



# MALAYSIAN STANDARD

MS 589-2:2018

<http://www.china-gauges.com/>

**13 A plugs, socket-outlets, adaptors and  
connection units - Part 2: Specification for  
13 A switched and unswitched socket-outlets  
(Fourth revision)**

**ICS: 29.120.30**

Descriptors: specification, plugs, fuse, socket-outlets, adaptors, connection unit, switched,  
unswitched

**© Copyright 2018**

**DEPARTMENT OF STANDARDS MALAYSIA**

## DEVELOPMENT OF MALAYSIAN STANDARDS

The **Department of Standards Malaysia (STANDARDS MALAYSIA)** is the national standards and accreditation body of Malaysia.

The main function of STANDARDS MALAYSIA is to foster and promote standards, standardisation and accreditation as a means of advancing the national economy, promoting industrial efficiency and development, benefiting the health and safety of the public, protecting the consumers, facilitating domestic and international trade and furthering international cooperation in relation to standards and standardisation.

Malaysian Standards (MS) are developed through consensus by committees which comprise balanced representation of producers, users, consumers and others with relevant interests, as may be appropriate to the subject at hand. To the greatest extent possible, Malaysian Standards are aligned to or are adoption of international standards. Approval of a standard as a Malaysian Standard is governed by the Standards of Malaysia Act 1996 [Act 549]. Malaysian Standards are reviewed periodically. The use of Malaysian Standards is voluntary except in so far as they are made mandatory by regulatory authorities by means of regulations, local by-laws or any other similar ways.

For the purposes of Malaysian Standards, the following definitions apply:

**Revision:** A process where existing Malaysian Standard is reviewed and updated which resulted in the publication of a new edition of the Malaysian Standard.

**Confirmed MS:** A Malaysian Standard that has been reviewed by the responsible committee and confirmed that its contents are current.

**Amendment:** A process where a provision(s) of existing Malaysian Standard is altered. The changes are indicated in an amendment page which is incorporated into the existing Malaysian Standard. Amendments can be of technical and/or editorial nature.

**Technical corrigendum:** A corrected reprint of the current edition which is issued to correct either a technical error or ambiguity in a Malaysian Standard inadvertently introduced either in drafting or in printing and which could lead to incorrect or unsafe application of the publication.

NOTE: Technical corrigenda are not to correct errors which can be assumed to have no consequences in the application of the MS, for example minor printing errors.

STANDARDS MALAYSIA has appointed **SIRIM Berhad** as the agent to develop, distribute and sell Malaysian Standards.

For further information on Malaysian Standards, please contact:

**Department of Standards Malaysia**  
Ministry of Science, Technology and Innovation  
Level 1 & 2, Block 2300, Century Square  
Jalan Usahawan  
63000 Cyberjaya  
Selangor Darul Ehsan  
MALAYSIA

Tel: 60 3 8318 0002  
Fax: 60 3 8319 3131  
<http://www.jsm.gov.my>  
E-mail: [central@jsm.gov.my](mailto:central@jsm.gov.my)

OR **SIRIM Berhad**  
(Company No. 367474 - V)  
1, Persiaran Dato' Menteri  
Section 2, P. O. Box 7035  
40700 Shah Alam  
Selangor Darul Ehsan  
MALAYSIA

Tel: 60 3 5544 6000  
Fax: 60 3 5510 8095  
<http://www.sirim.my>  
E-mail: [msonline@sirim.my](mailto:msonline@sirim.my)

## Contents

	<b>Page</b>
Committee representation .....	iii
Foreword.....	iv
1 Scope.....	1
2 Conditions of use.....	1
3 Terms and definitions.....	2
4 General .....	6
5 General conditions for type testing .....	6
6 Classification .....	8
7 Marking and labelling .....	9
8 Clearances, creepage distances and solid insulation.....	13
9 Accessibility of live parts .....	17
10 Provision for earthing .....	18
11 Terminals and terminations .....	19
12 (Not used).....	23
13 Construction of socket-outlets .....	24
14 Resistance to ageing, resistance to humidity and protection provided by enclosures .....	31
15 Insulation resistance and electric strength .....	35
16 Temperature rise .....	37
17 Breaking capacity of socket-outlets .....	40
18 Normal operation of socket-outlets.....	41
19 Connection of flexible cables and cable anchorage .....	42
20 Mechanical strength.....	45
21 Screws, current-carrying parts and connections .....	47

