

BS 8546:2016



BSI Standards Publication

# Travel adaptors compatible with UK plug and socket system – Specification

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## Foreword

### Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 April 2016. It was prepared by Panel PEL/23/-/13, *Travel adaptors*, under the authority of Technical Committee PEL/23, *Electrical accessories*. A list of organizations represented on this committee can be obtained on request to its secretary.

### 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.*

### 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.

**Compliance with a British Standard cannot confer immunity from legal obligations.**



## 1 Scope

This British Standard specifies requirements for the construction, rating, marking, dimensions and testing of travel adaptors intended for the temporary connection of electrical equipment. It applies to travel adaptors having at least one plug or socket-outlet portion compatible with BS 1363 plugs and socket-outlets, which are suitable for the connection of a non-BS 1363 plug, or to a non-BS 1363 socket-outlet.

Travel adaptors incorporating USB circuits for charging devices are also covered by this standard.

This British Standard applies to travel adaptors intended for use in household, commercial and light industrial premises where:

- the nominal supply voltage does not exceed 250 V a.c. single-phase, 50 Hz to 60 Hz; or
- the rated current of the travel adaptor does not exceed 13 A and is not less than 5 A.

Travel adaptors within the scope of this British Standard do not convert voltage.

This British Standard excludes adaptors conforming to BS 1363-3 and conversion plugs conforming to BS 1363-5.

## 2 Normative references

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

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

BS 1363-1:1995+A4:2012<sup>1)</sup>, *13 A plugs, socket-outlets, adaptors and connection units – Part 1: Specification for rewirable and non-rewirable 13 A fused plugs*

BS 1363-2:1995+A4:2012<sup>1)</sup>, *13 A plugs, socket-outlets, adaptors and connection units – Part 2: Specification for 13 A switched and unswitched socket-outlets*

BS 1363-3, *13 A plugs, socket-outlets, adaptors and connection units – Part 3: Specification for adaptors*

BS 1363-4, *13 A plugs, socket-outlets, adaptors and connection units – Part 4: Specification for 13 A fused connection units switched and unswitched*

BS 1363-5, *13 A plugs, socket-outlets, adaptors and connection units – Part 5: Specification for fused conversion plugs*

BS 1858, *Electric cables – Accessories – Bitumen-based filling compounds*

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

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

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

BS 5733, *General requirements for electrical accessories – Specification*<sup>2)</sup>

<sup>1)</sup> A new edition of BS 1363 (all parts) is due to be published in 2016.

<sup>2)</sup> Informative reference is made to BS 5733:2010+A1:2014.

- BS 6004:2012, *Electric cables – PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting*
- BS EN 1652, *Copper and copper alloys – Plate, sheet, strip and circles for general purposes*
- BS EN 10270-1:2001, *Steel wire for mechanical springs – Part 1: Patented cold drawn unalloyed spring steel wire*
- BS EN 50525-1, *Electric cables – Low voltage energy cables of rated voltages up to and including 450/750 V (U<sub>0</sub>/U) – Part 1: General requirements*
- BS EN 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*
- BS EN 60112:2003+A1:2009, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*
- BS EN 60127 (all parts), *Miniature fuses*
- BS EN 60269 (all parts), *Low voltage fuses*
- BS EN 60664-3, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*
- BS EN 60664-5, *Insulation coordination for equipment within low-voltage systems – Part 5: Comprehensive method for determining clearances and creepage distances equal to or less than 2 mm*
- BS EN 60695-2-11:2014, *Fire hazard testing – Part 2-11: 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 10-2: Abnormal heat – Ball pressure test method*
- BS EN 60950-1, *Information technology equipment – Safety – Part 1: General requirements*
- BS EN 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*
- BS EN 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*
- BS EN 61032:1998, *Protection of persons and equipment by enclosures – Probes for verification*
- BS EN 61558-2-6, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers*
- BS EN 61558-2-16, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units*
- BS EN 62368-1, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*
- BS EN 62680-1-1, *Universal serial bus interfaces for data and power – Part 1.1: Universal serial bus interfaces – Common components – USB battery charging specification, Revision 1.2 (TA 14)*



### 3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

- 3.1 configurable travel adaptor**  
travel adaptor having user configurable plug and/or socket portions
- 3.2 flat plug pin**  
plug pin having a ratio of thickness to width less than that of a BS 1363 type plug pin
- 3.3 fused travel adaptor**  
travel adaptor having a replaceable fuse link
- 3.4 insulated shutter opening device (ISOD)**  
protrusion from the engagement surface of a travel adaptor in place of a BS 1363 type brass earth pin, made of insulating material having dimensions similar to those of an earth pin
- 3.5 multiway travel adaptor**  
travel adaptor which allows the connection simultaneously of more than one plug to all socket-outlet portions of the travel adaptor
- 3.6 normal use**  
use of an accessory for the purpose for which it was made, and in the manner intended by the manufacturer  
[SOURCE: BS 5733:2010+A1:2014, 3.5]
- 3.7 rated current**  
current assigned to the travel adaptor by the manufacturer
- 3.8 rated voltage**  
voltage assigned to the travel adaptor by the manufacturer
- 3.9 standard sheet**  
dimensional requirements for plugs and socket-outlets defined in national and international standards  
*NOTE For further information regarding the standards refer to IEC/TR 60083.*
- 3.10 travel adaptor**  
portable accessory intended for temporary and occasional use, having plug portions intended to engage with the contacts of a corresponding socket-outlet and having socket-outlet portions to accommodate one or more plugs  
*NOTE Travel adaptors are not intended to convert voltage.*

## 4 Classification

Travel adaptors shall be classified as follows, as appropriate:

- a) single or multiway;
- b) fused or unfused;
- c) configurable or non-configurable;
- d) with or without provision for earthing;
- e) for use within the UK (i.e. with BS 1363 type plug pin portion);
- f) for use outside the UK (i.e. with BS 1363 type socket portion).

## 5 General requirements

**5.1** Travel adaptors shall be so designed and constructed that, in normal use, their performance is reliable and minimizes risk of danger to the user or surroundings.

**5.2** Travel adaptors incorporating plug pins and/or socket-outlets for use with a country's specific standard sheets shall conform to the dimensional requirements of those relevant standards sheets. Travel adaptors incorporating plug pins and/or socket-outlets for use with more than one country's standard sheets shall conform to those standard sheets as far as they reasonably apply.

## 6 Type testing

**6.1** Unless otherwise specified, travel adaptors shall be tested as delivered in accordance with normal use at an ambient temperature of  $(20 \pm 5)$  °C, after being conditioned at normal laboratory temperature and humidity levels for at least four days.

**6.2** Travel adaptors used for the tests shall be representative of production items in respect of all details which might affect the test results.

**6.3** Travel adaptors shall be submitted to inspection and tests in accordance with Table 1.

**6.4** Travel adaptors shall be deemed to conform if no travel adaptor fails in the complete series of tests given in Table 1. If one travel adaptor fails in any group in the complete series of tests specified in Table 1, then travel adaptors of that type shall be deemed to have failed to conform to this British Standard, unless that travel adaptor is shown to be not representative of normal production or design, in which case a further set of travel adaptors shall be submitted to the test or tests in that group. If there is no failure in this retest then travel adaptors of that type shall be deemed to conform to this British Standard.

**6.5** If more than one travel adaptor fails in the complete series of tests given in Table 1 then travel adaptors of that type shall be deemed to have failed to conform to this British Standard.

Table 1 Schedule of tests

| Sequence | Samples | Requirements and tests   | Clause number  |
|----------|---------|--|--|
| 1        | 3       | Inspection, measurement, gauging and manipulation  | 5, 6, 7, 8, 9, 11.1 to 11.9, 12, 13.1 (inspection only), 13.3, 13.4, 13.7, 13.8, 14.3, 13.9, 13.10, 13.11, 13.14, 13.18, 13.19, 14.1, 14.2, 10 |
| 2        | 3       | General (resilient covers and pin sleeves)   | 5, 6, 11.10, 13.12   |
| 3        | 3       | General [ageing, humidity, normal operation, insulation resistance (IR), electric strength (ES), temperature rise] | 5, 6, 15, 16, 17, 13.6, 11.4, 18   |
| 4        | 3       | Mechanical strength  | 5, 6, 15, 13.5, 15, 19, 17, 18   |
| 5        | 3       | Pin strength   | 5, 6, 13.15, 13.16   |
| 6        | 3       | Effect of pins on socket contacts (plated pins and ISODs only)   | 5, 6, 13.17  |
| 7        | 3       | Pin sleeves (if fitted)  | 5, 6, 15, 16, 17, 13.13  |
| 8        | 3       | Materials (glow wire)  | 5, 6, 21   |
| 9        | 3       | Materials (metals)   | 5, 6, 22   |

## 7 Rating

Travel adaptors shall have a rated voltage not exceeding 250 V a.c. and a rated current not lower than 5 A and not exceeding 13 A.

The rated voltage shall not be lower than that of the socket-outlet which can accept the adaptor.

The rated current of a travel adaptor shall be the lowest of the following:

- a) equal to the sum of the rated currents of the socket-outlet portions if this is lower than 13 A;
- b) the rated current of the lowest plug portion but not exceeding 13 A;
- c) the rating of the fuse-link fitted but not exceeding 13 A.

Conformity shall be checked by inspection of the marking (see Clause 8) and by the tests given in Table 1.

## 8 Marking

### 8.1 Requirements for marking

#### 8.1.1 Information to be marked on travel adaptors

Travel adaptors shall be marked with the information given in items a) to e) and if relevant, the information listed in f) to i):

- a) the name or trade mark of the manufacturer or responsible vendor;
- b) the number of this British Standard, i.e. BS 8546:2016<sup>3)</sup>;
- c) the rated current;
- d) the rated voltage;
- e) the nature of supply;
- f) for fused travel adaptors, the word "FUSE" or "FUSED", or the appropriate symbol specified in 8.1.4 marked on the external accessible surface of the travel adaptor;
- g) for travel adaptors which are intended for use with unearthed supply systems marked, "Caution: For use with unearthed appliances only";
- h) "This adaptor does not convert voltage"; and
- i) symbol for USB outlet.

#### 8.1.2 Safety information

Where it is necessary for safe operation that the user is aware of any particular characteristics of the travel adaptor, the necessary information shall be given by markings on the travel adaptor itself or, where this is not practicable, on the packaging and/or in instructions which accompany it.

Safety information shall include the manufacturer's declared compatible plug and socket systems.

#### 8.1.3 Visibility of marking

The marking specified in 8.1.1 c), d), g) and h) shall be visible when the travel adaptor is engaged in a socket-outlet.


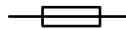

#### 8.1.4 Symbols for marking travel adaptors

If symbols are used they shall be as follows:

|                      |         |
|----------------------|---------|
| Amperes              | A       |
| Volts                | V       |
| Power                | W (max) |
| Alternating current* | ~       |
| Line                 | L       |

<sup>3)</sup> Marking BS 8546:2016 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.

|            |  |
|------------|--|
| Neutral    | N  |
| Earth*     |   |
| Fuse*      |  |
| USB outlet |   |

*NOTE* BS EN 60417 gives guidance on symbols marked \*. However, strictly proportional reductions might not be practical in certain media. Interpretative licence is permissible provided that a clear graphical representation of the symbol is produced which communicates the intention.

### 8.1.5 Marking of rated current and/or power and voltage

If a symbol for nature of supply is used, it shall be placed next to the marking for rated current and rated voltage.

#### EXAMPLE

13 A 250 V ~

13/250 ~

or

$$\frac{13\sim}{250}$$

or

13 A 250 V a.c.

13/250 a.c.

or

$$\frac{13\sim}{250}\text{a.c.}$$

Rated power shall be completed by the word MAX, e.g.

1200 W MAX

### 8.1.6 Legibility and durability

Marking on the travel adaptor shall be legible and durable, as determined in accordance with 8.2.2 and 8.2.3, and shall not be placed on screws, washers or other easily removable parts.

## 8.2 Test methods

### 8.2.1 Visual inspection

Conformity to the requirements of 8.1.1 to 8.1.6 shall be checked by visual inspection.

### 8.2.2 Test for legibility

Conformity shall be checked by inspection, using normal or corrected vision without additional magnification.

### 8.2.3 Test for durability

Marking made by engraving, moulding or a similar permanent process shall meet the requirement for durability, without the need for testing.

Unless the marking is made by engraving, moulding or a similar permanent process, the marking shall be rubbed by hand for approximately 15 s using a cloth soaked in water and again for approximately 15 s with a cloth soaked in 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 65 °C, a dry point of approximately 69 °C, and a relative density of approximately 0.68.

When tested by this method, the marking shall remain legible.

## 9 Dimensions and dispositions

Dimensional requirements, which are important for safety and interchangeability with plugs and socket-outlets conforming to other standards, shall be in accordance with the tolerances specified in the relevant standards sheets except as permitted below.

It shall not be possible, within the declared compatible plug and socket systems, to engage:

- a) the plug portion of a travel adaptor with a socket-outlet having a higher voltage rating;
- b) a live pin of a plug with an earthing contact of the socket-outlet portion of the travel adaptor;
- c) an earthing pin of a plug with a current-carrying contact of the socket-outlet portion of the travel adaptor;
- d) a plug with the socket-outlet portion of the travel adaptor in such a way that the earthing circuit is interrupted.

Travel adaptors shall conform to the dimensions and dispositions specified in the relevant standard sheets except for deviations which permit compatibility with multiple plug and socket systems and do not affect the safety of travel adaptors.

Travel adaptors with such deviations shall conform to all other requirements of this British Standard.

Conformity shall be checked by inspection, measurement or gauges as specified in the relevant standard sheets.

## 10 Clearances, creepage distances and solid insulation

### 10.1 General

Travel adaptors energized directly from the low-voltage supply shall be classified as Overvoltage Category III in accordance with Annex A.

Travel adaptors shall be constructed so that the clearances, creepage distances and solid insulation are adequate to withstand the electrical stresses taking into account the environmental influences that might occur (see Annex B).

Clearances, creepage distances and solid insulation shall conform to the relevant requirements of **10.2**, **10.3** and **10.4**.

The distance between lead wires in the pinch of a neon lamp with external resistor shall be a minimum of 1 mm.

Travel adaptors shall conform to the requirements for basic insulation in **10.2.3** and **10.3.3** and for functional insulation in **10.2.4** and **10.3.4**. If the manufacturer declares an insulation level exceeding basic insulation then the accessory shall be tested accordingly.

## **10.2 Clearances**

### **10.2.1 Requirements**

When tested in accordance with **10.2.2**, clearances shall be dimensioned to withstand the rated impulse voltage declared by the manufacturer, taking into account the rated voltage and the overvoltage category in accordance with Annex A and the pollution degree declared by the manufacturer in accordance with Annex B.

### **10.2.2 Test method**

All parts that can be removed without the use of a tool shall be removed.

All moveable parts that can be assembled in different orientations shall be placed in the most unfavourable position.

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

### **10.2.3 Clearances for basic insulation**

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

Smaller unspecified clearances shall only be used (except those values marked in Table 2 with a reference to Footnote B) if the accessory passes the impulse withstand voltage test of Annex C at the impulse voltage specified in Annex A, but only if the parts are rigid or located by mouldings or if the construction is such that it is unlikely that distances can be reduced by distortion or by movement of the parts during mounting, connection and normal use.

Conformity shall be checked by inspection, and if necessary by measurement, or by the test in Annex C.

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

### **10.2.4 Clearances for functional insulation**

The clearances for functional insulation shall be not less than the values specified for basic insulation in **10.2.3**.

Conformity shall be checked by inspection, and if necessary by measurement, or by the test in Annex C.

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

### **10.2.5 Clearances for supplementary insulation**

The clearances for supplementary insulation shall be not less than the values specified for basic insulation in **10.2.3**.

Conformity shall be checked by inspection, and if necessary by measurement, or by the test in Annex C.

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

Table 2 Minimum clearances for basic insulation

| Rated impulse withstand voltage<br>kV <sup>A)</sup> | Minimum clearances in air up<br>to 2 000 m above sea level<br>mm |
|---|--|
| 0.33  | 0.2 <sup>B)</sup>  |
| 0.50  | 0.2 <sup>B)</sup>  |
| 0.80  | 0.2 <sup>B)</sup>  |
| 1.5   | 0.5  |
| 2.5   | 1.5  |
| 4.0   | 3.0  |
| 6.0   | 5.5  |

<sup>A)</sup> See Annex A. This voltage is:

- 1) for functional insulation: the maximum impulse voltage expected to occur across the clearance;
- 2) for basic insulation directly exposed to or significantly influenced by transient overvoltage from the low voltage mains: the rated impulse withstand voltage of the accessory;
- 3) for other basic insulation: the highest impulse voltage that can occur in the circuit.

<sup>B)</sup> Minimum clearance values are based on BS EN 60664-1.

### 10.2.6 Clearances for reinforced insulation

The clearances for reinforced insulation shall be not less than the values specified for basic insulation in **10.2.3**, but using the next higher step for rated impulse withstand voltage given in Table 2.

Conformity shall be checked by inspection and by measurement, or by the test in Annex C.

## 10.3 Creepage distances

### 10.3.1 Requirements

The creepage distances shall be dimensioned for the voltage which is expected to occur in normal use, and shall be in accordance with the pollution degrees in Annex B and the material group, as declared by the manufacturer.

### 10.3.2 Test method

For the measurements, all parts which can be removed without the use of a tool shall be removed and moveable parts which can be assembled in different orientations shall be placed in the most unfavourable position.

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

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

Creepage distances shall be measured in accordance with Annex D. The relationship between material group and the comparative tracking index (CTI) values and proof tracking index (PTI) values shall be 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  $100 \leq \text{CTI/PTI} < 175$ .



The CTI or PTI values shall be determined in accordance with Annex E.

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

### 10.3.3 Creepage distances for basic insulation

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

Conformity shall be checked by measurement.

Table 3 Minimum creepage distances for basic insulation

| Rated voltage <sup>A)</sup><br>V (r.m.s.) | Minimum creepage distance<br>mm  |                   |                          |                                  |                   |                     |
|---|----------------------------------|-------------------|--------------------------|----------------------------------|-------------------|---------------------|
|   | Pollution degree 2 <sup>B)</sup> |                   |                          | Pollution degree 2 <sup>B)</sup> |                   |                     |
|   | Material group I                 | Material group II | Material group IIIa/IIIb | Material group I                 | Material group II | Material group IIIa |
| ≥250                                      | 1                                | 1                 | 2.5                      | 3                                | 3                 | 4                   |

<sup>A)</sup> This voltage is the voltage rationalized in accordance with BS EN 60664-1:2007, Table F3a and Table F3b.

<sup>B)</sup> Details of pollution degrees are given in Annex B.

### 10.3.4 Creepage distances for functional insulation

When measured in accordance with Annex D, the creepage distances for functional insulation shall be not less than the values specified for basic insulation in 10.2.3.

### 10.3.5 Creepage distances for supplementary insulation

When measured in accordance with Annex D, the creepage distances for supplementary insulation shall be not less than the values specified for basic insulation in 10.2.3.

### 10.3.6 Creepage distances for reinforced insulation

When measured in accordance with Annex D, the creepage distances for reinforced insulation shall be not less than twice the distances specified for basic insulation in Table 3.

## 10.4 Solid insulation

### 10.4.1 General

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

*NOTE No minimum thickness is specified for solid insulation.*

### 10.4.2 Basic, supplementary and functional solid insulation

When tested in accordance with Annex C, followed by the tests in Clause 17 using the values given in Table 4, basic, supplementary and functional solid insulation shall each withstand the required impulse voltage declared by the manufacturer of the accessory, as specified in 10.2.1 for overvoltage category III.

Table 4 Withstand test voltages for solid insulation types

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

#### 10.4.3 Reinforced solid insulation

When tested in accordance with Annex C, followed by the tests in Clause 17 using the values given in Table 4, reinforced solid insulation shall be dimensioned to withstand the required impulse voltage, but one step higher than that specified for basic insulation in 10.2.3.

