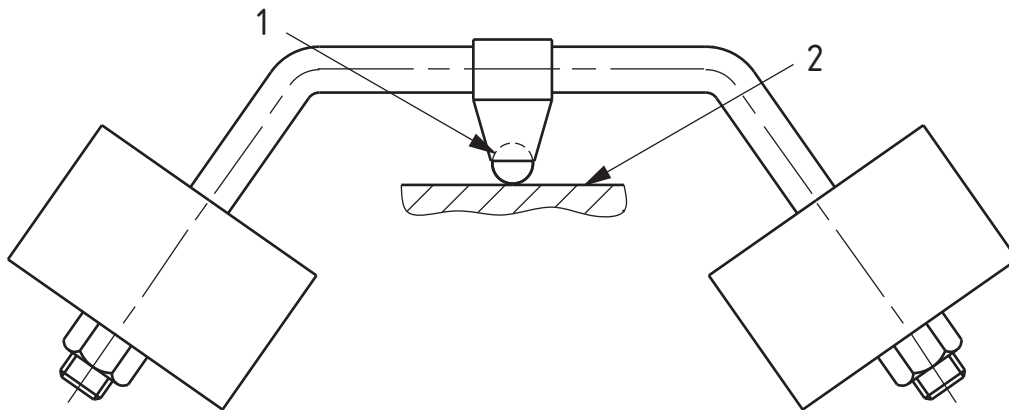
Key

- F Force
 1 Guide
 2 Fixed jaw
 3 Moving jaw
 4 Sample

NOTE 1 Dimensions are in millimetres.

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

Figure 24 Apparatus for ball pressure test (see Clause 22)

**Key**

- 1 Ø 5 ball bearing
 2 Sample

NOTE 1 Dimensions are in millimetres.

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

Figure 28 Calibrated link (see A.1)