Contents (continued)

	Page
22 Resistance to heat .....	48
23 Resistance to abnormal heat and fire .....	50
24 Resistance to excessive residual stresses and to rusting.....	51
25 Not used.....	52
26 Cyclic loading test.....	52
Annex A The construction and calibration of a calibrated link .....	77
Annex B Measurement of clearances and creepage distances.....	79
Annex C Determination of the Comparative Tracking Index (CTI) and Proof Tracking Index (PTI) .....	85
Annex D Relation between rated impulse withstand voltage, rated voltage and Overvoltage Category.....	86
Annex E Pollution degree .....	87
Annex F Impulse voltage test.....	88
Annex G Test plug for temperature-rise test .....	90
Annex H Specific structure of BS EN 50525 and its derivation from British Standards and from HD 21 and HD 22 (BS EN 50525-1:2011, National Annex NA) .....	91
Annex J Requirements for incorporated electronic components.....	92
Bibliography .....	97

## Committee representation

The Industry Standards Committee on Generation, Transmission and Distribution of Energy (ISC E) under whose authority this Malaysian Standard was developed, comprises representatives from the following organisations:

Association of Consulting Engineers Malaysia  
Department of Standards Malaysia  
Federation of Malaysian Manufacturers  
Jabatan Kerja Raya Malaysia  
Malaysia Nuclear Power Corporation  
Malaysian Association of Standards Users  
Malaysian Cable Manufacturers Association  
Malaysian Electrical Appliances and Distributors Association  
Malaysian Green Technology Corporation  
Persatuan Kontraktor Elektrikal dan Mekanikal Malaysia  
Sabah Electricity Sdn Bhd  
Sarawak Energy Berhad  
SIRIM Berhad (Secretariat)  
SIRIM QAS International Sdn Bhd  
Suruhanjaya Komunikasi dan Multimedia Malaysia  
Suruhanjaya Tenaga  
Sustainable Energy Development Authority Malaysia  
Tenaga Nasional Berhad  
The Electrical and Electronics Association of Malaysia  
The Institution of Engineers, Malaysia  
Universiti Malaya

The Technical Committee on LVAC Transformers, Switchgears and Electrical Accessories which supervised the development of this Malaysian Standard consists of representatives from the following organisations:

Association of Consulting Engineers Malaysia  
Association of Suppliers Against Fake Electrical Equipment  
Jabatan Kerja Raya Malaysia  
SIRIM Berhad (Secretariat)  
SIRIM QAS International Sdn Bhd  
Suruhanjaya Tenaga  
The Electrical and Electronics Association of Malaysia  
TNB Distribution Sdn Bhd  
Universiti Malaya

### Co-opted members:

Megapower Manufacturing (M) Sdn Bhd  
Schneider Electric Industries (M) Sdn Bhd

The Working Group on Plugs, Socket-outlets and Switches which developed this Malaysian Standard consists of representatives from the following organisations:

Eaton Industries Sdn Bhd  
Hager Engineering (M) Sdn Bhd  
Independent  
Jabatan Kerja Raya Malaysia  
MK Electric (M) Sdn Bhd  
Schneider Electric (M) Sdn Bhd  
SIRIM Berhad (Secretariat)  
SIRIM QAS International Sdn Bhd (Product Certification and Inspection Department)  
SIRIM QAS International Sdn Bhd (Testing Services Department)  
Suruhanjaya Tenaga  
Time Era Sdn Bhd  
United MS Electrical Mfg (M) Sdn Bhd

## MS 589-2:2018

### Foreword

This Malaysian Standard was developed by the Working Group on Plugs, Socket-outlets and Switches under the authority of the Industry Standards Committee on Generation, Transmission and Distribution of Energy.

Major modifications in this revision are as follows.

- a) Inclusion of additional requirements for plugs suitable for electric vehicle charging; and
- b) incorporation of Annex J which provides requirements for incorporated electronic components

MS 589 consists of the following parts, under the general title *13 A plugs, socket-outlets, adaptors and connection units*:

*Part 1: Specification for rewirable and non-rewirable 13 A fused plugs*

*Part 2: Specification for 13 A switched and unswitched socket-outlets*

*Part 3: Specification for adaptors*

*Part 4: Specification for 13 A fused connection units switched and unswitched*

This Malaysian Standard cancels and replaces MS 589-2:2011, *13 A Plugs, socket-outlets, adaptors and connection units - Part 2: Specification for 13 A switched and unswitched socket-outlets (Third revision)*.