#### 10.5 Requirements for printed wiring boards and equivalent construction

Wiring boards and equivalent shall conform to the constructional requirements of BS EN 60664-5.

Where coating, potting or moulding is used, these shall conform to BS EN 60664-3.

## 11 Accessibility of live parts

### 11.1 Requirement

When tested in accordance with 11.2, live parts of travel adaptors shall not be accessible. For configurable travel adaptors, live parts shall not be accessible even when partially configured or with any moveable/removable parts in all possible positions.

There shall be no contact between the test probe and any live part.

### 11.2 Test method

Test probe 11 of BS EN 61032:1998, using a force of  $5_{-1}^0$  N, shall be applied in every possible position when:

- the travel adaptor or any component part is in partial or complete engagement with a socket-outlet;
- plugs are in partial or complete engagement with the travel adaptor.

An electrical indicator with a voltage of  $(45 \pm 5)$  V shall be used to show contact with live parts.

### 11.3 Travel adaptors with detachable plug-pin portions

#### 11.3.1 Requirement

When tested in accordance with 11.3.2, travel adaptors having detachable plug-pin portions shall not have live parts accessible to test probe 13 of BS EN 61032:1998 when the plug-pin portion is engaged in a socket-outlet.

#### 11.3.2 Test method

Test probe 13 of BS EN 61032:1998 shall be applied without appreciable force in every possible position.

An electrical indicator with a voltage of  $(45 \pm 5)$  V shall be used to show contact with live parts.

## 11.4 Socket apertures with protection by shutters

### 11.4.1 Requirements

Travel adaptors which incorporate shutters to provide increased protection against electric shock shall be constructed such that, when tested in accordance with 11.4.2, live parts protected by the shutters are not accessible and the shutters do not operate.

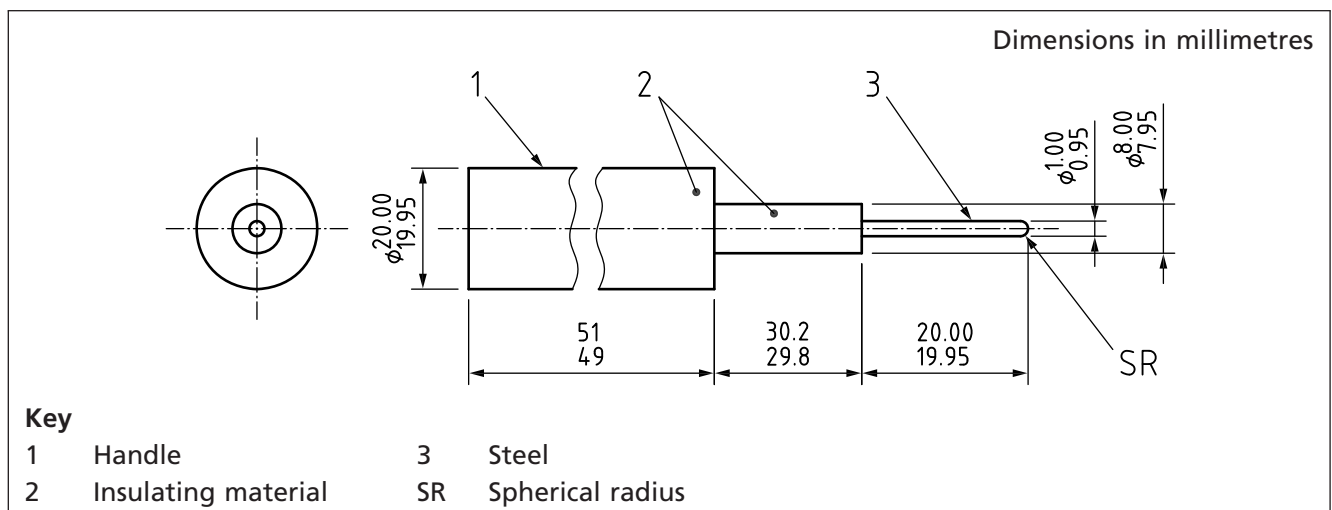
The travel adaptors shall be constructed such that, when tested in accordance with 11.4.2, live parts are automatically screened by a shutter, or shutters, which are not operated solely by the insertion of one current-carrying plug pin.

### 11.4.2 Test method

The test pin of Figure 1 shall be applied with a force of 5 N perpendicularly to the engagement surface of the socket-outlet portion of the travel adaptor.

Plug pins of the appropriate types shall be applied individually with a force of 20 N to the socket-outlet contacts of the travel adaptor.

Figure 1 Gauge for checking non-accessibility through shutters



## 11.5 Socket apertures without shutters

### 11.5.1 Requirements

When tested in accordance with 11.5.2, the live parts of travel adaptors having socket apertures without shutters shall not be accessible.

### 11.5.2 Test method

Test probe 13 of BS EN 61032:1998 shall be applied without appreciable force in every possible position.

An electrical indicator with a voltage of  $(45 \pm 5)$  V shall be used to show contact with live parts.

## 11.6 Single pin insertion

### 11.6.1 Requirements

When tested in accordance with 11.6.2, travel adaptors shall be so constructed such that:

- a) any earthing plug-pin of the travel adaptor or of a plug intended to be engaged with the travel adaptor does not make contact with a current-carrying socket-contact; and/or
- b) any current-carrying plug-pin of the travel adaptor or of a plug intended to be engaged with the travel adaptor does not make contact with a current-carrying socket-contact while any other plug-pin is accessible.

### 11.6.2 Test method

Conformity shall be checked by visual inspection.

An electrical indicator with a voltage of  $(45 \pm 5)$  V shall be used to show contact with live parts.

## 11.7 Earthing contact

### 11.7.1 Requirement

Earthing plug-pins or contacts shall make and break contact with the earthing socket-contact respectively before and after the current-carrying plug-pins make and break contact with the current-carrying socket-contacts.

For earthed configurations, it shall not be possible to engage the current-carrying pins in a socket-outlet without the corresponding earth becoming engaged.

### 11.7.2 Test method

An electrical test shall be performed with the travel adaptor pins in all possible positions.

Conformity shall be checked by inspection.

## 11.8 Fused travel adaptors

In fused travel adaptors it shall not be possible to gain access to the fuse-link whilst the travel adaptor is in engagement with a socket-outlet.

Conformity shall be checked by inspection.

## 11.9 Dismantling

Apart from user configurable parts, it shall not be possible to dismantle travel adaptors by hand or by using a general purpose tool, e.g. a screwdriver.

Conformity shall be checked by inspection.

## 11.10 Resilient covers

### 11.10.1 Requirement

Resilient covers of travel adaptors shall be so designed and constructed that 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 specified in Clause 10.

After the test in 11.10.2 it shall not be possible to touch live parts with test probe 11 of BS EN 61032:1998, applied with a force of  $30_{-2}^0$  N.

### 11.10.2 Test method

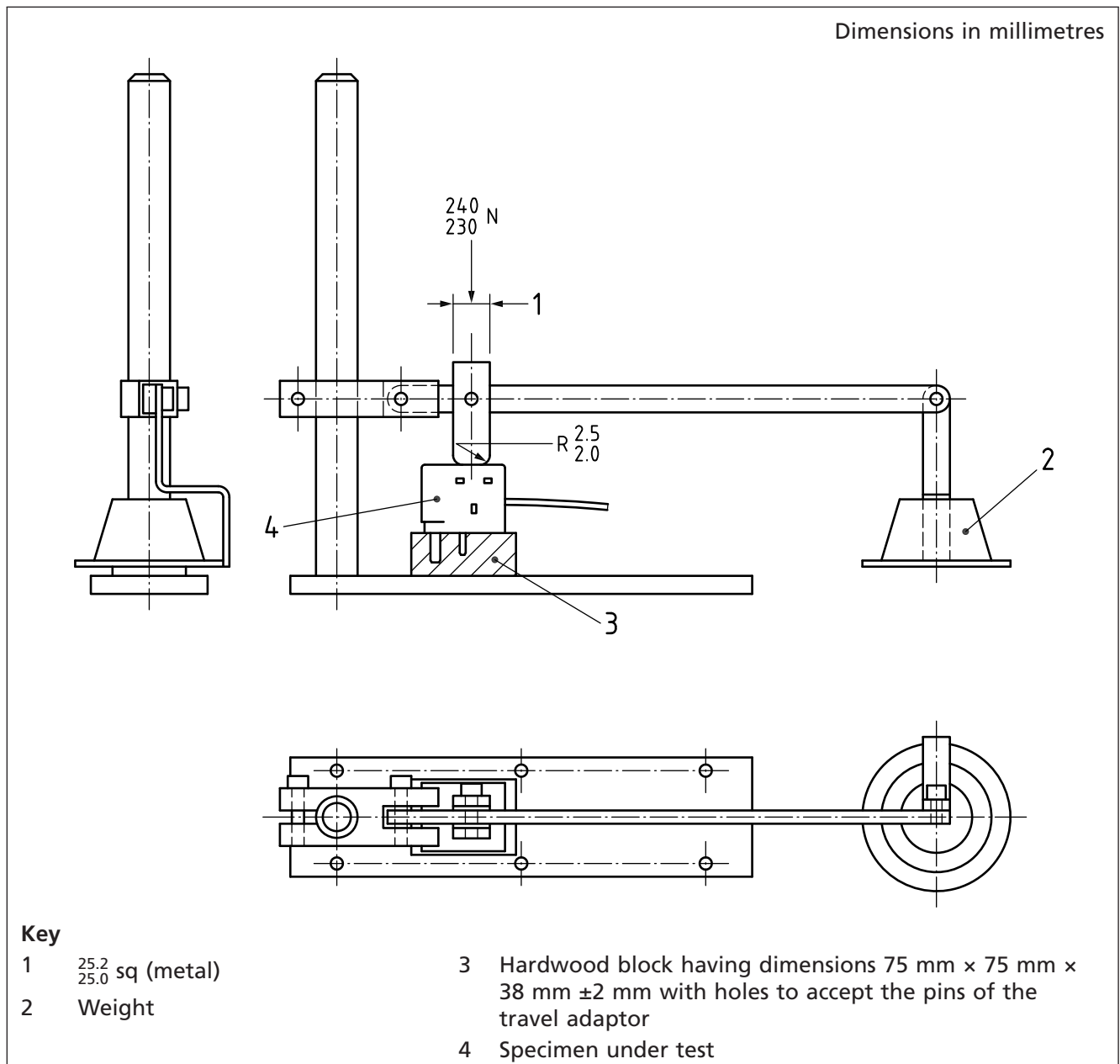
A steady force of  $<240_{-10}^0$  N shall be applied to those places where the possibility of a failure exists, the force being applied through a metal test pressure block as shown in Figure 2.

Each sample shall be subjected to the force at each chosen place in turn.

During each application of force, a test voltage of  $(2\ 000 \pm 60)$  V, 50 Hz of substantially sinusoidal waveform shall be applied for  $(60 \pm 5)$  s between all live parts bonded together and the earthed test pressure block.

During the test no flashover or breakdown shall occur.

Figure 2 Apparatus for mechanical strength test on resilient covers



## 12 Provision for earthing

### 12.1 Requirements

With the exception of travel adaptors in **12.3.1**, there shall be effective earthing of all metal parts that might become live in the event of failure of the insulation of the travel adaptor, and which are capable of being touched during normal operation.

*NOTE This requirement does not apply to metal parts on, or screws in or through, non-conducting material and separated by such material from live parts in such a way that, in normal use, they cannot become live.*

The connection between the earthing pin or contact and parts required to be connected thereto shall be of low resistance.

When tested in accordance with **12.2**, the resistance between the earthing pin or contact and any other nominated part shall not exceed  $0.05 \Omega$ .

### 12.2 Test method

Conformity shall be checked by visual inspection and by the following tests.

A current of  $(25 \pm 0.75)$  A derived from an a.c. source having a no-load voltage not exceeding 12 V shall be passed for  $(60 \pm 5)$  s as follows:

- a) between the earthing pin or contact and any accessible metal parts intended to be earthed; and/or
- b) between any corresponding earthing plug-pin inserted fully into an earthing socket-contact and the remote end of the earthing plug-pin of the travel adaptor.

### 12.3 Insulated metal parts

#### 12.3.1 Requirements

The requirements of **12.1** shall not apply to travel adaptors having accessible metal parts, such as removable covers or cover plates, where such parts are not intended to be earthed, provided that:

- a) such accessible metal parts are separated from live parts by doubled or reinforced insulation; and
- b) such parts cannot be removed and replaced in an incorrect position; and
- c) there is no risk of accidental contact between live parts and metal covers or cover plates, for example through fixing screws; and
- d) precautions are taken to prevent creepage distances or clearances becoming less than the values specified in Clause **10**.

#### 12.3.2 Test method

Conformity shall be checked by visual inspection and in accordance with the tests in Clause **17** at a test voltage of  $(4\ 000 \pm 120)$  V.

## 13 Construction

### 13.1 Current-carrying parts

#### 13.1.1 Requirements

Current-carrying parts and parts of the earthing contacts shall be made of brass, copper or phosphor-bronze.

Materials other than brass containing at least 50% copper shall not be used in the construction of travel adaptor plug pins except for sleeves of pins and ISODs.

*NOTE Plug pins can be nickel plated.*

This requirement shall not be applied to screws, nuts or washers.

### 13.1.2 Test method

Conformity shall be checked by visual inspection and in accordance with the tests for normal operation (13.6.2), temperature rise (Clause 18) and resistance to rust (Clause 22).

## 13.2 Sealing compounds

Sealing compounds of travel adaptors shall be resistant to heat and shall be of insulating material capable of maintaining a satisfactory seal under service conditions.

Conformity shall be checked by the test in 20.1.2.

Bituminous filling compounds shall conform to BS 1858.

## 13.3 Plug portion

The plug portion of the travel adaptor shall be provided with earthing plug pins or contacts if the socket-outlet portion of the travel adaptor accepts plugs with an earthing contact, except if the travel adaptor is intended for use with an unearthed system.

Travel adaptors for use in polarized socket-outlets shall be designed so that the plug pins and socket contacts maintain the same polarity as the input and output portions of the travel adaptor.

Conformity shall be checked by inspection and by an electrical continuity test.

## 13.4 Fuses

Travel adaptors incorporating BS 1363-1 type plug pins shall be provided with a fuse link in accordance with BS 1362.

Fused travel adaptors only incorporating non-BS 1363 type plug pins shall be provided with a fuse with a minimum breaking capacity of 1 500 A in accordance with BS 1362, BS EN 60269 or BS EN 60127.

The fuse link shall be mounted between the line plug pin and the corresponding socket-outlet contact.

It shall not be possible to remove or replace a fuse whilst the adaptor is engaged in a socket-outlet.

Conformity shall be checked by visual inspection and manipulation.

## 13.5 Fuse contacts

### 13.5.1 Requirements

Fuse contacts shall have sufficient resiliency for the safe operation of the travel adaptor.

Fuse contacts shall conform to 14.3.

When tested in accordance with 13.5.2, the fuse contacts shall not become detached or broken and be in suitable condition for subsequent tests.

### 13.5.2 Test method

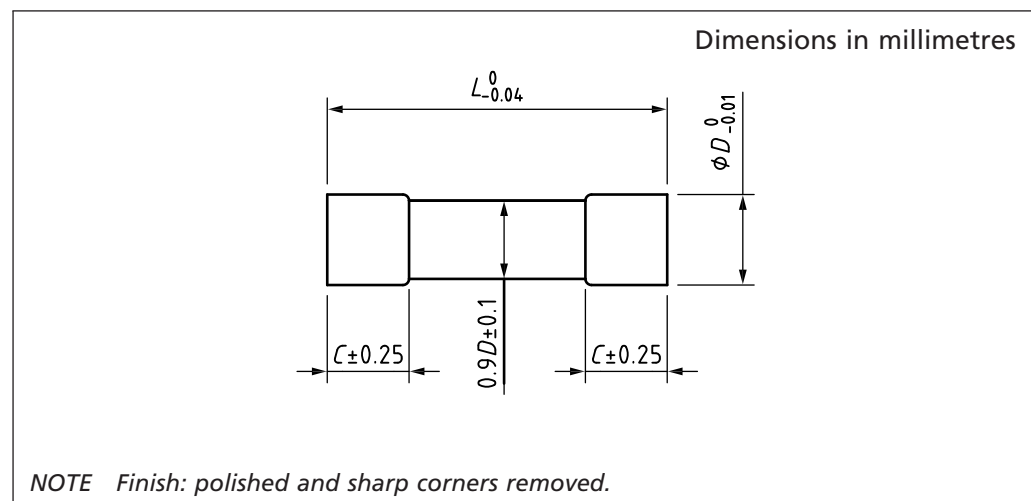
A solid link shall be manufactured from stainless steel as follows:

- a) for travel adaptors fitted with fuse-links conforming to BS 1362, the dimensions shall be as shown in Figure 3;
- b) for travel adaptors fitted with fuse-links conforming to other standards, the dimensions shall be the maximum shown in the relevant standards sheet, but with the following permissible negative tolerances:
  - 1) fuse cap diameters:  $-0.01$  mm;
  - 2) lengths:  $-0.04$  mm.

The solid link shall be inserted in and withdrawn from the fuseclips of the fused accessory 10 times in succession (20 movements) in a normal manner, at a rate of approximately 10 insertions per minute.

After the test, the stainless steel solid test link shall be replaced by the original fuse-link fitted to the travel adaptor for subsequent tests.

Figure 3 Solid link for test on fuseclips



## 13.6 Socket-outlet portions of the travel adaptor

### 13.6.1 Requirements

The socket-outlet portions of the travel adaptor shall withstand, without excessive wear or other harmful effects, the electrical and mechanical stresses occurring in use.

Socket-outlet portions of the travel adaptor shall have shutters if these are included in the relevant national standard for the socket-outlet.

When tested in accordance with 13.6.2, the travel adaptor shall not show any wear impairing its operation. Shutters, if fitted, shall still be operating satisfactorily and the socket-contacts safely shielded.

After the test, the travel adaptor shall meet the insulation resistance and electric strength requirements of Clause 17 and Clause 19 when tested with the plugs used for the insertion and withdrawal test.

### 13.6.2 Test method

A combination of appropriate plugs and each socket-outlet portion of the travel adaptor under test shall be operated by mechanically withdrawing and inserting the appropriate plug 5 000 times (10 000 movements).



The most onerous plug type shall be used and, where the socket-outlet portion of the travel adaptor accepts multiple sizes of plug pins, at least the smallest and the largest size shall be tested.

Where the travel adaptor accepts round and flat plug pins, at least one of each type shall be tested.

The plug-pins and socket-contacts, when engaged, shall carry the rated current  $\pm 2\%$  of the plug but not exceed the rated current  $\pm 2\%$  of the travel adaptor at the rated voltage  $\pm 5\%$  in a substantially non-inductive circuit.

Each plug shall be inserted into and withdrawn from the accessory under test at a rate of approximately six insertions and six withdrawals per minute, the speed of travel of the plug being approximately 150 mm/s. The periods during which the plug is inserted and withdrawn shall be approximately equal.

For the purpose of this test no lubrication shall be applied to the plug or socket-contacts under test.

### 13.7 Torque imposed on a socket-outlet

#### 13.7.1 Requirements

When tested in accordance with 13.7.2, travel adaptors with associated plugs and cords shall not impose undue strains on fixed socket-outlets.

#### 13.7.2 Test method

Socket-outlet portions of travel adaptors shall be fitted with a plug fitted with 1 m of flexible cord suitable for the current rating of the plug. The total mass shall not exceed 800 g.

The travel adaptor with plugs and flexible cords shall be inserted into an appropriate socket-outlet.

The socket-outlet shall be pivoted about its horizontal axis, 8 mm behind the engagement face and parallel with it, with its centre equidistant from pin centres.