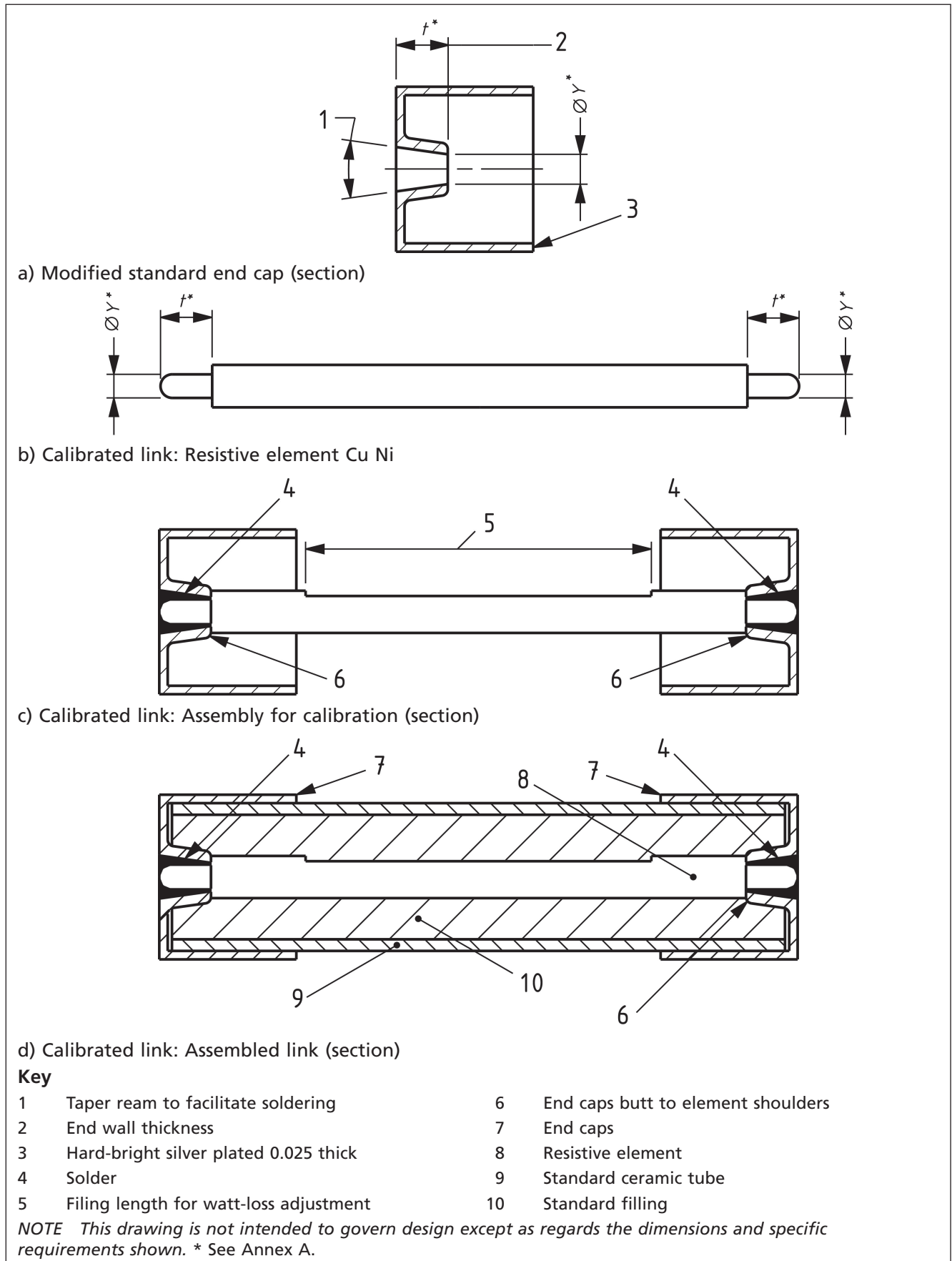


Figure 29 Calibration jig for calibrated link (see A.2) (1 of 2)