Compliance with a Malaysian Standard does not of itself confer immunity from legal obligations.

## 13 A plugs, socket-outlets, adaptors and connection units - Part 2: Specification for 13 A switched and unswitched socket-outlets

### 1 Scope

This Malaysian Standard specifies requirements for 13 A switched and unswitched shuttered socket-outlets for household, commercial and light industrial purposes, with particular reference to safety in normal use. The socket-outlets are suitable for the connection of portable appliances, sound-vision equipment, luminaires, etc. in a.c. circuits only, operating at voltages not exceeding 250 V r.m.s. at 50 Hz using plugs in accordance with MS 589-1. Additional requirements are included for socket-outlets suitable for electric vehicle charging.

Requirements are specified for 13 A shuttered socket-outlets in single or multiple arrangements, with or without associated controlling switches, for flush mounting in suitable boxes, e.g. conforming to BS 4662, or for surface or panel mounting or for portable use. Fixed socket-outlets are intended for use with cables conforming to MS 2112-3 or MS 2112-4 or BS 6004:2012 and cables to the relevant part of BS EN 50525 (see Annex H), having copper conductors. Portable socket-outlets are intended for use with flexible cables conforming to MS 2112-5 or relevant part of BS EN 50525. Socket-outlets incorporating fuse links, switches and indicator lamps are included within the scope of this part of MS 589. Socket-outlets incorporating electronic components as detailed in Annex J are included within the scope of this part of MS 589.

Socket-outlets conforming to this standard are shuttered and therefore do not require the use of additional means to shield the current-carrying contacts when no plug is present in the socket-outlet.

#### NOTES:

1. The titles of the publications referred to in this part of MS 589 are listed in the bibliography.
2. In order to maintain safety and interchangeability with plugs and socket-outlets it is necessary that these products conform to the requirements of Clauses 9 and 13 of this part of MS 589, however their body outline need not be limited at a distance of 6.35 mm from the plug engagement surface.
3. Requirements for electromagnetic compatibility for socket-outlets that incorporate electronic devices are given in Annex J.

A socket-outlet that does not incorporate electronic devices does not emit intolerable electromagnetic interference since significant electromagnetic disturbances are only generated during insertion and withdrawal which are not continuous.

A socket-outlet that does not incorporate electronic devices is mechanical by nature of construction. The product is therefore immune from electromagnetic interference.

### 2 Conditions of use

Socket-outlets shall be suitable for use under the following conditions:

## MS 589-2:2018

- a) an ambient temperature in the range  $-5\text{ }^{\circ}\text{C}$  to  $+40\text{ }^{\circ}\text{C}$ , the average value over 24 h not exceeding  $35\text{ }^{\circ}\text{C}$ ;

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

- b) a situation not subject to exposure to direct radiation from the sun or other source of heat likely to raise temperatures above the limits specified in a);
- c) an altitude not exceeding 2 000 m above sea level; and
- d) an atmosphere not subject to abnormal pollution by smoke, chemical fumes, rain, spray, prolonged periods of high humidity, or other abnormal conditions. This is equivalent to pollution degree 2 (see Annex E), and overvoltage category III (see Annex D).

### 3 Terms and definitions

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

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

#### 3.1 accessible external surface of a socket-outlet

All surfaces which can be touched by test probe B of MS IEC 61032 when the socket-outlet is installed as in use.

#### 3.2 actuating member

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

#### 3.3 basic insulation

Insulation applied to live parts to provide basic protection against electric shock.

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

#### 3.4 calibrated link

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

#### 3.5 clearance

Shortest distance in air between two conductive parts.

#### 3.6 clamp type (screwless) terminal

Terminal for the connection and subsequent disconnection of one or more conductor(s), the connection being made directly or indirectly by means of springs, wedges or the like.



**3.7 creepage distance**

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

**3.8 engagement surface of a socket-outlet**

That surface, ignoring any raised marking, which is in contact with or directly beneath the Figure 11 gauge when it is in full engagement with the socket-outlet.

NOTE. See 13.1.

**3.9 fine wire thermocouple**

Thermocouple having wires not exceeding 0.3 mm in diameter.