The additional torque to be applied to the socket-outlet to maintain the engagement face in the vertical plane shall be not greater than 0.7 Nm for BS 1363 socket-outlets and 0.25 Nm in all other cases.

Flexible cords, if any, shall hang freely during the test.

The test shall be repeated for all configurations.

*NOTE* A device for checking this requirement is shown in Figure 4.

#### 13.7.3 Provision for withdrawal of travel adaptors

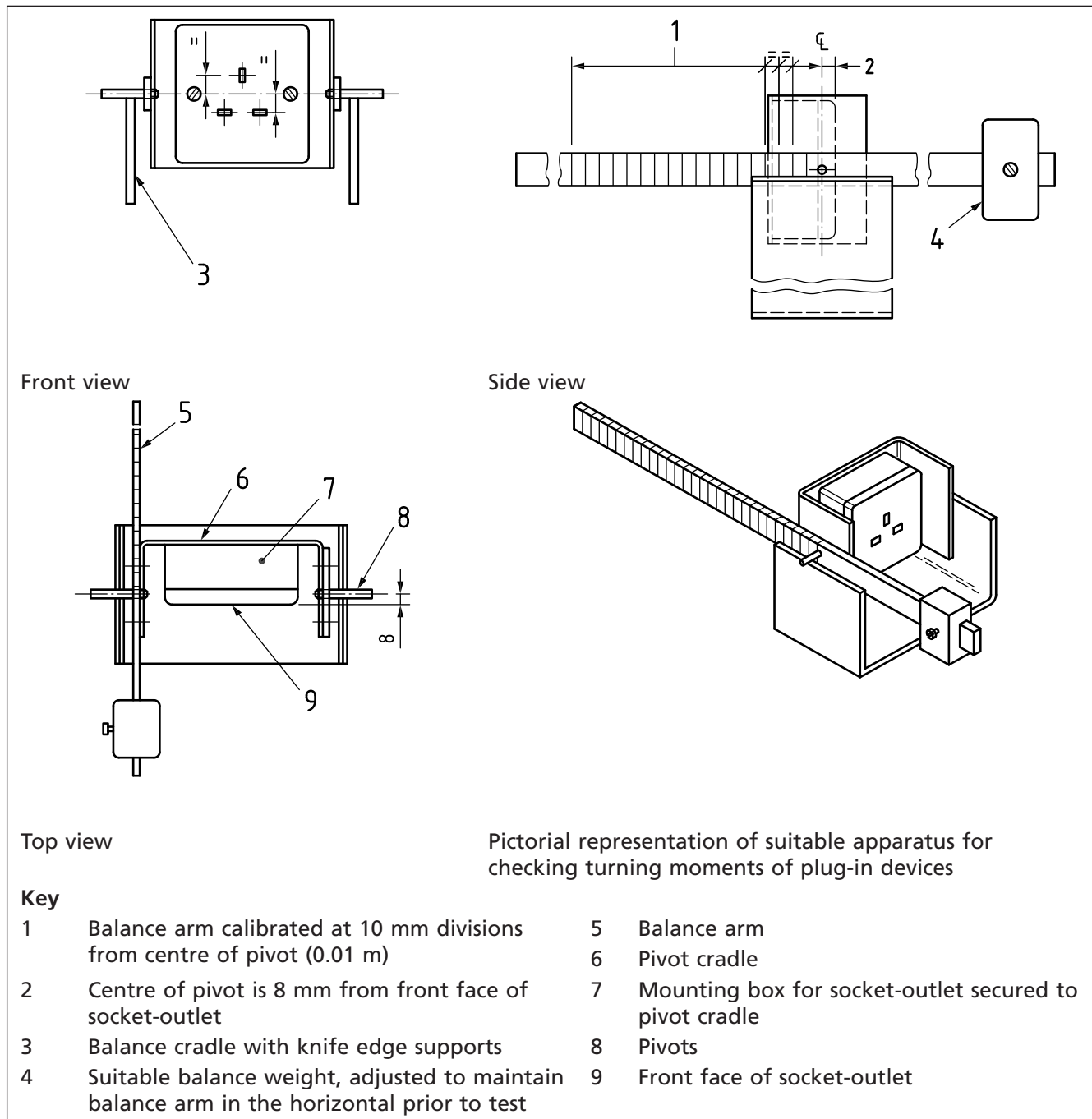
Travel adaptors shall be shaped such that they can be easily withdrawn by hand from the relevant socket-outlet.

The travel adaptor shall meet one of the following characteristics:

- a) the travel adaptor has a usable length for gripping of at least 55 mm in the axial direction; or
- b) the travel adaptor has indents or a ridge such that a ball with a diameter of  $(12 \pm 0.1)$  mm can penetrate into that indent or past the edge of the ridge by at least 2 mm from two opposite directions or at least 4 mm from one direction; or
- c) the travel adaptor has special means for withdrawal (e.g. hooks, rings).

Conformity shall be checked by visual inspection and measurement.

Figure 4 Turning moment apparatus



## 13.8 Socket contacts

### 13.8.1 Requirements

Socket contacts shall have metallic contact on at least two opposing sides of each pin.

Socket contacts shall be self-adjusting with regard to contact making and each socket contact shall be such as to make and maintain, in normal use, effective electrical and mechanical contact with a corresponding plug pin.

The means for producing the contact pressure shall be associated with each socket contact independently and shall not be dependent on insulating material.

Earthing contacts shall, irrespective of the number, be considered as one pole.

The socket contact shall meet the maximum and minimum withdrawal force specified in Table 5.

Table 5 Maximum and minimum withdrawal force for travel adaptors

| Ratings of the accessory            | Number of the poles of the travel adaptor | Withdrawal force N    |                         |
|-------------------------------------|---|-----------------------|-------------------------|
|                                     |   | Complete plug maximum | Single plug pin minimum |
| Up to and including 10 A            | 2   | 40                    | 1.5                     |
|                                     | 3   | 50                    |                         |
| Above 10 A up to and including 13 A | 2   | 50                    | 2.0                     |
|                                     | 3   | 54                    |                         |

### 13.8.2 Test method

Conformity shall be checked by visual inspection and the tests of 13.9.2 and 13.10.2.

## 13.9 Verification of the maximum withdrawal force

### 13.9.1 Requirements

The maximum withdrawal force of a plug from the travel adaptor shall be not greater than the values specified in Table 5.

### 13.9.2 Test method

The travel adaptor shall be mechanically fixed to the appropriate socket-outlet such that the travel adaptor does not fall out of the fixed socket-outlet.

The axes of the socket-contacts of the travel adaptor shall be vertical and the entry holes for the pins of the appropriate plug shall face downwards.

An appropriate plug, having the maximum size pins which the socket-outlet is designed to accept and with pins of the dimensions specified in the relevant standard sheet, shall be used for this test.

The pins of the plug shall be wiped free of grease before each test, using a cold chemical degreaser.

The plug shall be inserted into and withdrawn from the socket-outlet portion of the travel adaptor ten times.

The plug shall again be fully inserted into the socket-outlet portion of the travel adaptor and the maximum withdrawal force measured.

## 13.10 Verification of the minimum withdrawal force

### 13.10.1 Requirements

The minimum withdrawal force of a plug pin from the travel adaptor shall be not less than the minimum value given in Table 5.

### 13.10.2 Test method

If the travel adaptor is intended to accept plugs having pins with different nominal dimensions, the smallest appropriate ones shall be used for the test. In this case, the rating in Table 5 shall be the rating of the plug.

A plug pin with the dimensions specified in the relevant standard sheet of the appropriate plug shall be applied to each individual socket-contact of the travel adaptor with the travel adaptor held in such a way that the plug pin is hanging downwards.

Shutters, if any, shall be rendered inoperative so as not to affect the test. Care shall be taken to ensure that the insulating material surrounding the socket contact does not influence the test.

The pin shall be wiped free from grease before each test, using a cold chemical degreaser.

The plug shall be inserted into and withdrawn from the socket-outlet portion of the travel adaptor ten times.

The plug shall again be fully inserted into the socket-outlet portion of the travel adaptor and the minimum withdrawal force measured.

### 13.11 Rotation of plug pins

#### 13.11.1 Requirements

When tested in accordance with 13.11.2, plug pins of travel adaptors shall:

- a) be locked against rotation, except where the pin is designed to be rotated in order to fit more than one socket-outlet type, in which case the amount of rotation shall be limited to that required to engage with the socket-outlet;
- b) not be removable without permanently rendering the travel adaptor useless.

After the test, the travel adaptor shall conform to the dimensional requirements of Clause 9.

Conformity shall be checked by inspection and manipulation.

#### 13.11.2 Test method

The travel adaptor shall be clamped and each pin twisted about its longitudinal axis by applying a torque of 1 Nm  $\pm$ 10% for 60<sub>0</sub><sup>+5</sup> s for BS 1363 type pins and 0.4 Nm  $\pm$ 10% for 60<sub>0</sub><sup>+5</sup> s for other pin types.

### 13.12 Abrasion of plug pin sleeves

#### 13.12.1 Requirements

Sleeves of plug pins of travel adaptors shall have adequate electric strength and resistance to abrasion.

When tested in accordance with 13.12.2, the sleeved plug pins shall not break down and a flashover shall not occur. The sleeved plug pins shall show no damage which might impair further use and the sleeve shall not have been penetrated or creased.

#### 13.12.2 Test method

**13.12.2.1** A 50 Hz voltage of substantially sinusoidal waveform shall be applied between each line and neutral plug pin, and a thin metal strip of between 5.5 mm and 6 mm width wrapped around the base of the plug pin sleeve adjacent to the base of the plug portion of the travel adaptor. Initially not more than 500 V shall be applied, the voltage then being raised to (1 250  $\pm$ 30) V and maintained for (60 +5) s.

**13.12.2.2** The test apparatus for resistance to abrasion (see Figure 5) shall comprise a horizontally disposed beam pivoted about its centre point. A short length of steel wire ( $1 \pm 0.02$ ) mm in diameter and bent into a U-shape, the base of the U being straight with no surface defect, shall be 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.

**13.12.2.3** The travel adaptor shall be held in a suitable clamp as shown in Figure 5 in such a position that the straight part of the steel wire rests upon the plug pin of the travel adaptor at right angles to it and the plug pin slopes downward at an angle between  $5^\circ$  and  $10^\circ$  to the horizontal. The beam shall be loaded so that the wire exerts a force of  $4_{-0.1}^0$  N on the pin.

**13.12.2.4** The travel adaptor shall be moved backwards and forwards in a horizontal direction in the plane of the axis of the beam so that the wire rubs along the plug pin of the travel adaptor. The length of plug pin thus abraded shall be approximately 9 mm, of which approximately 7 mm is over the insulating sleeve.

**13.12.2.5** The travel adaptor shall be moved 5 000 times in each direction (10 000 movements) at a rate of 25 movements to 30 movements per minute.

**13.12.2.6** The test shall be made on one plug pin of each plug portion of the travel adaptor.

**13.12.2.7** Any abraded brass contamination on the sleeve shall be removed and 13.12.2.1 repeated.

## **13.13 Resistance of plug pin sleeves to heat and pressure**

### **13.13.1 Requirements**

Plug pin sleeves shall be resistant to heat and pressure.

When tested in accordance with 13.13.2, the thickness of the insulation remaining at the point of impression shall not have been reduced by more than 50%.

### **13.13.2 Test method**

A set of three specimen pins shall be tested by means of the apparatus shown in Figure 6.

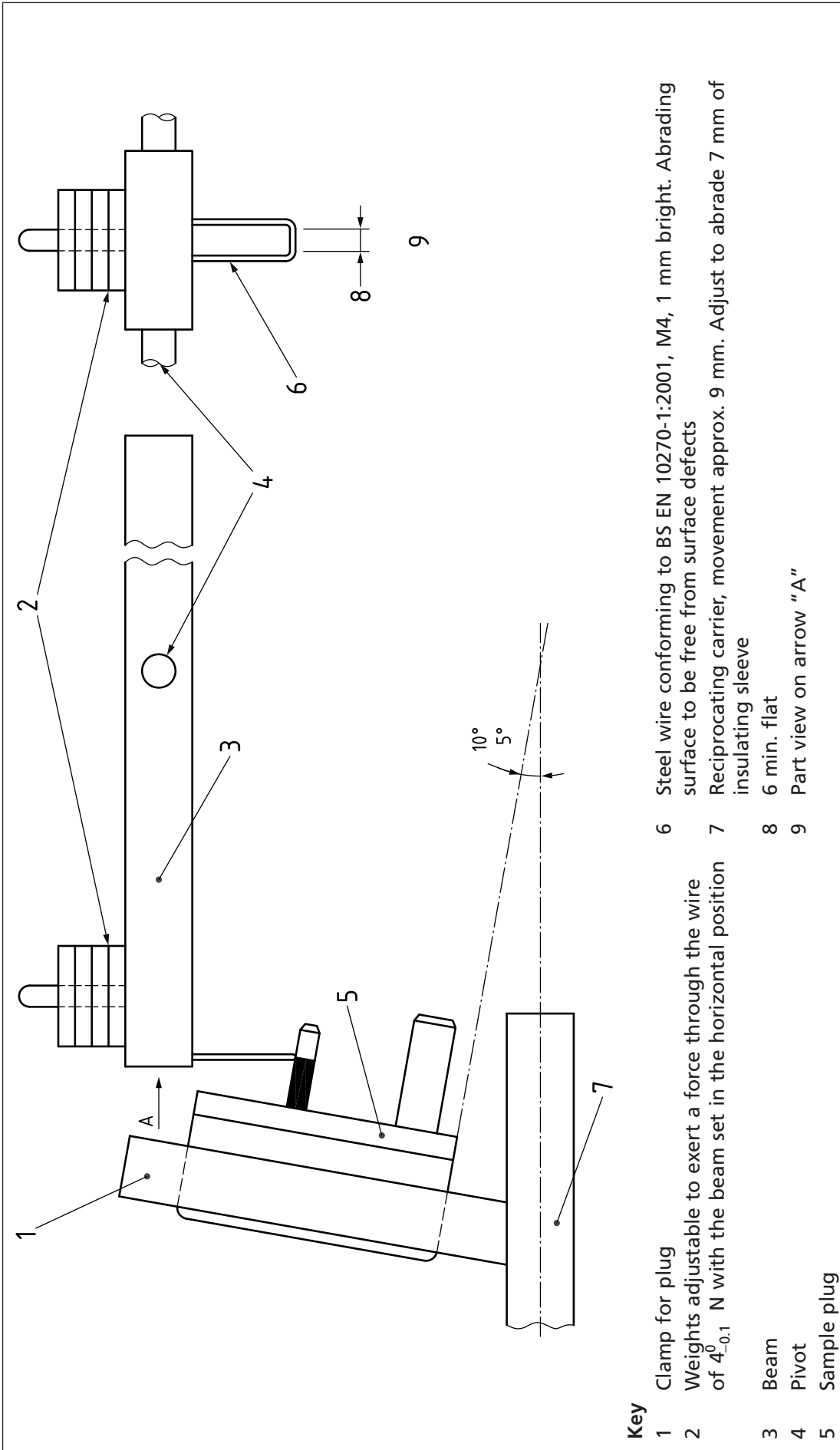
For flat pins the blade shall be  $0.70_{0}^{+0.05}$  mm wide with a radius of  $(3 \pm 0.1)$  mm.

For round pins the blade shall be rectangular with an edge  $0.70_{0}^{+0.05}$  mm wide.

A specimen pin shall be positioned as shown in Figure 6 and the apparatus loaded so that the blade exerts a force of  $2.5_{-1}^0$  N on the specimen.

The apparatus complete with specimen shall then be placed in a heating cabinet at  $(200 \pm 5)$  °C or  $(120 \pm 5)$  °C for travel adaptors with a rated current not exceeding 2.5 A for a period of  $120_{0}^{+0.05}$  min, after which the specimen shall be removed and immediately cooled by immersion in water at approximately room temperature.

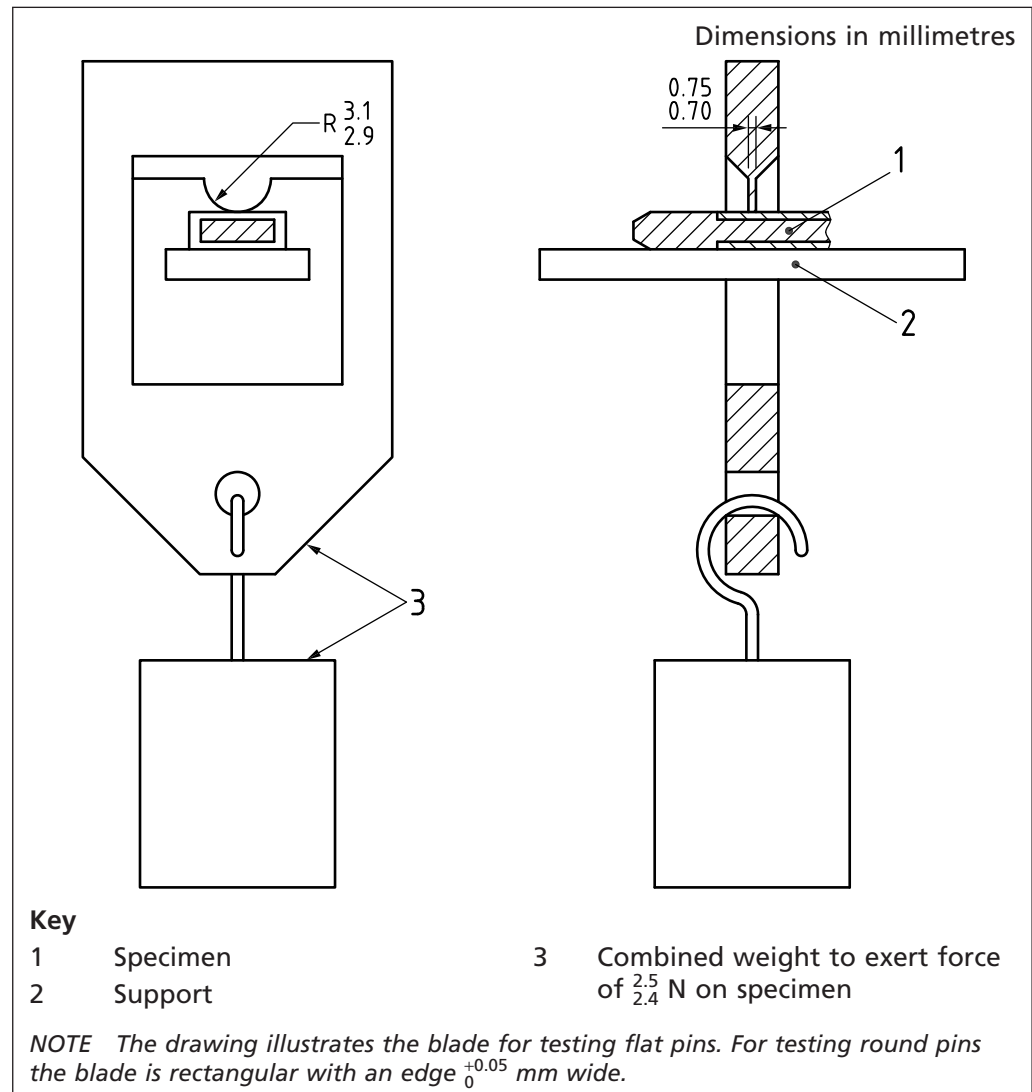
Figure 5 Apparatus for abrasion test on insulating sleeves of plug pins



**Key**

- 1 Clamp for plug
- 2 Weights adjustable to exert a force through the wire of  $4_{-0.1}^0$  N with the beam set in the horizontal position
- 3 Beam
- 4 Pivot
- 5 Sample plug
- 6 Steel wire conforming to BS EN 10270-1:2001, M4, 1 mm bright. Abrading surface to be free from surface defects
- 7 Reciprocating carrier, movement approx. 9 mm. Adjust to abrade 7 mm of insulating sleeve
- 8 6 min. flat
- 9 Part view on arrow "A"

Figure 6 Apparatus for pressure test at high temperature



## 13.14 Travel adaptor plug pins and ISODs

### 13.14.1 Requirements

**13.14.1.1** Travel adaptor plug pins and ISODs shall conform to **13.14.1.3**. In addition, ISODs shall conform to the dimensional requirements of BS 1363-1:1995, Figure 4a and Figure 4b.