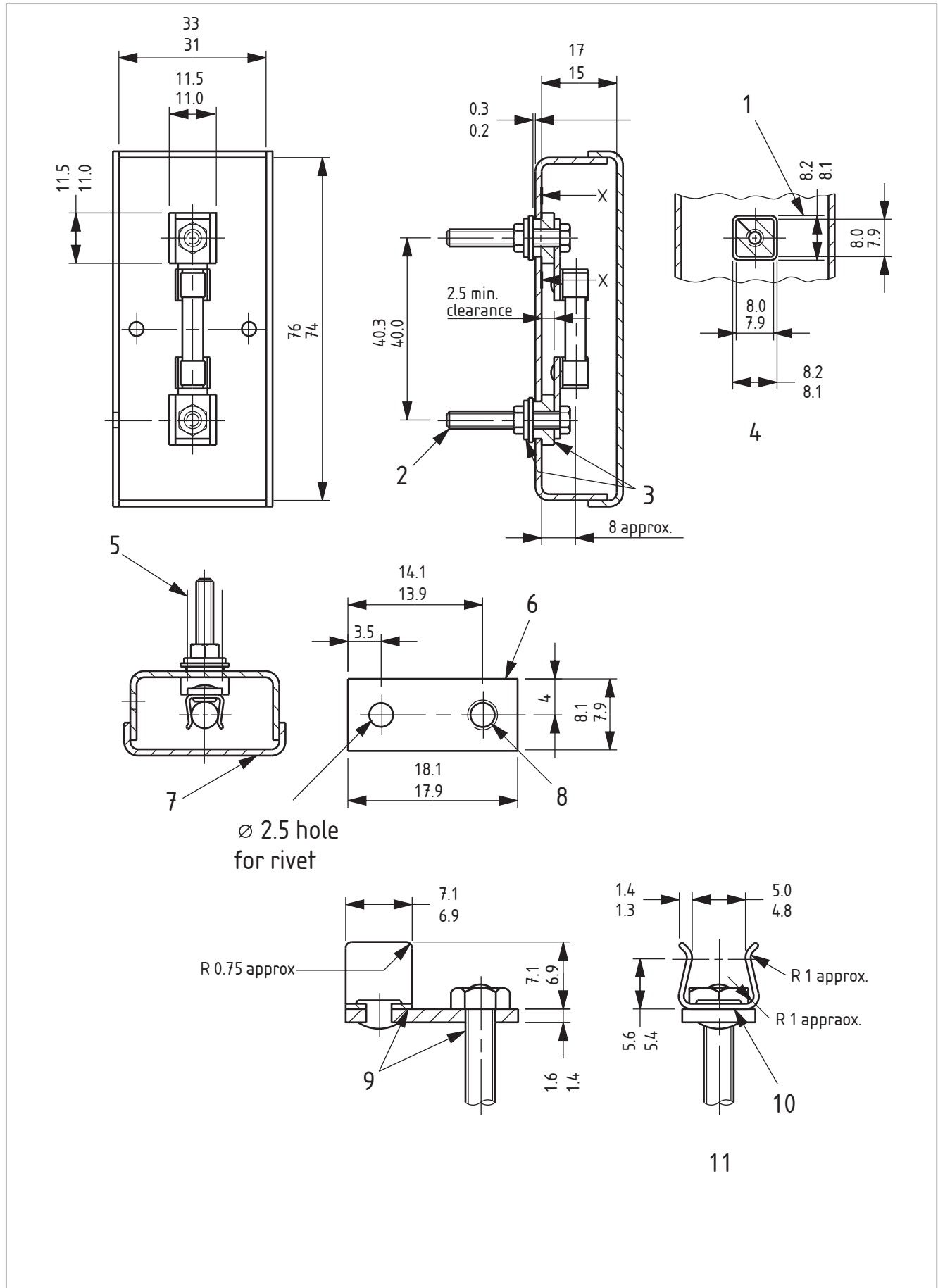


Figure 29 Calibration jig for calibrated link (see A.2) (2 of 2)

Key

- | | | | |
|---|--------------------------------|----|---|
| 1 | Float ^{A)} | 7 | Cover ^{B), C)} |
| 2 | Terminal stem M3 × 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.

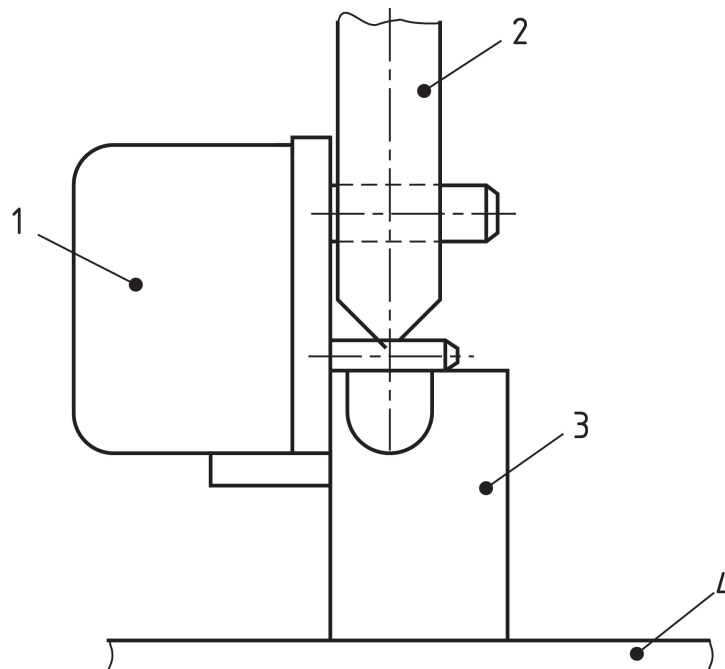
^{B)} Box and cover made from 1.25 mm brass sheet, clean natural finish.

^{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 32a Apparatus for tests on conversion plug pins: A plug pin under test (see Clause 12)

**Key**

- | | |
|---|------------------|
| 1 | Plug body |
| 2 | Moving anvil |
| 3 | Fixed anvil |
| 4 | Rigid base plate |

NOTE 1 The body of the plug should be supported so that the face of the plug is held in contact with the face of the fixed anvil.

NOTE 2 The moving anvil should be aligned in the centre of the gap in the fixed anvil.

Annex A (normative) The construction and calibration of a calibrated link

A.1 Construction

The calibrated link (see Figure 28) shall employ the following components used to produce fuses conforming to BS 1362:1973.

- a) ceramic body (as standard);
- b) filling (as standard);
- c) end caps [modified standard cap as shown in Figure 28a)].

The resistive element shall be of copper nickel wire having a resistivity value between $44 \mu\Omega\cdot\text{cm}$ and $49 \mu\Omega\cdot\text{cm}$. 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 the 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 28b)].

The resistive element shoulders shall be firmly butted to the inside faces of the end caps and soldered using a tin silver solder, grade 96S as specified in BS 219:1977. The assembly thus formed [see Figure 28c)] shall be checked for watts loss in accordance with A.2. Metal shall then be carefully filed from the resistive element over as long 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 face of the end cap; the ceramic body shall not interfere with this condition [see Figure 28d)].

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

The resulting calibrated link shall be marked "NOT A FUSE" on the ceramic body and shall dimensionally be in accordance with BS 1362:1973.