**13.14.1.2** Non-solid pins shall conform to **13.14.1.4** and **13.14.1.5**.

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

**13.14.1.4** Those surfaces of the non-solid plug pins which are visible when the adaptor is correctly assembled shall be free of apertures.

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

### 13.14.2 Test method

Conformity shall be checked by measurement and visual inspection.

In case of doubt, a steel probe of 0.2 mm diameter, conforming to BS EN 10270-1:2001, Table 1, shall be pushed into all seams and joints.

The test probe shall not enter into any seam or joint to a depth greater than the thickness of the material from which the plug pin is formed.

### 13.15 Strength of plug pins

#### 13.15.1 Solid plug pins

##### 13.15.1.1 Requirements

Travel adaptor plug pins shall have adequate strength to withstand the stresses of normal use.

The strength of solid pins having dimensions conforming to BS 1363-3 shall be tested in accordance with 13.15.1.2.

After this test the adaptor shall conform to the dimensional requirements of Clause 9.

##### 13.15.1.2 Test method

A pin shall be positioned on the fixed anvil of the apparatus, as shown in Figure 7, with its contact surfaces in the horizontal plane.

A force of  $1\ 100_{-10}^0$  N shall be applied to the moveable anvil by any convenient method such that the pin is strained at a rate not exceeding 10 mm/min.

The test shall be made separately on the line, neutral and earth pins, applying the load perpendicular to the major axis surfaces of the pins.

#### 13.15.2 Non-solid plug pins

##### 13.15.2.1 Requirement

The strength of non-solid pins having dimensions in accordance with BS 1363-3 shall be tested in accordance with 13.15.2.2 and 13.15.2.3.

After the tests the adaptor plug pins shall conform to the dimensional requirements of Clause 9.

##### 13.15.2.2 Test method part one

The test shall be made separately on the line, neutral and earth pins, applying the load perpendicular to the major axis surfaces of the pins.

A pin shall be positioned on the fixed anvil of the apparatus, as shown in Figure 7, with its contact surfaces in the horizontal plane.

The moveable anvil shall rest against the upper surface of the pin.

A force of  $800_{-10}^0$  N shall be applied to the moveable anvil 50 times without impact.

If there is a joint or seam in one of the major axis surfaces of a pin then the test shall be made twice.

The seam or joint shall face the moving anvil for the first test and shall face the fixed anvil for the second test.

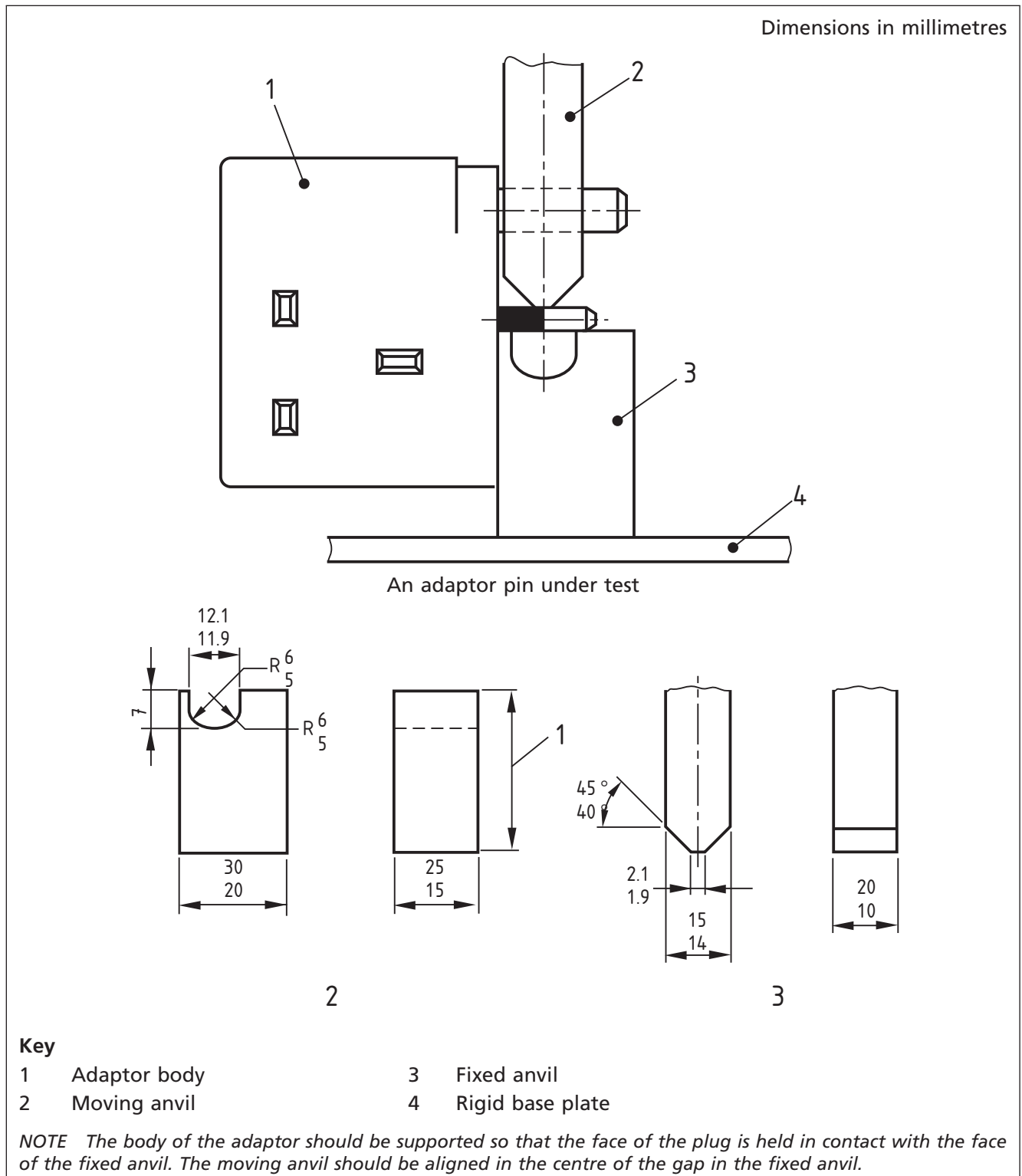
##### 13.15.2.3 Test method part two

Separate specimens shall then be measured in accordance with the following test.

A pin shall be positioned on the fixed anvil of the apparatus, as shown in Figure 7, with the widest surface in the horizontal plane.



Figure 7 Apparatus for tests on adaptor pins



The moveable anvil shall rest against the upper surface of the pin.

This quiescent position shall be taken as the datum point.

A force shall be applied to the moveable anvil by any convenient method such that the pin is strained at a rate not exceeding 10 mm/min.

The applied force shall be measured when the movement of the anvil from the datum point reaches  $1.5_{-0.1}^0$  mm.

The test shall be made separately on 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 then the test shall be made twice.

The seam or joint shall face the moving anvil for the test and shall face the fixed anvil for the second test. The force applied shall be not less than 1 100 N.

### **13.16 Insulated shutter opening device**

#### **13.16.1 Requirements**

When tested in accordance with **13.16.2**, the ISOD shall not break or show cracks that are visible with normal or corrected vision without additional magnification; any measured deflection shall not exceed 1.5 mm; and the adaptor plug pins shall satisfy the dimensional requirements of Clause 9.

#### **13.16.2 Test method**

The ISOD shall be positioned on the fixed anvil of the apparatus, as shown in Figure 7, with the widest surface in the horizontal plane.

The moveable anvil shall rest against the upper surface of the ISOD.

This quiescent position shall be taken as the datum point.

A force shall be applied to the moveable anvil by any convenient method such that the ISOD is strained at a rate of  $(10 \pm 2)$  mm/min.

A force of  $400_0^{+10}$  N shall be applied.

When testing an adaptor fitted with an ISOD, due to the flexibility of plastic materials, some additional alignment of the ISOD shall be allowed when inserting into the appropriate gauge from the relevant standard.

Where alignment cannot be maintained, the test of BS 1363-2:1995+A4:2012, **13.8**, shall be applied and the maximum withdrawal force from a socket-outlet conforming to BS 1363-2 shall not exceed 36 N.

For non-solid plug pins other than those conforming to BS 1363-3, the test in **13.18.2** shall be performed with a force of  $100_0^{+10}$  N applied.

### **13.17 Travel adaptors with BS 1363-style non-solid and/or nickel plated pins and/or ISODs**

#### **13.17.1 Requirements**

##### **13.17.1.1 General**

When tested in accordance with **13.17.1.2**, travel adaptors with non-solid and/or nickel plated pins shall not cause excessive wear to socket contacts or shutters of socket-outlets.

The shutters of the socket-outlets shall be operating satisfactorily, the socket contacts shall be safely shielded and the socket-outlets shall be in accordance with BS 1363-2:1995+A4:2012, **9.1**, **10.2**, **13.6** and **13.7**.

The pins of the travel adaptor shall remain intact with no openings in the surface, joints or seams which can accept a probe of 0.2 mm diameter.

There shall be no visible evidence of peeling or flaking of the plating.

When tested in accordance with **13.17.1.3**, travel adaptors with ISODs shall not cause excessive wear to socket contacts or shutters of socket-outlets.

The socket-outlets shall be examined and shall show no sign of damage that could impair further use.

The travel adaptors under test shall show no damage and shall conform to the dimensional requirements of Clause 9.

The shutters of the socket-outlets shall operate satisfactorily and the socket contacts shall be safely shielded.

#### **13.17.1.2 Test method for travel adaptors with non-solid and/or nickel plated pins**

Travel adaptors with non-solid and/or nickel plated pins shall be tested with three different types of new socket-outlets which conform to BS 1363-2. One type of socket-outlet shall have the shutters operated by the earth pin, one shall be operated by live and neutral pins only, and the third preferably operated by all three pins.

This combination of travel adaptors and socket-outlets shall make and break rated current and voltage  $\pm 10$  V a.c. 300 times (600 movements) in a substantially non-inductive circuit.

Each travel adaptor shall be 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 adaptor being approximately 150 mm/s. The periods during which the travel adaptor is inserted and withdrawn shall be approximately equal.

#### **13.17.1.3 Test method for travel adaptors with ISODs**

Using a selection of three different makes of rewirable plugs conforming to BS 1363-1 and three different makes of unswitched socket-outlets conforming to BS 1363-2, selected to represent different earth contact designs, the earth resistance between the earthing adaptor plug pin and the earthing socket contact of the socket-outlets shall be determined in accordance with BS 1363-2:1995+A4:2012, 10.2.1 b).

All socket-outlets shall be of the type where the earth pin or ISOD of an adaptor inserted into the socket-outlet operates the shutter mechanism.

The test shall be made using a separate sample of travel adaptor plug with ISOD for each type of socket-outlet, with 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 adaptor plug being approximately 150 mm/s. The periods during which the travel adaptor is inserted and withdrawn shall be approximately equal.

For the purpose of this test, no lubrication shall be applied to the pins of the adaptor or the socket-outlet contacts.

After 300 insertions and withdrawals, the standard rewirable plugs used prior to the test for each type of socket-outlet shall be reinserted and the earth resistance test repeated.

The earth resistance between the earthing adaptor plug pin and the earthing socket contact of the socket-outlets shall conform to BS 1363-2:1995+A4:2012, 10.2.1 b).

### **13.18 Configurable travel adaptors**

#### **13.18.1 Requirements**

When tested for the strength and effectiveness of connections in accordance with 13.18.2.1 to 13.18.2.4, configurable travel adaptors having moveable or removable parts shall show no deterioration affecting further use and any mechanical interlocks shall remain operational.

When tested in accordance with 13.18.2.5, plug pins shall remain locked in their deployed position.

### 13.18.2 Test method

**13.18.2.1** The voltage drop between each individual line or neutral pin and corresponding socket contact shall be measured whilst carrying a rated current of  $\pm 0.4$  A at rated voltage  $\pm 10$  V. The voltage drop shall not exceed 40 mV.

**13.18.2.2** Each moveable part shall be operated through its complete range of movement for 300 cycles.

**13.18.2.3** Each removable part shall be assembled and removed 300 times.

**13.18.2.4** The test in **13.18.2.1** shall then be repeated. The voltage drop measured shall be not more than 1.5 times the value measured in the initial test of **13.18.2.1**.

**13.18.2.5** A load of  $10_0^{+10}$  N for  $60_0^{+5}$  s shall be applied to each plug pin in an axial direction.

### 13.19 Travel adaptors incorporating USB outlets

Travel adaptors incorporating USB outlets shall conform to Annex F.

### 13.20 Travel adaptor switches

Travel adaptors shall not include a switch or switches.

### 13.21 Electronic components incorporated in travel adaptors

Electronic components incorporated in travel adaptors shall conform to Annex G.

## 14 Screws, current-carrying parts and connections

### 14.1 General

Connections, electrical or mechanical, shall withstand the mechanical stresses occurring in normal use.

### 14.2 Screws, nuts, rivets and similar features

#### 14.2.1 Requirements

Screws, nuts and similar features intended to be operated by a user shall have adequate strength.

When checked by visual inspection and tested in accordance with **14.2.2**, there shall be no deterioration affecting further use.

Rivets which serve as electrical as well as mechanical connections shall be locked against loosening or turning.

#### 14.2.2 Test method

The test shall be made by means of a suitable test screwdriver or a suitable tool, applying a torque as specified in Table 6.

The shape of the blade of the test screwdriver shall suit the head of the screw to be tested.

The screws or nuts or other similar features shall be tightened and loosened five times without jerks.

Rivets shall be checked by visual inspection.

*NOTE For rivets, a non-circular shank or an appropriate notch might provide satisfactory locking.*

Table 6 Torque values for test of screws and nuts

| Nominal outside diameter of thread<br>mm | Torque<br>N·m   |                 |                 |
|--|-----------------|-----------------|-----------------|
|  | 1 <sup>A)</sup> | 2 <sup>B)</sup> | 3 <sup>C)</sup> |
| Up to and including 2.8                  | 0.2             | 0.4             | 0.4             |
| Over 2.8 up to and including 3.0         | 0.25            | 0.4             | 0.4             |
| Over 3.0 up to and including 3.2         | 0.3             | 0.6             | 0.6             |
| Over 3.2 up to and including 3.6         | 0.4             | 0.8             | 0.8             |
| Over 3.6 up to and including 4.1         | 0.7             | 1.2             | 1.2             |
| Over 4.1 up to and including 4.7         | 0.8             | 1.8             | 1.8             |
| Over 4.7 up to and including 5.3         | 0.8             | 2.0             | 2.0             |
| Over 5.3 up to and including 6.0         | –               | 2.5             | 3.0             |

<sup>A)</sup> Applicable to screws without heads if the screw when tightened does not protrude from the hole, and to other screws which cannot be tightened by means of a screwdriver with a blade wider than the diameter of the screw.

<sup>B)</sup> Applicable to other screws or threaded fixing devices which are tightened by means of a screwdriver.

<sup>C)</sup> Applicable to screws or nuts which are tightened by means other than a screwdriver.

### 14.3 Electrical connections and current-carrying parts

Electrical connections shall be so designed that contact pressure is not transmitted through insulating material other than ceramic or pure mica, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or yielding of the insulating material.

Connections to plug pins, fuse clips and socket contacts shall not be made by screws.

Internal connections shall be permanently made except for parts which are intended to be connected or disconnected during configuration of the travel adaptor by the user.

Current-carrying parts shall be of a metal having, under the conditions occurring in the travel adaptor, mechanical strength, electrical conductivity and resistance to corrosion adequate for their intended use and in accordance with Clause 22.

Metals showing a great difference of electrochemical potential with respect to each other, under moist conditions and where corrosion might result, shall not be used in contact with each other.

Screws shall not be used for the connection of current-carrying parts.

*NOTE Thread-forming screws might be used to provide earthing continuity provided that it is not necessary to disturb the connection in normal use and at least two screws are used for each connection.*

Conformity shall be checked by visual inspection.

In case of doubt, to determine whether an insulating material is providing contact pressure, the travel adaptor shall be examined with the insulating material in question removed.

## 15 Resistance to ageing

### 15.1 Requirements

Travel adaptors shall be resistant to ageing.

When tested in accordance with 15.2, the samples shall show no cracks or damage visible to normal or corrected vision without magnification which might impair safety or prevent further use.

The samples shall subsequently pass the remaining tests in the series as specified in Table 1.

### 15.2 Test method

Travel adaptors, mounted as in normal use, shall be placed in a heating cabinet with an atmosphere having the composition and pressure of the ambient air, and ventilated by natural circulation or fan assistance.

The temperature in the cabinet shall be  $(70 \pm 5)$  °C.

The samples shall be kept in the cabinet for  $(168 \pm 2)$  h.

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

*NOTE 2 Natural air circulation can be provided by holes in the walls of the cabinet.*

After the treatment, the samples shall be removed from the cabinet and kept at room temperature and relative humidity for 1 h, following which they shall be examined.

## 16 Resistance to humidity

### 16.1 General

Travel adaptors shall be resistant to humidity which might occur in normal use.

### 16.2 Requirements

When tested in accordance with 16.3 followed immediately by the measurement of the insulation resistance and by the electric strength test specified in Clause 17, the samples shall show no signs of damage.

### 16.3 Test method

Parts which can be removed without the aid of a tool shall be removed and tested with the main part of the travel adaptor.

Any spring lids shall be kept open during the test.

The humidity test shall be carried out in a humidity cabinet containing air with a relative humidity maintained between 85% r.h. and 95% r.h.

The temperature of the air in which the samples are placed shall be maintained within  $\pm 2$  °C of an appropriate temperature  $t$  between 20 °C and 30 °C.

Before being placed in the humidity cabinet, the samples shall be brought to a temperature between  $t$  and  $t + 4$  °C.

The samples shall be kept in the cabinet for (48 +1) h.

*NOTE 1* The samples can be brought to the specified temperature by keeping them at this temperature for at least 4 h before the humidity treatment.

*NOTE 2* A relative humidity between 85% r.h. and 95% r.h. can be obtained by placing in the humidity cabinet a saturated solution, having a sufficiently large contact surface with the air, of sodium sulfate ( $\text{Na}_2\text{SO}_4$ ) or potassium nitrate ( $\text{KNO}_3$ ) in water.

## 17 Insulation resistance and electric strength

### 17.1 Insulation resistance

#### 17.1.1 Requirement

When tested in accordance with 17.1.2, the insulation resistance shall be not less than the following:

- a) 5 M $\Omega$  between parts of opposite polarity;
- b) 5 M $\Omega$  between parts of opposite polarity connected together and other parts insulated therefrom, including earthed metal.

When tested in accordance with 17.1.2 no breakdown shall occur.

#### 17.1.2 Test method

The test shall be performed in a humidity cabinet in accordance with 16.3, or immediately after removal of the travel adaptor from the cabinet in a room where the specified temperature is maintained.

*NOTE* Incorporated electronic components and circuits which have been tested to their relevant standards should be disconnected for this test.

Having disconnected one pole of any neon indicator, or similar, the insulation resistance shall be measured using a d.c. voltage of 500<sub>0</sub><sup>+250</sup> V.

The measurement shall be for 60<sub>0</sub><sup>+5</sup> s after application of the voltage. The insulation resistance shall be measured consecutively between:

- a) live parts of opposite polarity; and
- b) parts of opposite polarity connected together, and:
  - 1) other parts insulated therefrom, including earthed metal;
  - 2) a sheet of metal foil in contact with the entire accessible external surface.

The test specimens shall be examined for conformity to 17.1.1.

## 17.2 Electric strength

### 17.2.1 Requirement

The electric strength of travel adaptors shall be such that, when tested in accordance with 17.2.2, no flashover or breakdown occurs.

Glow discharges without drop in voltage shall be ignored.

Any overcurrent protection shall not operate at a current of less than 100 MA.

### 17.2.2 Test method

*NOTE* Incorporated electronic components and circuits which have been tested to their relevant standards should be disconnected for this test.

Having disconnected one pole of any neon indicator, or similar, a 50 Hz voltage of substantially sinusoidal waveform of not more than 1 000 V shall be applied before raising the voltage to  $(2\ 000 \pm 60)$  V.

A high voltage source shall be used such that when the output is adjusted to  $(2\ 000 \pm 60)$  V for  $60_0^{+5}$  s and is then short circuited, the output current is not less than 200 MA.

The test specimens shall be examined for conformity to 17.2.1.

## 18 Temperature rise

### 18.1 Requirements

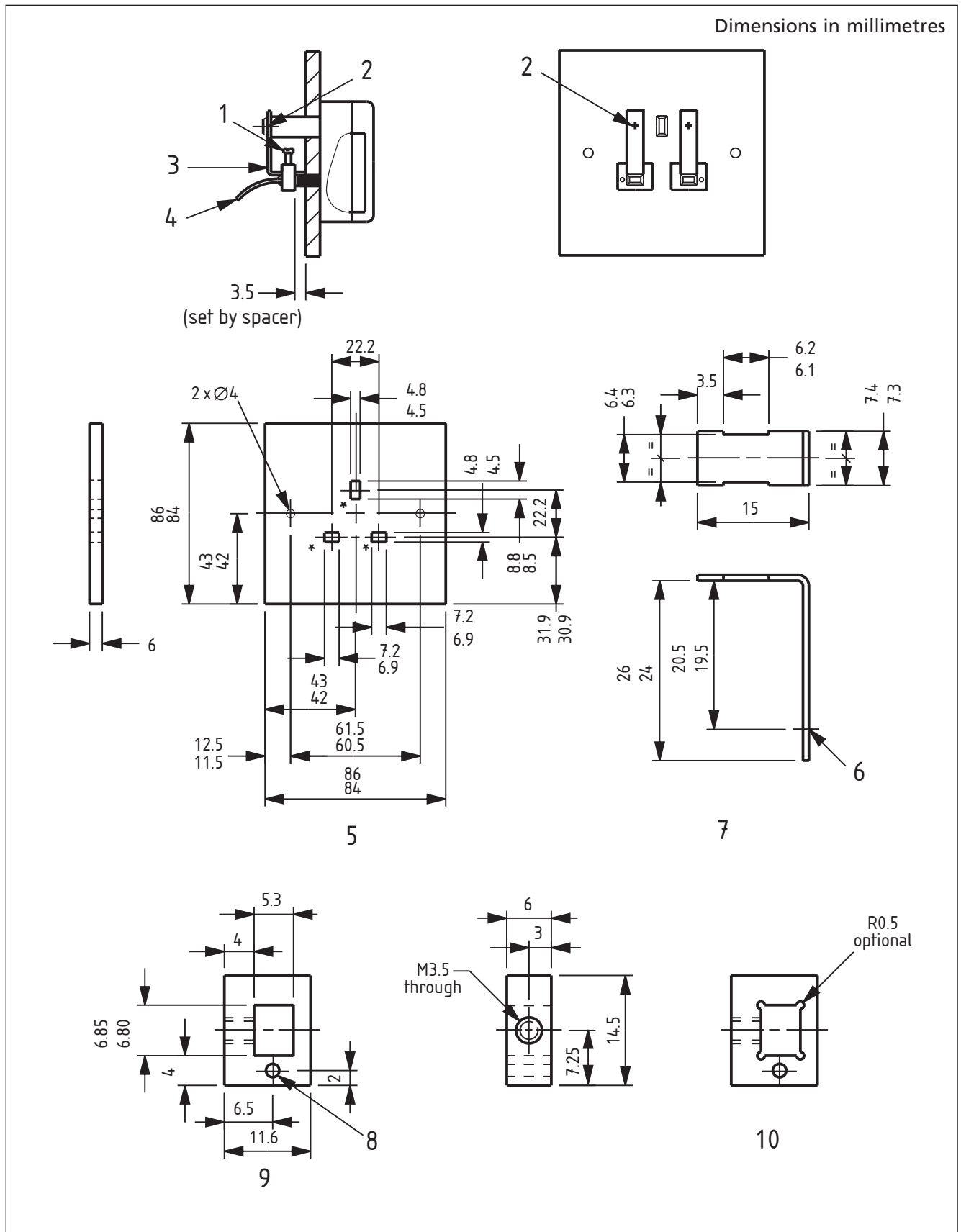
Travel adaptors shall be constructed such that, when tested in accordance with 18.2 and 18.3, the temperature rise shall not exceed the following limits:

- at line and neutral pin spacers if applicable (see 18.3.2 and Figure 8): 37 K;
- at clamping units for non-BS 1363 type pins: 45 K;
- at the terminals or terminations of the test plug (non-BS 1363): 45 K;
- at the terminals or terminations of the test plug (BS 1363): 52 K;
- at the accessible external surface: 52 K.

*NOTE* These values take account of an uncertainty of temperature measurement of  $\pm 2$  °C.



Figure 8 Dummy front plate for temperature-rise test (1 of 2)



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Figure 8 Dummy front plate for temperature-rise test (2 of 2)

| Key |   |
|-----|---|
| 1   | Brass clamping screws M 3.5 × 10                                    |
| 2   | Thermocouple position   |
| 3   | Spacer  |
| 4   | 2.5 mm <sup>2</sup> conductor                                       |
| 5   | Plate (of insulating material SRBP brown BS 2572/P2/1)              |
| 6   | Thermocouple position. Hole Ø1 for location of the thermocouple     |
| 7   | Spacer material brass CZ 108, 0.8 mm thick conforming to BS EN 1652 |
| 8   | Hole Ø1.8 for soldering supply conductor                            |
| 9   | Clamp, material brass   |
| 10  | Optional alternative clamp  |

*NOTE 1* Tolerance ±0.2 mm except where otherwise shown.

*NOTE 2* The positional tolerance of the three pin apertures can be provided by the use of gauges.

## 18.2 Test conductors

Test conductors shall conform to the nominal cross-sectional areas given in Table 7 appropriate to the current-rating of the travel adaptor being tested.

Solid or stranded rigid conductors conforming to Table 7 shall be fitted to represent the fixed supply wiring.

Non-BS 1363 type plugs used for testing shall be fitted with flexible cords or cables in accordance with Table 7.

Cables used for tests shall conform to BS 6004 or BS EN 50525-1, as appropriate.

Test conductors shall have a length of at least 1 m.

Table 7 Cross-sectional areas for copper conductors for temperature-rise test

| Rated current<br>A              | Rigid conductors<br>(solid or stranded) nominal<br>cross-sectional area<br>mm <sup>2</sup> | Flexible conductors<br>(cords or cables) nominal<br>cross-sectional area<br>mm <sup>2</sup> |
|---------------------------------|--|---|
| Up to 6                         | 1.5  | 0.75  |
| Above 6 up to and including 10  | 1.5  | 1.0   |
| Above 10 up to and including 13 | 2.5  | 1.5   |

## 18.3 Mounting procedures for travel adaptors with a non-BS 1363 type plug pin portion

### 18.3.1 General

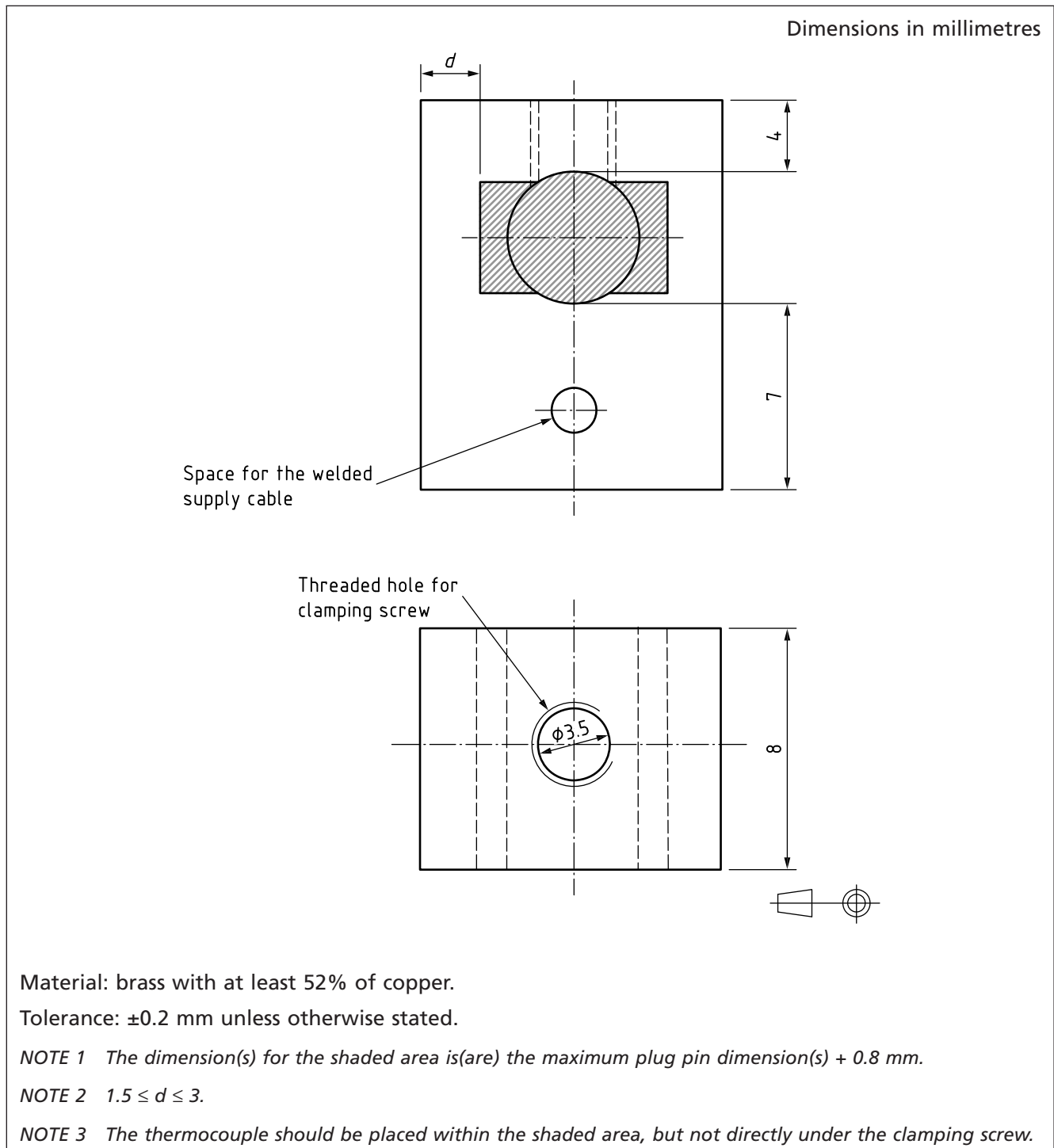
Travel adaptors with non-BS 1363 type plug pin portions shall be mounted on a flat insulating plate as shown in Figure 8, except with holes to suit the plug pin portion.

The supply conductors shall be attached to the line and neutral pins by means of clamps in accordance with Figure 9, which also serve to retain the travel adaptor in position.

The clamp screws shall be tightened to a torque of between 0.8 Nm and 1.0 Nm.

The assembly shall be mounted with the plate in a vertical position.

Figure 9 Clamping unit for the temperature rise test



Material: brass with at least 52% of copper.

Tolerance:  $\pm 0.2$  mm unless otherwise stated.

NOTE 1 The dimension(s) for the shaded area is(are) the maximum plug pin dimension(s) + 0.8 mm.

NOTE 2  $1.5 \leq d \leq 3$ .

NOTE 3 The thermocouple should be placed within the shaded area, but not directly under the clamping screw.

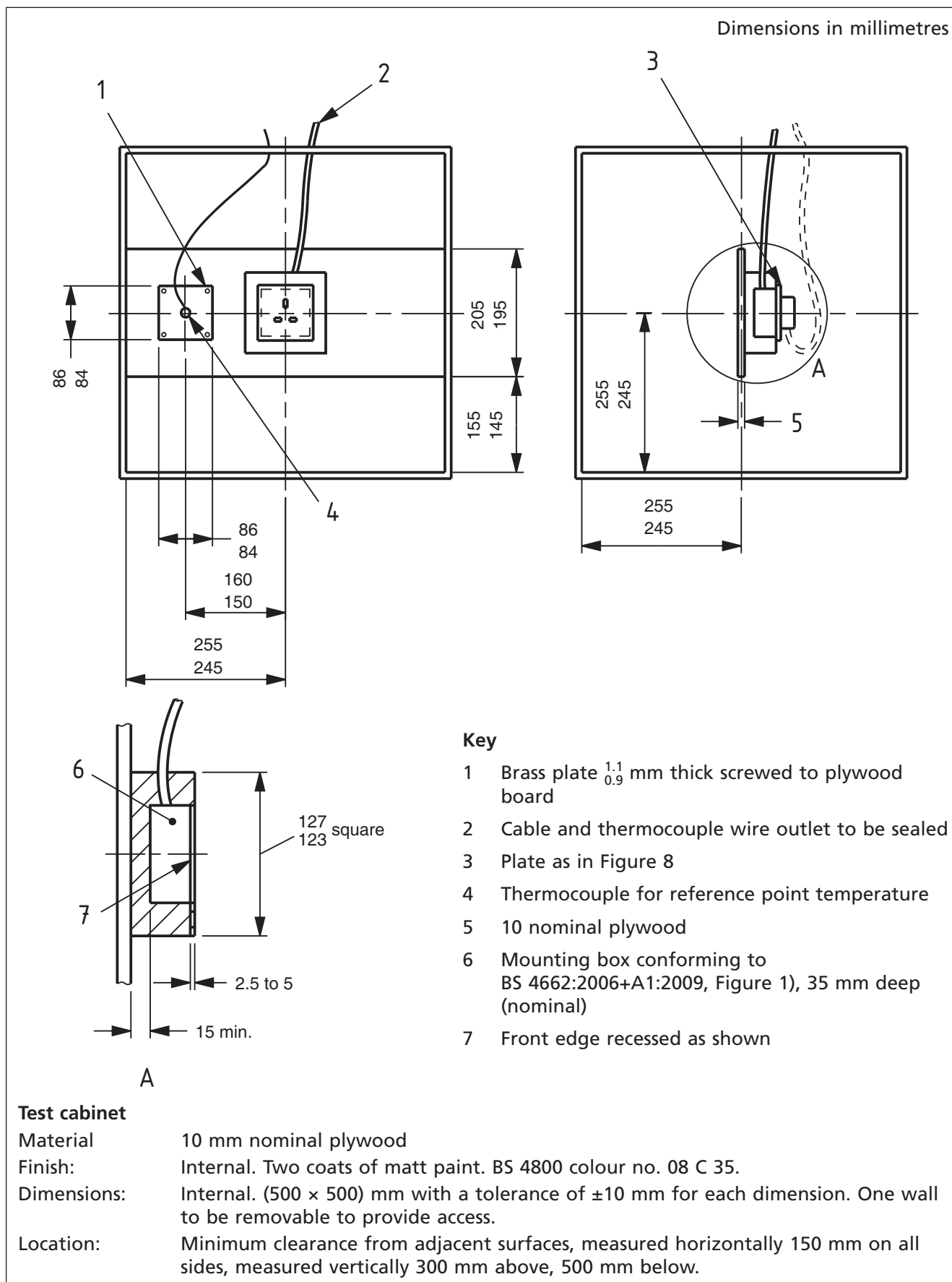
### 18.3.2 Mounting procedures for travel adaptors with a BS 1363 type plug pin portion

A travel adaptor with a BS 1363 type plug pin portion shall be mounted in the test apparatus as shown in Figure 10.

The temperature rise of the line and neutral pins of the plug pin portion of the travel adaptor shall be measured by means of thermocouples using the apparatus shown in Figure 8.

The travel adaptor shall then be mounted in a flat insulating plate as shown in Figure 8.

Figure 10 Test apparatus for temperature rise test



The supply conductors shall be attached to the line and neutral pins of the plug pin portion of the travel adaptor by means of clamps which also serve to retain the travel adaptor in position.

The clamp screws shall be tightened to a torque of between 0.8 Nm and 1.2 Nm.

The assembly shall be mounted 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 which shall be mounted in a test cabinet as shown in Figure 10.

The incoming cable and outgoing flexible cord(s) shall enter the test cabinet through holes in the top surface which shall then be sealed to prevent circulation of air.

The length of cable and flexible cord within the Figure 10 enclosure shall be a maximum of 600 mm and 850 mm, respectively.

The cable and flexible cord shall be positioned away from the reference temperature measuring point so as not to influence the derivation of plug temperature rise values.

The incoming cable shall be 2.5 mm<sup>2</sup> PVC insulated and sheathed cable, as specified in BS 6004:2012, Table 4, and shall enter the socket-outlet mounting box through the standard knock-out provided.

The knock-out shall be fitted with a suitable rubber grommet, the point of entry being sealed to prevent the circulation of air.

The length of cable within the socket-outlet box shall be (150 ±5) mm and the outer sheath and the circuit protective conductor shall be removed to within 20 mm of the point of entry.

The test cabinet (Figure 10) shall be placed in an environment having an ambient temperature of (20 ±5) °C.

The test current shall be passed through the travel adaptor and through a load connected to the flexible cord of the appropriate plug.

### 18.3.3 Test method

For travel adaptors designed to be used with more than one type of socket-outlet the most onerous socket-outlet type shall be used.

Travel adaptors which accept plugs with both round and flat pins shall be tested using at least one of each type of plug.

Travel adaptors shall be tested with test plugs with brass pins having the minimum dimensions  ${}_0^{+5}$  specified in the appropriate standard sheet and shall be fitted with (1 000 ±50) mm of PVC insulated flexible cable to suit the maximum current rating of the plug.

Travel adaptors incorporating BS 1362 fuses shall be fitted with a calibrated link constructed and calibrated in accordance with BS 1363-1:1995+A4:2012, Annex A.

BS 1363 test plugs shall have the BS 1362 fuse replaced with a calibrated link as specified in BS 1363-1:1995+A4:2012, Annex A.

Multiway travel adaptors shall be tested with a plug engaged in one socket portion only. The most onerous arrangements shall be tested. Plug and socket portions of the same system shall not be tested in that configuration.

Temperature rise shall be determined by means of fine-wire thermocouples, having wires not exceeding 0.3 mm in diameter, so chosen and positioned that they have minimum effect on the temperature of the part under test.

Thermocouples shall be attached by soldering, or by means of a mixture of equal parts of resin adhesive and zinc oxide, or by other equally effective means.

If soldering is used, heat from the soldering process shall not affect the performance of the accessory and no electrical connections shall be bridged by solder.

All tests shall be carried out as follows:

- a) in a draught-free environment;
- b) at an ambient temperature of  $(20 \pm 5)$  °C;
- c) for a period of  $(60 \pm 5)$  min;
- d) at any convenient voltage up to rated +10%;
- e) for travel adaptors rated at 13 A, with socket-outlet portions that accept BS 1363 type plugs, at a test current of  $(14 \pm 0.4)$  A;
- f) for travel adaptors other than in e), at a test current at  $1.25 \times$  the rated current  $^{+5}_0$  % of the travel adaptors; and
- g) USB circuits where fitted shall be loaded to their maximum rated current.

The temperature rise shall be measured at clamping units fitted to the pins and the accessible external surface of the travel adaptor.

In addition, for travel adaptors with a BS 1363 type plug pin portion, the temperature rise of the line and neutral pins of the plug pin portion of the travel adaptor shall be measured.