A.2 Calibration

The calibration jig shown in Figure 29 is mounted horizontally approximately 25 mm above a wooden board by means of two ceramic pillars. A fine wire thermocouple is attached to the centre of each fuse contact clip, on the outside of the top edge, in such a way that it does not interfere with the contact area. The thermocouples are taken out of the box in slots cut in one end of the jig base, the width of the slots just being sufficient to accept the diameter of the thermocouples. The connection to the jig base shall be by means of PVC insulated single core copper cables, 0.3 m \pm 0.05 m in length and 2.5 mm² cross-section.

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

Alternating current (a.c.) voltage 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: $1_{-0.05}^{0.00}$ 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 distance 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.

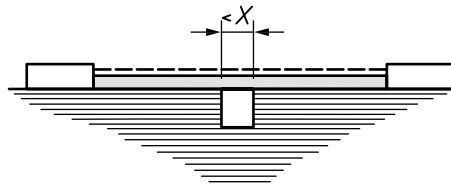
The following assumptions are made:

- any recess is assumed to be bridged with an insulating link having a length equal to the specified width X and being placed in the most unfavourable position (see Example 3);
- where the distance across a groove is equal to or larger than the specified width X , the creepage distance is measured along the contours of the groove (see Example 2);
- creepage distances and clearances measured between parts which can assume different positions in relation to each other, are measured when these parts are in their most unfavourable position.

Explanation for examples 1 to 11

----- clearance
 creepage distance
 All dimensions are in millimetres

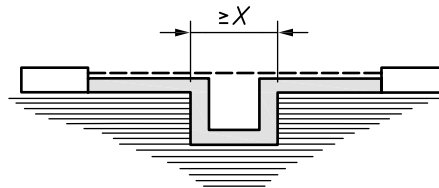
Example 1



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.

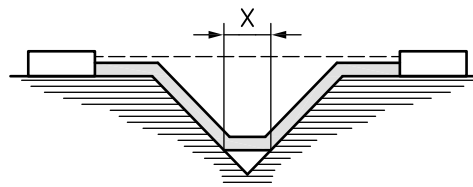
Example 2



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.

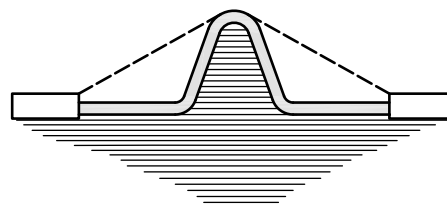
Example 3



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.

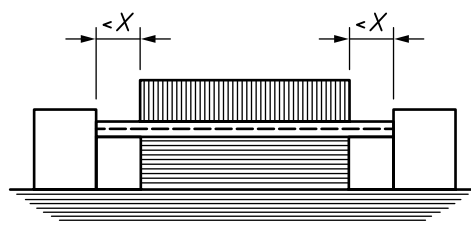
Example 4



Condition: Path under consideration includes a rib.

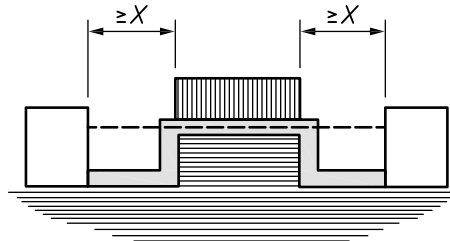
Rule: Clearance is the shortest direct air path over the top of the rib. Creepage path follows the contour of the rib.

Example 5



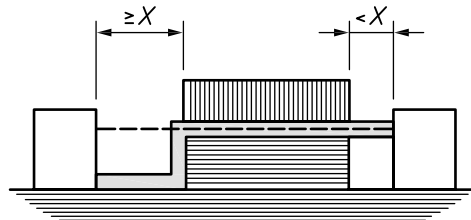
Condition: Path under consideration includes an uncemented joint with grooves less than "X" mm wide on each side.
 Rule: Creepage and clearance path is the "line of sight" distance shown.

Example 6



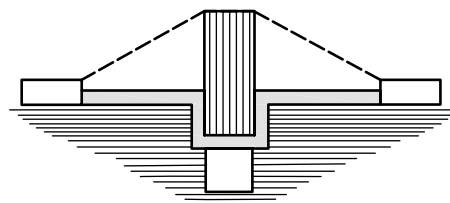
Condition: Path under consideration includes an uncemented joint with grooves equal to or more than "X" mm wide on each side.
 Rule: Clearance path is the "line of sight" distance. Creepage follows the contour of the grooves.