## 19 Mechanical strength

### 19.1 Requirements

When tested in accordance with **19.2**, **19.3** and **19.4**, travel adaptors shall have adequate mechanical strength and shall be so constructed as to withstand such handling as might be expected in normal use.

When a travel adaptor is tested in accordance with **19.2** and **19.3**:

- a) it shall show no damage which might affect safety;
- b) live parts shall not have become accessible;
- c) small chips or dents which do not affect the protection against electric shock shall be ignored; and
- d) cracks not visible to the naked eye, using normal or corrected vision without additional magnification, and surface cracks in fibre-reinforced mouldings shall be ignored.

When tested in accordance with **19.3**, the travel adaptor shall conform to Clause **10**, Clause **11** and Clause **17**. After the test on a lens, the lens might be cracked and/or dislodged, but it shall not be possible to touch live parts using the test pin shown in Figure 1 applied with a maximum force of 5 N in accordance with **11.2**.

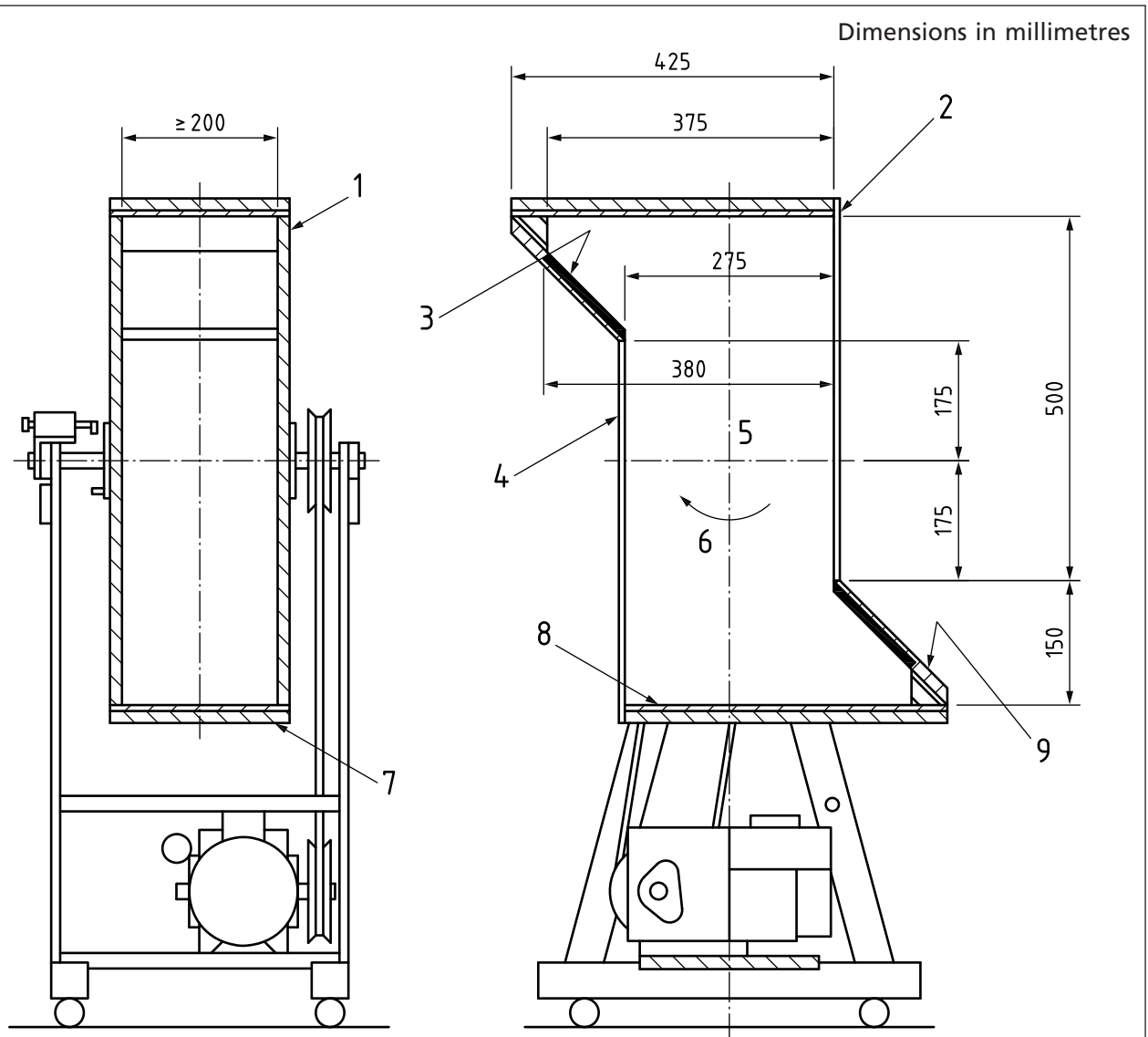
Damage to the finish, small dents which do not reduce creepage distances and clearances below the values specified in Clause **10** and small chips that do not adversely affect the protection against electric shock or moisture shall be ignored.

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

## 19.2 Tumbling barrel test method

Travel adaptors shall be tested in the tumbling barrel shown in Figure 11.

Figure 11 Tumbling barrel



### Key

- 1 19 mm nominal thickness blockboard or suitable alternative
- 2 Transparent sheet for observation purposes. Can be removable for loading
- 3 Shelves faced with non-grip material
- 4 Transparent sheet for observation purposes. Can be removable for loading
- 5 Centre of axis
- 6 Direction of rotation
- 7 19 mm nominal thick blockboard can be removable for the replacement of the impact plates
- 8 Impact base 9 mm nominal thick plywood to be replaceable (both ends)<sup>A)</sup>
- 9 19 mm nominal thick blockboard or suitable alternative

<sup>A)</sup> 9 mm nominal plywood having an impact face of birch, 1.4 mm nominal thickness and of 5 ply construction.

**NOTE 1** This drawing is not intended to govern design except as regards the dimensions and specific requirements shown.

**NOTE 2** All dimensions, other than those governing material thickness, are subject to a tolerance of  $\pm 3$  mm.

The travel adaptor shall be dropped from a height of approximately 500 mm onto a plywood base with a nominal thickness of 9 mm.

The plywood base shall have an impact face of birch of a nominal thickness of 1.4 mm and be of 5-ply construction.

The barrel shall be turned at a rate of approximately 5 r.p.m. so that 10 falls per minute take place.

Only one travel adaptor shall be tested at a time. Each travel adaptor shall be dropped 25 times.

Configurable adaptors shall be tested in the most onerous configuration.

*NOTE Each of the three samples tested might be differently configured.*

Additional samples shall be tested to confirm the performance of all detachable parts.

### 19.3 Pendulum impact test method

Travel adaptors shall be tested with the impact test apparatus shown in Figure 12 a) when mounted in a socket-outlet.

The pendulum shall consist of a steel tube with an external diameter of 9 mm and a wall thickness of 0.5 mm, suspended in such a way that it only swings in a vertical plane. A hammer shall be rigidly fixed to the lower end.

The striking element shall have a hemispherical face made of polyamide having a Rockwell hardness of  $(100 \pm 5)$  HR, or hornbeam, and a radius of  $(10 \pm 0.5)$  mm [see Figure 12 b)].

The design of the apparatus shall be such that a force of between 1.9 N and 2 N has to be applied to the face of the hammer to maintain the pendulum in a horizontal position.

A flush socket-outlet conforming to BS 1363-2 shall be mounted with its associated box, which is placed in a block of hardwood which is itself fixed to a sheet of plywood. The wood used shall have the direction of the wood fibres perpendicular to the direction of impact.

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

The mounting support [see Figure 12 c)], having a mass of  $(10 \pm 1)$  kg, shall be mounted on a rigid bracket by means of pivots. The bracket shall be mounted on a frame which is fixed to a solid wall.

The design of the mounting assembly shall be such that:

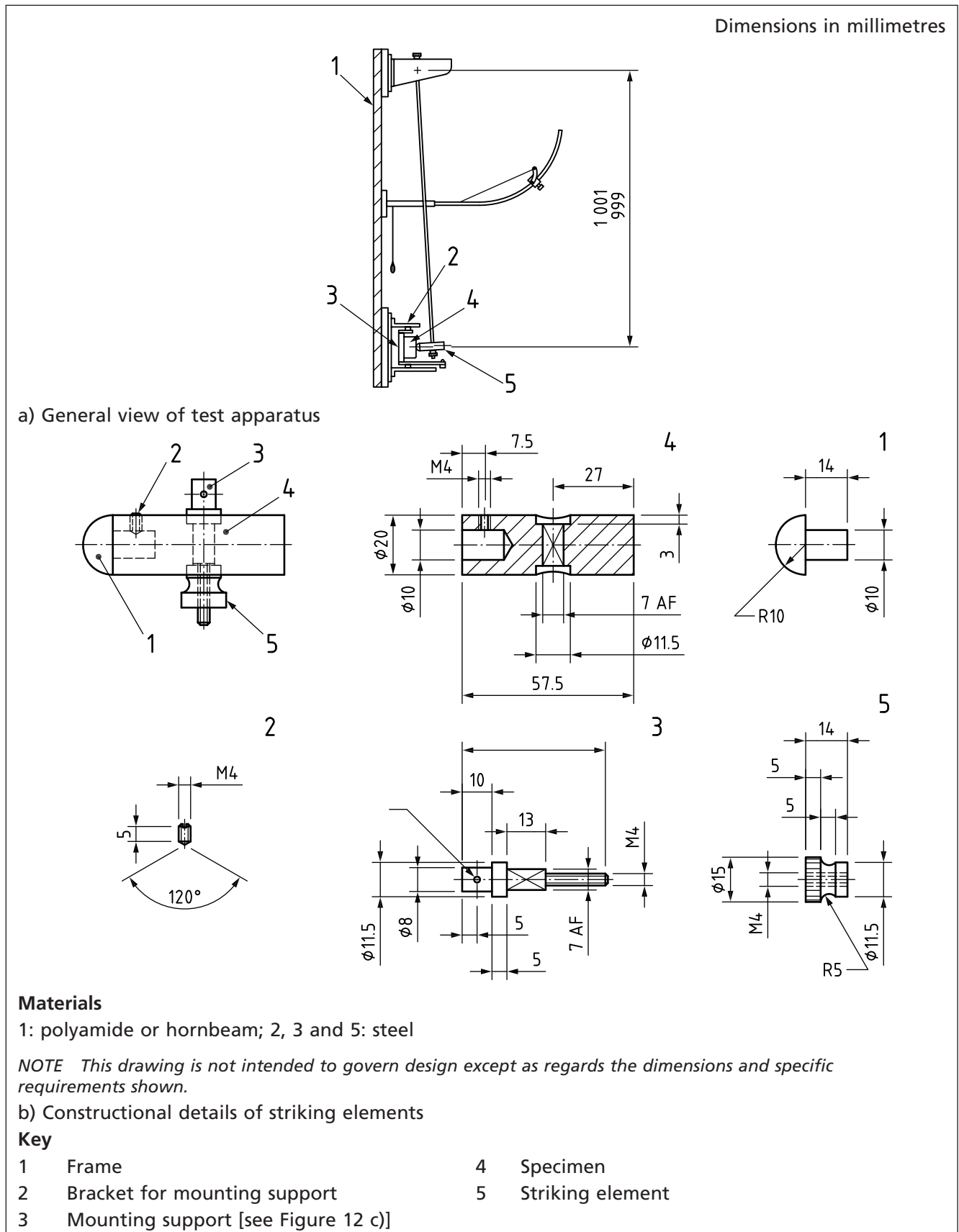
- a) the specimen can be so placed that the point of impact lies in the vertical plane through the axis of the pivot of the pendulum;
- b) the specimen can be moved horizontally and turned about an axis perpendicular to the surface of the plywood; and
- c) the plywood can be turned about a vertical axis.

The travel adaptor shall be inserted into the socket-outlet so that the point of impact lies in the vertical plane through the axis of the pivot of the pendulum.

For all tests the hammer shall fall from a height of  ${}_0^{+150}$  mm measured vertically between the point of impact on the specimen and the face of the hammer at the point of release. Ten blows shall be applied to points evenly distributed over the adaptor, and any lens shall receive one blow of the hammer at a point approximately in its centre.

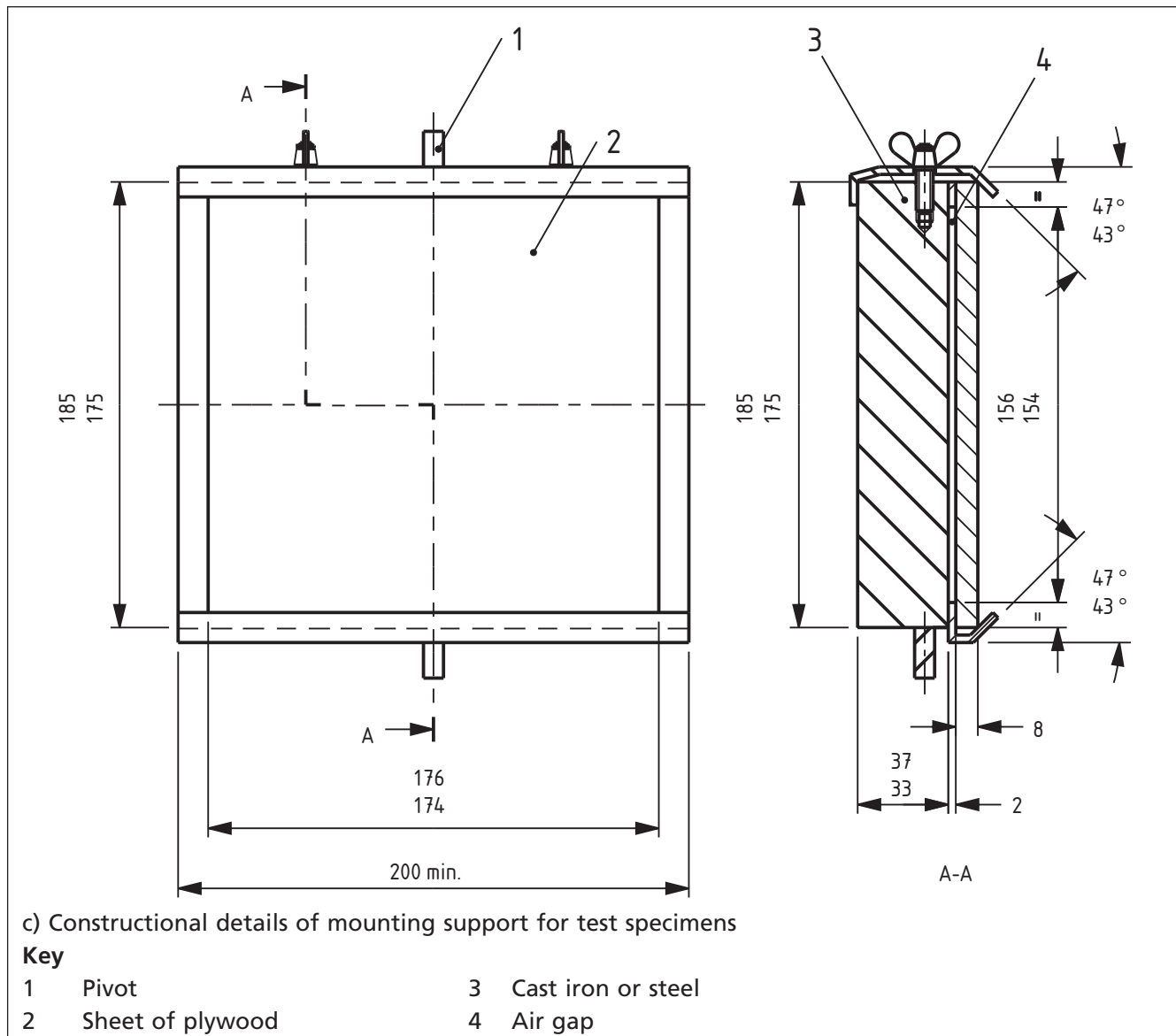


Figure 12 Pendulum impact test (1 of 2)



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Figure 12 Pendulum impact test (2 of 2)



## 19.4 Plug pin retention

### 19.4.1 Requirements

Travel adaptors 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 travel adaptor during normal use.

When tested in accordance with 19.4.2, the travel adaptor pins shall satisfy the dimensional requirements of Clause 9.

### 19.4.2 Test method

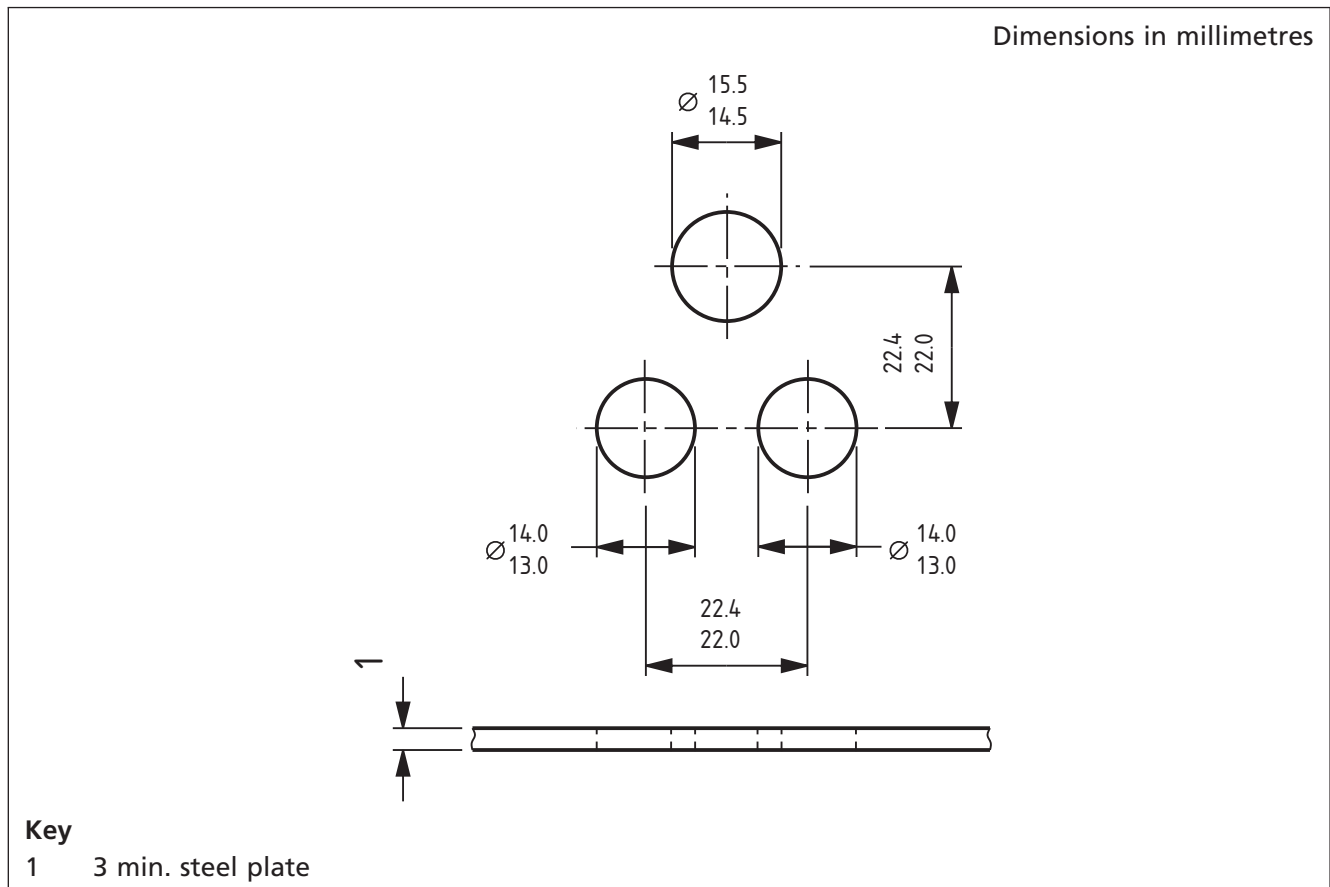
Upon completion of the tumbling barrel test (see 19.2), each pin shall be subjected for  $(60 \pm 5)$  s to a pull of  $100_{-2}^0$  N in one smooth and continuous movement in the direction of the major axis.