Example 7



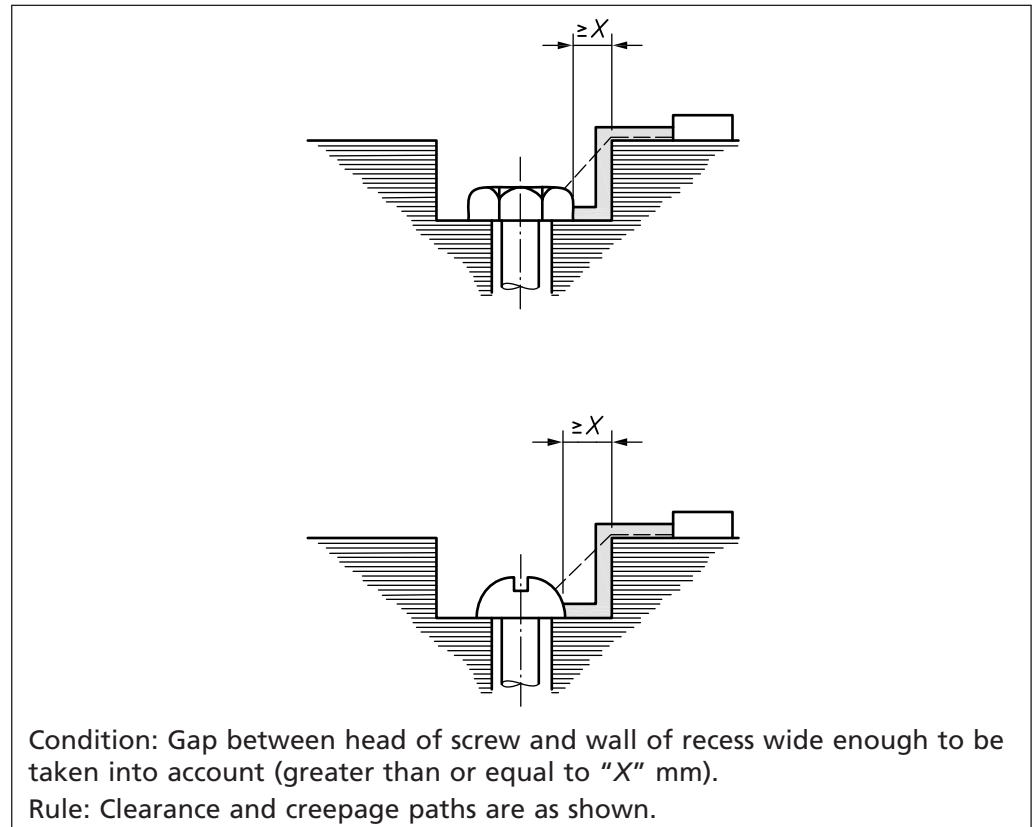
Condition: Path under consideration includes an uncemented joint with groove on one side less than "X" mm wide and the groove on the other side equal to or more than "X" mm wide.
 Rule: Clearance and creepage paths are as shown.