The adaptor shall be mounted using the steel plate shown in Figure 13.

The apparatus shall be placed within an oven with the pull applied 1 h after the travel adaptor body has attained the test temperature of  $(70 \pm 5)$  °C and while maintained at this temperature.

Accessories which pass shall repeat the tests in Clause 17 and Clause 18.

Figure 13 Mounting plate



## 20 Resistance to heat

### 20.1 General

#### 20.1.1 Requirements

When tested in accordance with 20.1.2, travel adaptors shall not undergo any change impairing their further use and any sealing compound shall not flow to such an extent that live parts are exposed.

*NOTE A slight displacement of the sealing compound can be disregarded.*

#### 20.1.2 Test method

Travel adaptors shall be kept for  $(60 \pm 5)$  min in a heating cabinet maintained at  $(70 \pm 5)$  °C.

After the test the travel adaptor shall conform to Clause 11 and Clause 17.

### 20.2 Resilient materials

#### 20.2.1 Requirement

When tested in accordance with 20.2.2, travel adaptors shall not undergo any change impairing their further use and the adaptors shall conform to Clause 17 and the dimensional requirements of Clause 9.

### 20.2.2 Test method

Travel adaptors with external parts of resilient material, e.g. rubber or elastomeric, shall be subjected to a pressure test by means of an apparatus similar to that shown in Figure 14.

The test shall be made in a heating cabinet at a temperature of  $(70 \pm 5) ^\circ\text{C}$ .

The adaptor shall be clamped 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.

The force applied through, and including the effect of, the jaws shall be  $20_{-1}^0$  N.

After  $(60 \pm 5)$  min, the jaws shall be removed.

Figure 14 Apparatus for pressure test on portable accessories (1 of 2)

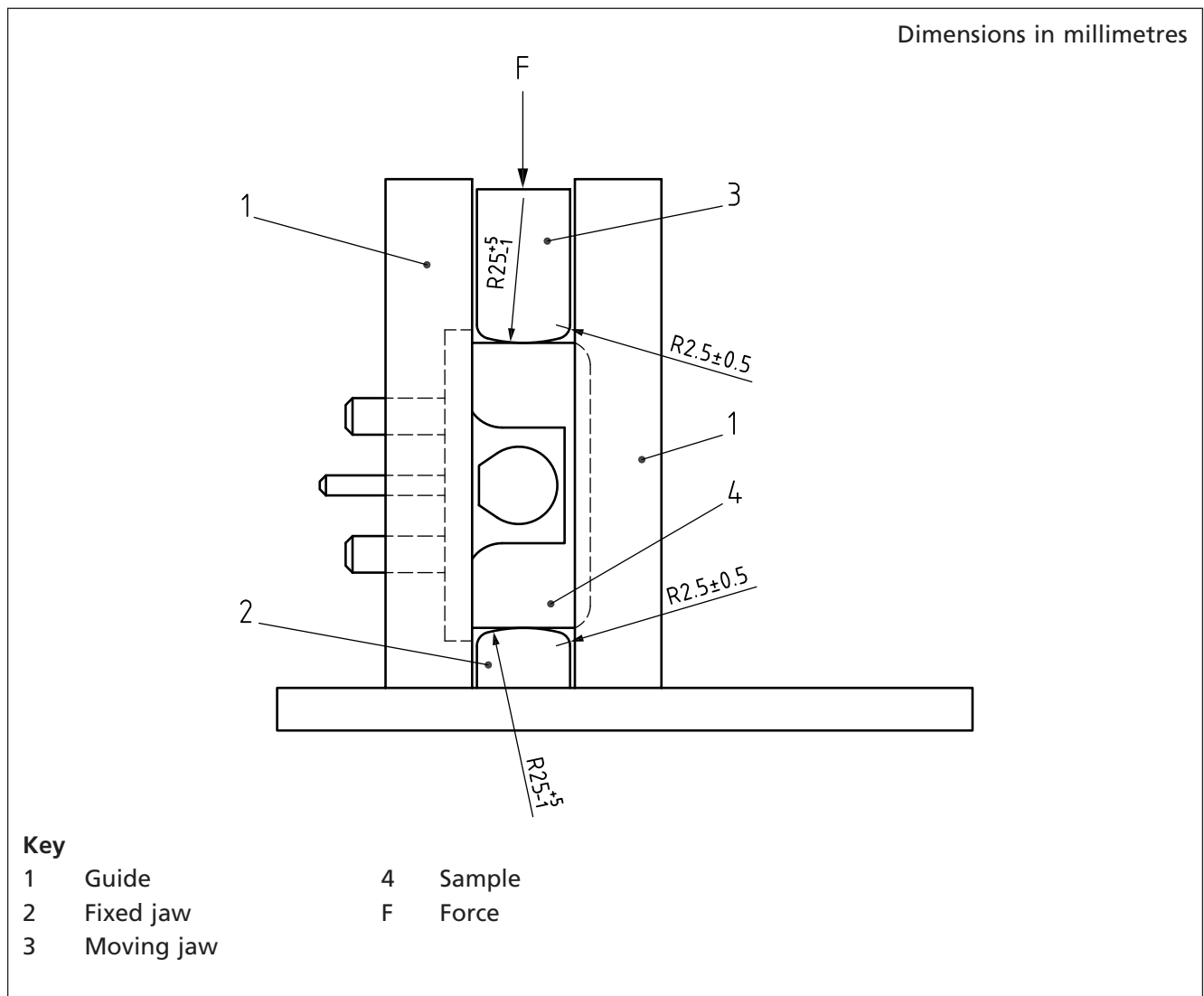
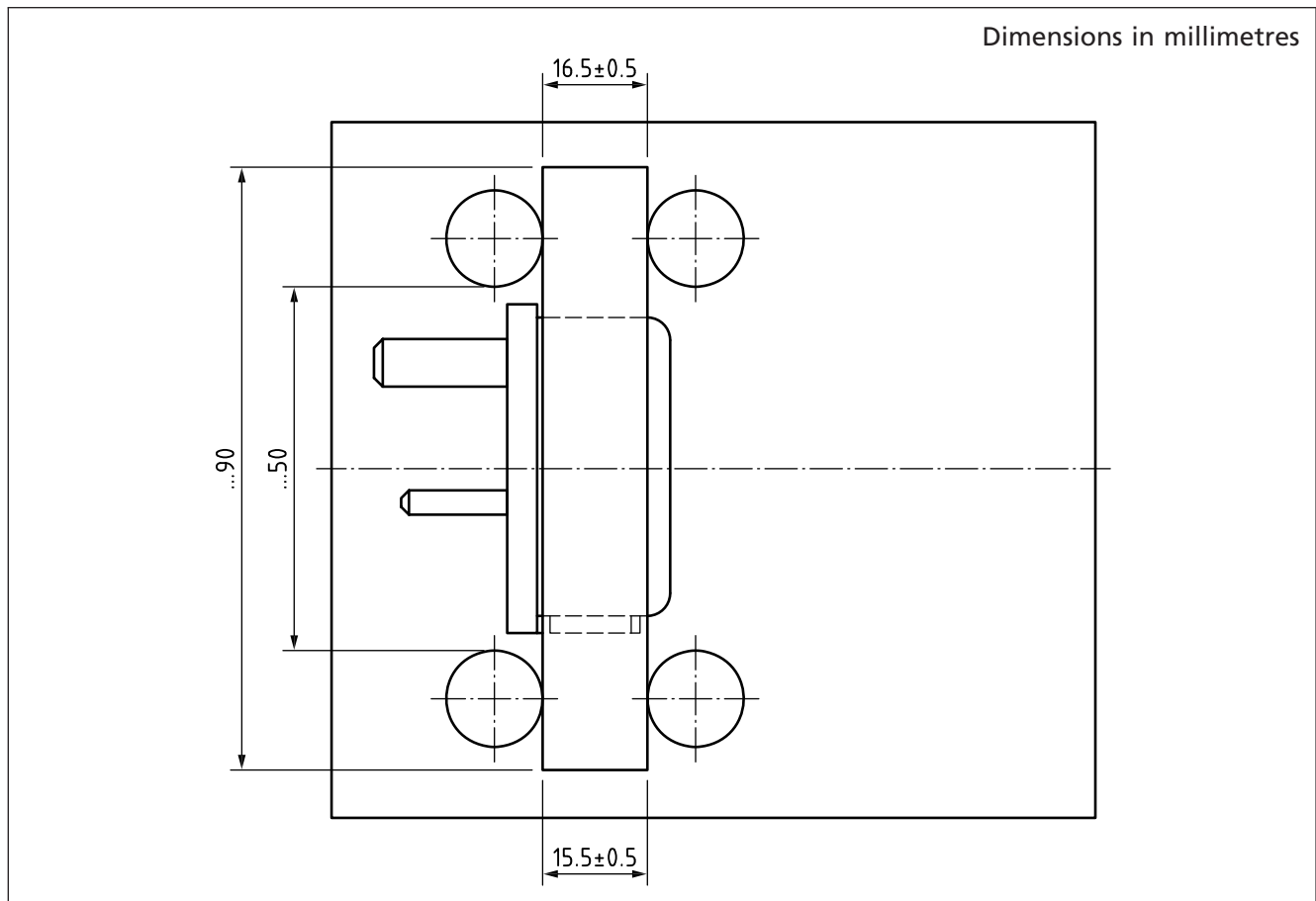


Figure 14 Apparatus for pressure test on portable accessories (2 of 2)



## 20.3 Non-resilient insulating materials

### 20.3.1 Requirements

Parts of insulating material other than those tested in accordance with 20.1.2 shall be sufficiently resistant to heat, having particular regard for their location and function in the complete travel adaptor.

When tested in accordance with 20.3.2, the diameter of the impression caused by the ball shall not exceed 2 mm.

Conformity shall be checked as follows:

- a) parts of ceramic material shall be deemed to conform without test;
- b) external parts of travel adaptors tested in accordance with Clause 22 shall be deemed to conform without further testing;
- c) parts of insulating material necessary to retain in position, current-carrying parts, ISODs if fitted, and parts of the earthing circuit shall be subjected to the ball pressure test in accordance with BS EN 60695-10-2;
- d) all other parts of insulating material shall be subjected to the ball pressure test in accordance with BS EN 60695-10-2.

### 20.3.2 Test method

For 20.3.1 c), the test shall be made in a heating cabinet maintained at a temperature of  $(125 \pm 5)$  °C.

For 20.3.1 d), the test shall be made in a heating cabinet at a temperature of  $(75 \pm 5)$  °C.

After the test the diameter of the impression caused by the ball shall be measured.

## 21 Resistance of insulating material to abnormal heat, and to fire

### 21.1 Requirements

When tested in accordance with 21.2, parts of insulating material which might be exposed to thermal stresses due to electric effects and whose deterioration might impair the safety of the travel adaptor, shall satisfy one of the following criteria.

- a) There shall be no visible flame and no sustained glowing.
- b) Flames and glowing shall extinguish within 30 s after the removal of the glow-wire, with no ignition of the wrapping tissue or scorching of the board.

### 21.2 Glow-wire test method

*NOTE* If possible, the specimen should be a complete travel adaptor. If the test cannot be made on a complete travel adaptor, a suitable part can be cut from it for the purpose of the test.

The test shall be performed in accordance with BS EN 60695-2-11:2014, Clause 5 to Clause 11, under the following conditions:

- a) for parts of insulating material necessary to retain current-carrying parts in position, by the test made at a temperature of  $(750 \pm 10)$  °C;
- b) for parts of insulating material not necessary to retain current-carrying parts in position, although they might be in contact with them, by the test made at a temperature of  $(650 \pm 10)$  °C.

If it is necessary to perform the tests at more than one place on the same travel adaptor, any deterioration caused by previous tests shall not affect the result of subsequent tests.

The test shall not be performed on:

- 1) small parts, e.g. washers; or
- 2) parts made of ceramic material.

The test shall be made on one specimen. In case of doubt, the test shall be repeated on two further specimens.

The test shall be made by applying the glow-wire once.

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

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

## 22 Resistance to excessive residual stresses and to rusting

### 22.1 Current-carrying parts of copper alloy: resistance to excessive residual stresses

#### 22.1.1 Requirements

Current-carrying parts of copper alloy containing less than 80% of copper, which are press-formed or produced in a similar manner and which could induce excessive internal stresses, shall be resistant to failure in use due to brittleness.

When tested in accordance with 22.1.2, there shall be no cracks visible with normal or corrected vision without additional magnification.

#### 22.1.2 Test method

The sample shall be degreased in an alkaline degreasing solution or organic solvent.

The sample shall then be immersed in an aqueous solution of mercurous nitrate containing 10 g of  $\text{Hg}_2(\text{NO}_3)_2$  and 10 mL of  $\text{HNO}_3$  (relative density 1.42) per litre of solution for  $(30 \pm 1)$  min at a temperature of  $(20 \pm 5)$  °C.

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

### 22.2 Ferrous parts: resistance to corrosion/rust

#### 22.2.1 Requirements

When tested in accordance with 22.2.2, ferrous parts, including covers and boxes, shall show no signs of rust.

#### 22.2.2 Test method

The sample shall be degreased in a suitable alkaline degreasing solution or organic solvent.

The sample shall then be immersed for  $(10 \pm 0.5)$  min in a 10% (*m/m*) solution of ammonium chloride in water at a temperature of  $(20 \pm 5)$  °C.

On removal of the sample from the solution, excess solution shall be shaken off without drying.

The sample shall then be placed for  $(10 \pm 0.5)$  min in a box containing air saturated with moisture at a temperature of  $(20 \pm 5)$  °C.

The sample shall be dried for  $(10 \pm 0.5)$  min in a heating cabinet at a temperature of  $(100 \pm 5)$  °C.

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

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

Annex A  
(normative)**Relationship between rated impulse withstand voltage, rated voltage and overvoltage category**

The relationship between rated impulse withstand voltage, rated voltage and overvoltage category shall be as given in Table A.1.

Table A.1 **Rated impulse withstand voltage for accessories energized directly from the low voltage mains**

| Nominal voltage of the supply system based on IEC/TR 60038 <sup>A)</sup> | Voltage line-to-neutral derived from nominal voltages a.c. or d.c. | Rated impulse withstand voltage |       |       |
|--|--|---------------------------------|-------|-------|
|  |  | V                               |       |       |
|  |  | Overvoltage category            |       |       |
| V  | V  | I                               | II    | III   |
| 230/400  | Up to and including 300  | 1 500                           | 2 500 | 4 000 |

<sup>A)</sup> 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.

*NOTE 1 For more information concerning supply systems, see BS EN 60664-1.*

*NOTE 2 For more information concerning overvoltage category, see BS EN 60664-1.*

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

Annex B  
(normative)**Pollution degree***COMMENTARY ON ANNEX B*

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

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

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

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

For the purpose of evaluating creepage distances and clearances, one of the following three degrees of pollution in the micro-environment shall be used, as declared by the manufacturer.

- **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 C  
(normative)**Impulse withstand voltage test****C.1 General**

This test shall verify that solid insulation, and clearances not verified by measurement, withstands specified transient overvoltage. The impulse withstand voltage test shall be carried out with a voltage having a lightning impulse waveform as specified in BS EN 60060-1 with  $T_1/T_2 = 1.2/50 \mu\text{s}$  and is intended to simulate overvoltage of atmospheric origin. The test also covers overvoltages due to switching of low-voltage equipment.

**C.2 Procedure**

The test shall be conducted for a minimum of three impulses of each polarity with an interval of at least 1 s between impulses. There shall be no discharges during the test. Glow discharges without drop in voltage shall be ignored.

For solid insulation and for clearances not verified 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) a metal foil in contact with the entire accessible external surface;
  - 2) the earthing terminal/terminations;
  - 3) any metal part of a cord anchorage;
- c) each switched pole terminal of a switched accessory with the switch contacts open.

*NOTE 1* The output impedance of the impulse generator should be not greater than 500  $\Omega$ .

*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 waveform 1.2/50  $\mu\text{s}$  for the no load voltage with amplitudes equal to the values given in Table C.1.

*NOTE 3* If the sample is provided with surge suppression the impulse voltage wave can 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 C.1 Test voltages for impulse withstand test

| Rated impulse withstand voltage $\hat{U}$<br>kV | Impulse test voltage at sea level $\hat{U}$<br>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 is subjected to the test voltage. As the impulse test voltage of Table C.1 is increased with respect to the rated impulse withstand voltage, solid insulation needs to be designed accordingly. This results in an increased impulse withstand capability of the solid insulation.

**NOTE 2** The test can 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 is not subjected to the same withstand voltage 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.

## Annex D (normative) Measurement of clearances and creepage distances

Measurement of clearances and creepage distances shall be carried out in accordance with Figure D.1 to Figure D.11, as applicable.

The value of width  $X$  specified in Figure D.1 to Figure D.11 shall be a function of the pollution degree as given in Table D.1.

Table D.1 Minimum values of width  $X$ 

| Pollution degree<br>(see Annex B) | Minimum values of width $X$<br>mm |
|-----------------------------------|-----------------------------------|
| 1                                 | 0.25                              |
| 2                                 | 1.0                               |
| 3                                 | 1.5                               |

**NOTE 1** If the associated clearance is less than 3 mm, the minimum groove width can be reduced to one third of this clearance.

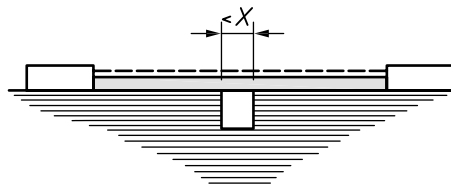
**NOTE 2** The examples do not differentiate between gaps and grooves or between types of insulation.

The following rules shall be applied.

- Any recess shall be 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 Figure D.3).
- Where the distance across a groove is equal to or larger than the specified width  $X$ , the creepage distance shall be measured along the contours of the groove (see Figure D.2).
- Creepage distances and clearances measured between parts which can assume different positions in relation to each other shall be measured when these parts are in their most unfavourable position.

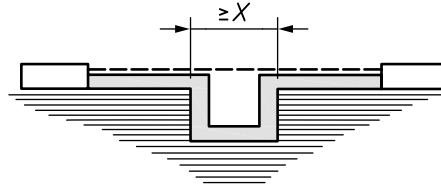
Key to Figure D.1 to Figure D.11

----- Clearance  
 ——— Creepage distance

Figure D.1 **EXAMPLE 1**

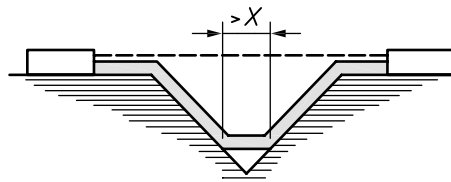
Condition: Path under consideration includes a parallel- or converging-sided groove of any depth with a width less than  $X$  mm.

Rule: Creepage distance and clearance shall be measured directly across the groove as shown.

Figure D.2 **EXAMPLE 2**

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

Rule: Clearance shall be the "line of sight" distance. Creepage path shall follow the contour of the groove.

Figure D.3 **EXAMPLE 3**

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

Rule: Clearance shall be the "line of sight" distance. Creepage path shall follow the contour of the groove but "short circuit" the bottom of the groove by an  $X$  mm link.

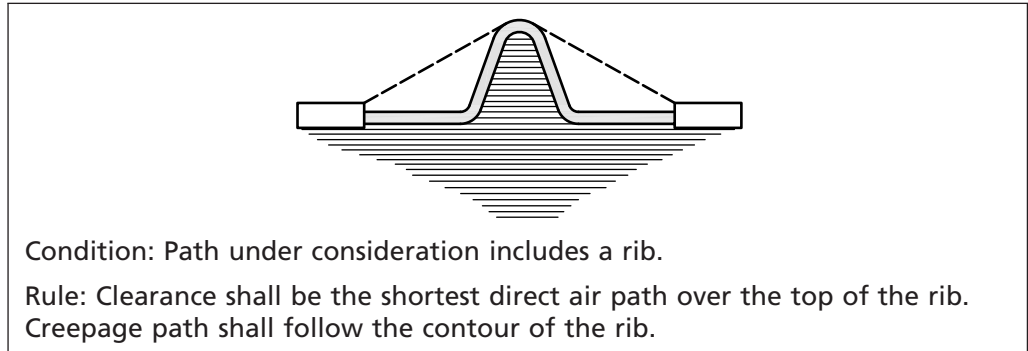
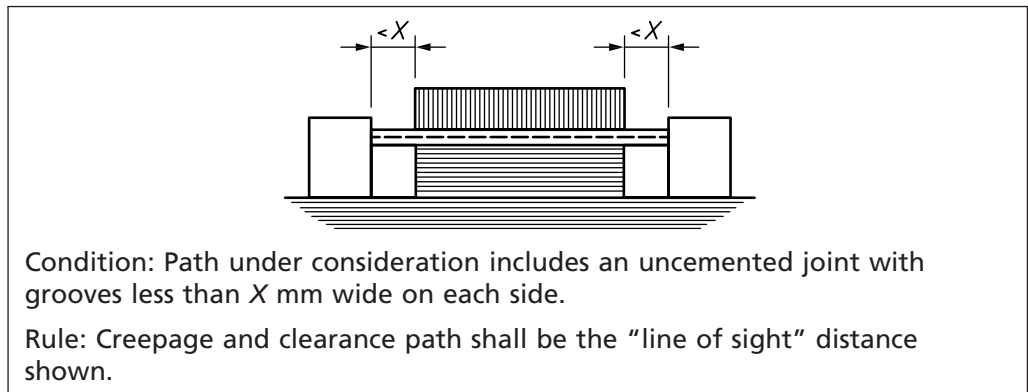
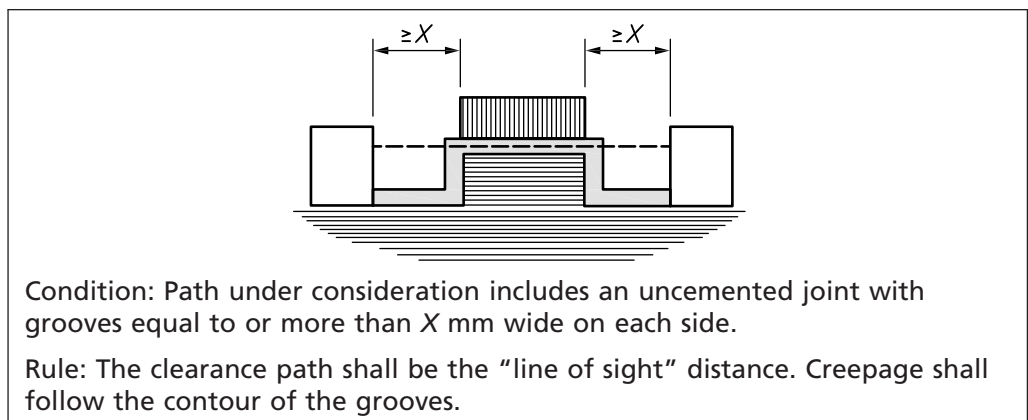
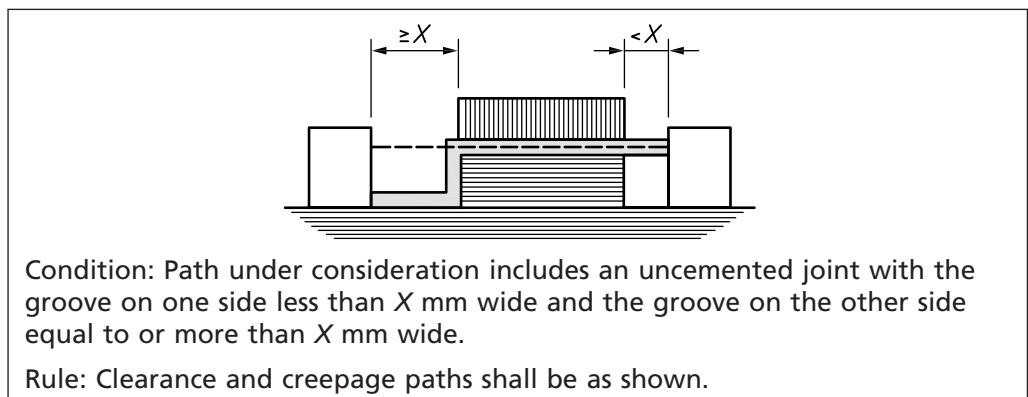
Figure D.4 **EXAMPLE 4**Figure D.5 **EXAMPLE 5**Figure D.6 **EXAMPLE 6**Figure D.7 **EXAMPLE 7**

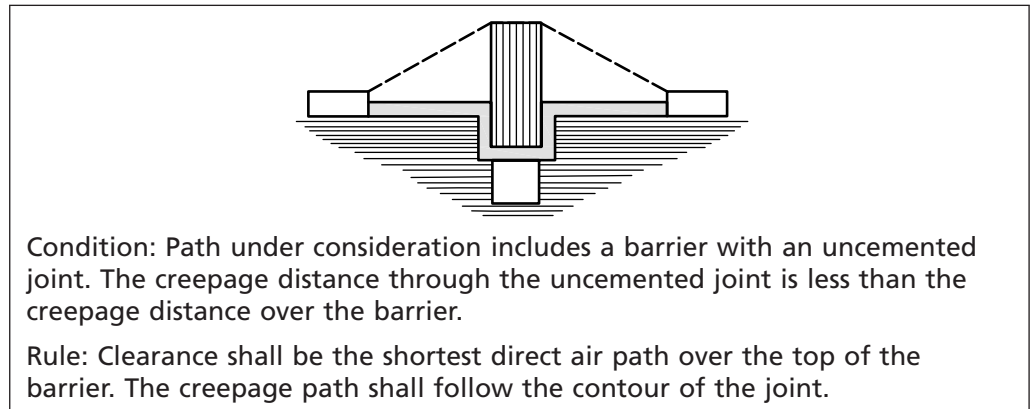
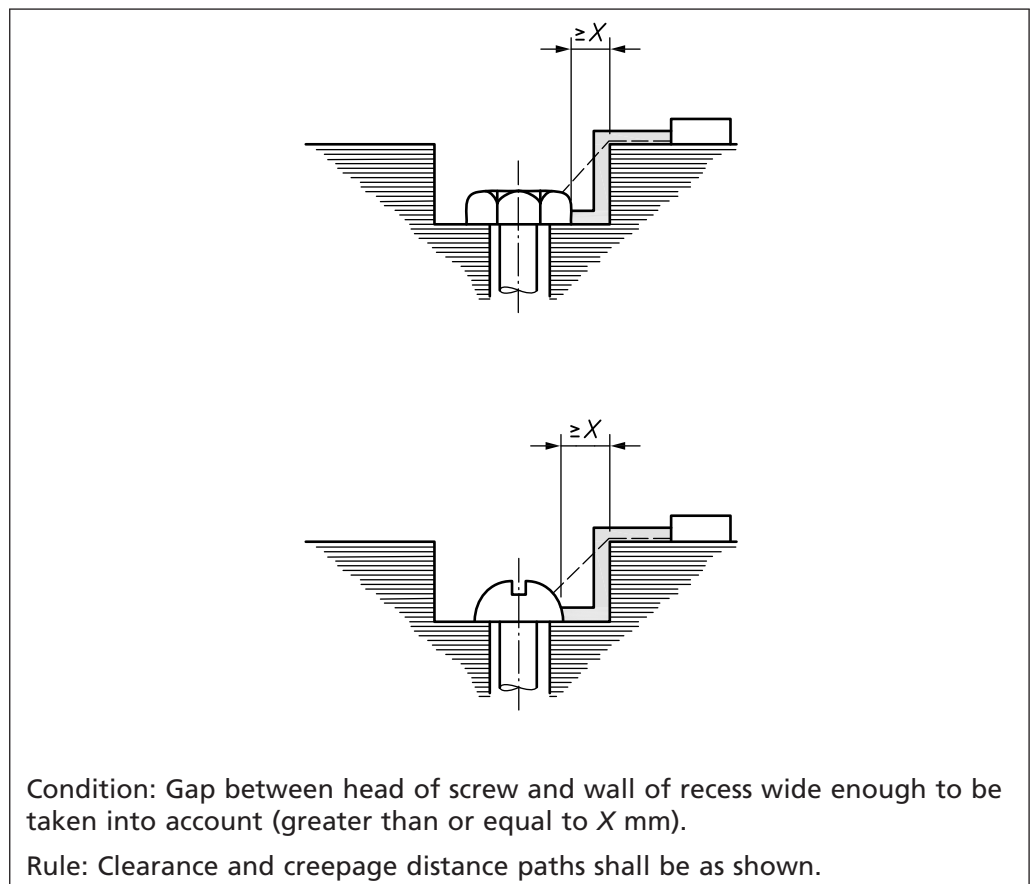
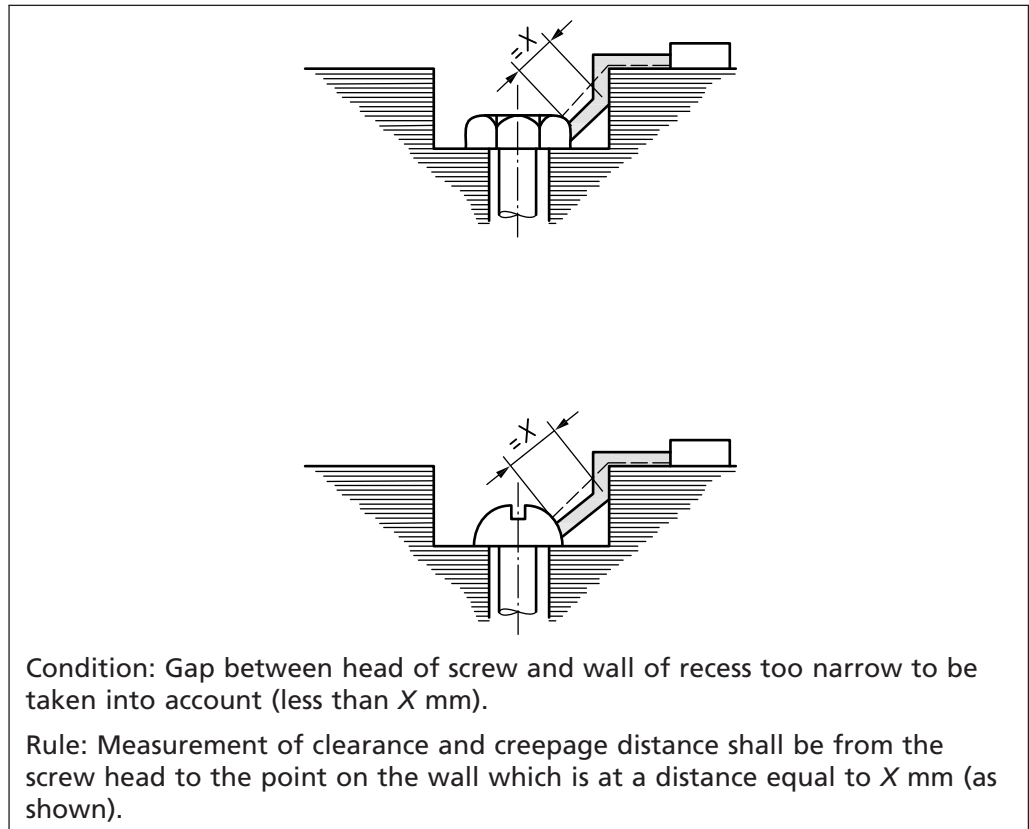
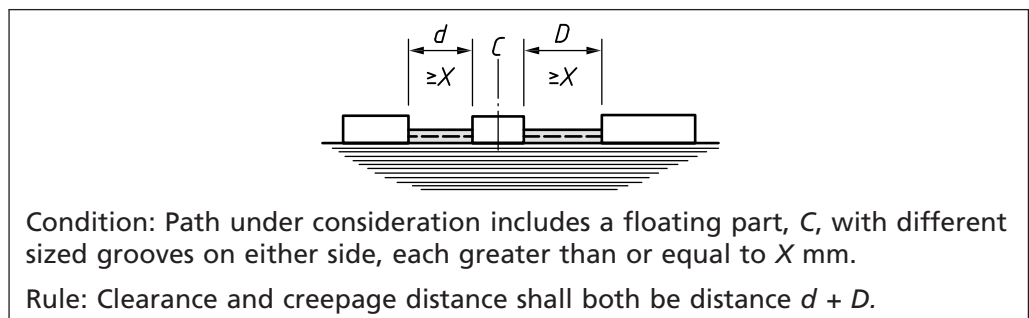
Figure D.8 **EXAMPLE 8**Figure D.9 **EXAMPLE 9**

Figure D.10 **EXAMPLE 10**Figure D.11 **EXAMPLE 11**

### Annex E (normative)

## Determination of the comparative tracking index (CTI) and proof tracking index (PTI)

The CTI or PTI shall be determined in accordance with BS EN 60112, with the following provisions:

- a) in BS EN 60112:2003+A1:2009, Clause 5 Test specimen:
  - Note 3 and the last paragraph also apply to PTI;
  - if the surface ( $15 \times 15$ ) mm cannot be obtained because of the small dimensions of the PT system then special samples made with the same manufacturing process can be used;
- b) the test solution "A" described in BS EN 60112:2003+A1:2009, 7.3, shall be used;

- c) in BS EN 60112:2003+A1:2009, Clause 8, either CTI or PTI is determined:
- CTI shall be determined in accordance with BS EN 60112:2003+A1:2009, Clause 11;
  - the PTI test of BS EN 60112:2003+A1:2009, Clause 10, shall be performed on five samples at the voltage referred to in BS EN 60112:2003+A1:2009, 10.1, based on the appropriate creepage distance, material group, pollution degree and on the rated voltage of this British Standard as declared by the manufacturer.

Annex F  
(normative)

## USB circuits intended for charging portable devices

### F.1 General

#### F.1.1 Requirements

USB circuits incorporated in a travel adaptor shall conform with the requirements of:

- a) BS EN 60950-1; or
- b) BS EN 62368-1; or
- c) BS EN 61558-2-16 and BS EN 61558-2-6; and
- d) BS EN 62680-1-1.

The USB circuit shall be tested as a component or sub-assembly to BS EN 60950-1 or BS EN 62368-1 or BS EN 61558-2-16 and BS EN 61558-2-6, and when incorporated into the travel adaptor the USB circuit shall meet the requirements of BS EN 60950-1 or BS EN 62368-1 or BS EN 61558-2-16 (used in conjunction with BS EN 61558-2-6) as far as they reasonably apply. If it is not practical to meet a particular requirement of BS EN 60950-1 or BS EN 62368-1 or BS EN 61558-2-16 (used in conjunction with BS EN 61558-2-6) then measures shall be taken to achieve an equivalent level of safety with particular regard to reduction of the risks of fire, electric shock or injury for the operator or layman who might come into contact with the equipment.

The requirements in F.2 to F.8 relating to the appropriate use of the component or sub-assembly in the travel adaptor shall be met.

#### F.1.2 Verification

Conformity shall be verified by inspection of compliance evidence or by test, and in accordance with F.2 to F.8.

### F.2 Power rating and identification markings

#### F.2.1 Requirements

The input voltage rating of the USB circuit shall be compatible with the voltage rating of the travel adaptor.

The input voltage rating of the USB circuit shall not be marked on the travel adaptor.

USB outlets shall be marked with the following, such that the marking is visible after the travel adaptor has been installed as in normal use:

- a) symbol for nature of supply, for d.c. only;
- b) rated current, in milliamperes or amperes; and
- c) rated output voltage.

## **F.2.2 Verification of markings**

Conformity shall be checked by the tests of **8.1.6**, **8.2.1**, **8.2.2** and **8.2.3**.

## **F.3 Overcurrent and earth fault protection in primary circuits**

### **F.3.1 Requirements**

There shall be overcurrent protection in the primary circuit of the USB circuit.

Where overcurrent protection is not provided within the USB circuit, provision shall be made for appropriate overcurrent protection in the supply to the USB circuit within the travel adaptor. The USB circuit shall not rely on the building or installation protection device for overcurrent protection.

A single overcurrent protection device shall be provided and it shall be located in the line circuit, either within the USB circuit or in the supply to the USB circuit within the travel adaptor.

### **F.3.2 Verification**

Conformity shall be verified by inspection or, alternatively, by reference to the compliance evidence for the incorporated USB circuit.

## **F.4 Clearances, creepage distances and distances through insulation**

### **F.4.1 Requirements**

Double or reinforced insulation shall be provided between the primary and secondary circuits of the USB circuit. The output of the USB circuit shall be SELV or equivalent.

When installed in the travel adaptor, double or reinforced insulation shall be provided between the primary circuit and accessible parts of the travel adaptor.

*NOTE USB circuits are generally tested as overvoltage CAT II whereas adaptors are overvoltage CAT III.*

The USB circuit shall be either:

- a) built and designed to meet the requirements of overvoltage CAT III; or
- b) have additional overvoltage protection within the travel adaptor, i.e. a varistor or equivalent.

*NOTE BS EN 60664 gives guidance on the use of appropriate overvoltage reduction.*

### **F.4.2 Verification**

Conformity shall be verified by inspection of compliance evidence for the incorporated USB circuit or by the tests in Clause **10**.

## **F.5 Disconnection from the mains supply**

The disconnect device specified in BS EN 60950-1 shall be provided by the travel adaptor plug pins.



## F.6 Mechanical strength

### F.6.1 Requirement

Incorporated USB circuits shall have adequate mechanical strength.

### F.6.2 Verification

The requirements of Clause 19 shall be applied for USB circuits when incorporated in the travel adaptor.

*NOTE* The mechanical strength requirements of BS EN 60950-1 are not applicable.

## F.7 Risk of ignition and spread of flame

### F.7.1 Requirements

The USB circuit shall be resistant to ignition and the spread of flame.

One of the following methods shall be used:

- a) Method 1: A fire enclosure shall be provided conforming to BS EN 60950-1; or
- b) Method 2: Assessment and testing of all possible single fault tests shall be applied.

*NOTE* In this case a fire enclosure is not required for equipment or that portion of equipment for which testing of all relevant components in both PRIMARY CIRCUITS and SECONDARY CIRCUITS has been carried out.

Whichever method is selected, the USB circuit shall also conform to Clause 20 and Clause 21.

### F.7.2 Verification

Conformity shall be confirmed by inspection of the compliance evidence for the USB circuit and by test.

## F.8 Performance

### F.8.1 Requirements

The USB circuit intended for charging portable devices shall conform to the requirements for dedicated charging ports (DCP) of BS EN 62680-1-1.

### F.8.2 Verification

Conformity shall be verified by inspection of compliance evidence or by test.

Annex G  
(normative)

## Requirements for incorporated electronic components

### G.1 General

Incorporated electronic components shall conform to their relevant standard(s).

*NOTE* Conformity with a standard for the relevant component does not necessarily ensure conformity to this standard.

### G.2 EMC requirements

Travel adaptors incorporating electronic circuits, apart from inherently benign components, shall conform to the immunity and emission requirements of the relevant product or generic BS EN 61000 standard series, in particular:

- a) BS EN 61000-6-1; and
- b) BS EN 61000-6-3.

*NOTE* Inherently benign components do not normally generate electromagnetic disturbances. Examples of inherently benign components are LED indicators, diodes, resistors, varistors, capacitors, surge suppressors and inductors. This list is not exhaustive.

## Bibliography

### Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 60417 (all parts), *Graphical symbols for use on equipment*<sup>4)</sup>

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

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

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<sup>4)</sup> Withdrawn.

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