Example 8

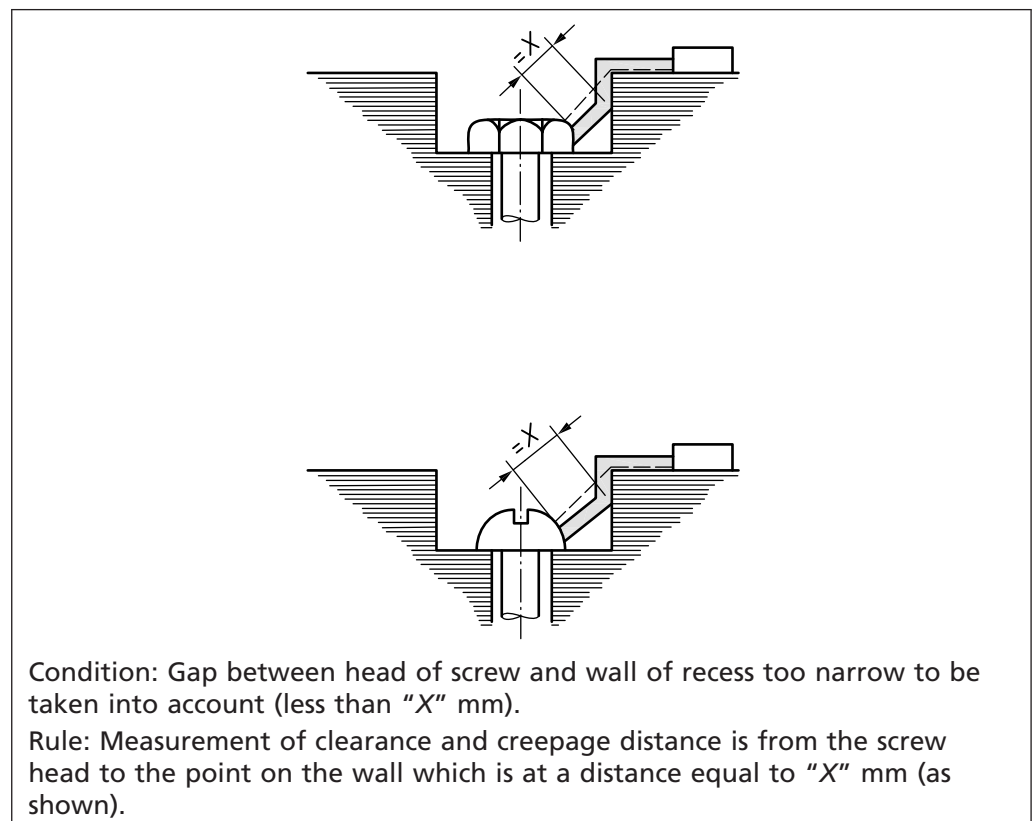


Condition: Path under consideration includes a barrier with an uncemented joint. The creepage distance through the uncemented joint is less than the creepage distance over the barrier.
 Rule: Clearance is the shortest direct air path over the top of the barrier. The creepage path follows the contour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

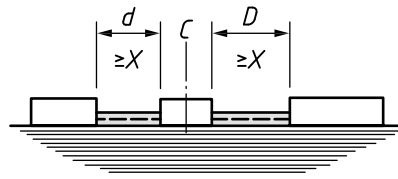
Example 9



Example 10



Example 11



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 BS EN 60112:2003+A1:2009.

For the purpose of this standard the following applies.

- a) In Clause 5 of BS EN 60112:2003+A1:2009, Test sample:
 - 1) Note 3 and the last paragraph also apply to PTI;
 - 2) If the surface 15 mm × 15 mm cannot be obtained because of the small dimensions of the PT system then special samples made with the same manufacturing process may be used.
- b) The test solution "A" described in 7.3 of BS EN 60112:2003+A1:2009 shall be used.
- c) In Clause 8 of BS EN 60112:2003+A1:2009, Procedure, either CTI or PTI is determined.
 - 1) CTI is determined in accordance with Clause 11 of BS EN 60112:2003.
 - 2) The PTI test of Clause 10 of BS EN 60112:2003+A1:2009 is performed on five samples at the voltage referred to in 10.1 of BS EN 60112:2003+A1:2009 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)

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

Table D.1 Rated impulse withstand voltage for conversion plugs energized directly from the low voltage mains (1 of 2)

Nominal voltage of the supply system based on IEC 60038 ^{A)}	Voltage line-to-neutral derived from nominal voltages a.c. or d.c. up to and including	Rated impulse withstand voltage		
		Overvoltage Category		
V	V	I	II	III
230/400	300	1 500	2 500	4 000

NOTE 1 For more information concerning supply systems see BS EN 60664-1:2007.

NOTE 2 For more information concerning Overvoltage Category see BS EN 60664-1:2007.

Table D.1 **Rated impulse withstand voltage for conversion plugs energized directly from the low voltage mains** (2 of 2)

NOTE 3 Conversion plugs fall into Overvoltage Category III. Parts of conversion plugs 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 into account when considering the micro-environment.

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

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

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

Degrees of pollution in the micro-environment

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

Pollution degree 1

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

Pollution degree 2

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

Pollution degree 3

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

**Annex F
(normative)**

Impulse voltage test

The purpose of this test is to verify that clearances will withstand specified transient overvoltage. The impulse withstand voltages test shall be carried out with a voltage having a 1.2/50 μ S waveform as specified in BS EN 61180-1:1995, Section 6 and is intended to simulate overvoltage of atmospheric origin. It also covers overvoltages due to switching of low voltage equipment.

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

- a) line and neutral terminals/terminations;
- b) line and neutral terminals/terminations connected together and:

- 1) sheet of metal foil in contact with the entire accessible external surface;
- 2) the earthing terminal/termination;
- 3) any metal part of a cable anchorage.

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

NOTE 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 1.2/50 μ S for the no-load voltage with amplitudes equal to the values given in Table F.1.

NOTE 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 waveform will not be noticeably distorted.

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

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

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

NOTE 2 The test 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.

NOTE 3 Explanations concerning the influencing factors (air pressure, altitude, temperature humidity) with respect to electric strength of clearances are given in BS EN 60664-1:2007.

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