**3.10 fixed socket-outlet**

Socket-outlet which with its associated enclosure is intended for use mounted in or on a fixed surface.

**3.11 flush-mounted socket-outlet**

Socket-outlet which is intended to be mounted in a box which is recessed into a wall or other flat surface.

NOTE. The socket-outlet plate and the socket-outlet base are regarded as forming a complete unit, and the socket-outlet plate is mounted with its back either flush with a wall or other flat-surface structure, or flush with the front of a socket-outlet box or enclosure.

**3.12 functional insulation**

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

**3.13 fuse carrier**

Moveable or removable part designed to carry, retain, cover and/or remove the fuse link.

**3.14 fused socket-outlet**

Socket-outlet having provision for a replaceable cartridge fuse link.

**3.15 indicator lamp (pilot lamp)**

Lamp or similar device which illuminates to indicate that the socket-outlet contacts are energised.

**3.16 insignificant mass**

Insufficient combustible mass to constitute a fire hazard.

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

<http://www.china-gauges.com/>

## **MS 589-2:2018**

### **3.17 live parts**

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

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

### **3.18 moulded-on portable socket-outlet**

Non-rewirable portable socket-outlet, the manufacture of which is completed by insulating material moulded around pre-assembled component parts and the terminations of the flexible cable.

### **3.19 multiple socket-outlet**

A combination of two or more socket-outlets.

### **3.20 non-rewirable portable socket-outlet**

Portable socket-outlet so constructed that it forms a complete unit with the flexible cable which cannot be replaced after assembly by the manufacturer of the portable socket-outlet.

NOTE. See also 13.18.

### **3.21 panel-mounted socket-outlet**

Socket-outlet intended for incorporation into equipment panels or electrical trunking and which depends upon such incorporation for its enclosure.

### **3.22 portable socket-outlet**

Socket-outlet shall be connected to, or integral with, a flexible cable, and which can easily be moved from one place to another while connected to the supply.

### **3.23 reinforced insulation**

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

### **3.24 resilient material**

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

### **3.25 rewirable portable socket-outlet**

Portable socket-outlet so constructed that a flexible cable can be fitted or replaced using general purpose tools.

### **3.26 screw-type terminal**

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

NOTE. The following are examples of screw-type terminals:

- a) a pillar terminal is a terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws;
- b) a screw terminal is a terminal in which the conductor is clamped under the head of the screw; and
- c) a stud terminal is a terminal in which the conductor is clamped under a nut.

### 3.27 shutter

Movable device arranged to shield the current-carrying socket-outlet contacts automatically when a corresponding plug is removed.

### 3.28 small parts

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

[BS EN 60695-2-11:2014. 3.15, modified]

NOTE. More information concerning small parts can be found in BS EN 60695-2-11:2014, 4.4.

### 3.29 socket-outlet

Accessory having a set of three socket-contacts designed to engage with the pins of a corresponding plug and having means for the electrical connection of appropriate flexible cables and may include its dedicated enclosure.

### 3.30 socket-outlet base

Part of the socket-outlet which carries the contacts.

NOTE. It may be integral with the socket-outlet plate.

### 3.31 socket-outlet box

Box suitable for mounting one or more socket-outlets.

### 3.32 socket-outlet plate

External plate which covers the base and contact assembly of a socket-outlet and through which the pins of the plug are inserted.

### 3.33 supplementary insulation

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

### 3.34 surface-mounted socket-outlet

Socket-outlet which is intended to be mounted on a wall or other flat surface without the need for recessing.

## **MS 589-2:2018**

### **3.35 switched socket-outlet**

Socket-outlet with an associated switch to disconnect the supply to the line socket contact or to both line and neutral socket contacts.

### **3.36 terminals**

Means by which the user can make an electrical connection between the appropriate cable or flexible cable and the conducting parts of the socket-outlet without the use of special tools.

### **3.37 termination**

Means by which an electrical connection can be made between the appropriate flexible cable and the conducting part of the socket-outlet using special purpose tools, e.g. soldering, welding, crimping.

### **3.38 type test**

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

### **3.39 type test sample**

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

## **4 General**

Socket-outlets shall be so designed and constructed that in normal use their performance is reliable and minimises the risk of danger to the user or to the surroundings. Such socket-outlets shall be capable of meeting all the relevant requirements and tests specified in this part of MS 589.

Unless otherwise stated, reference to a plug within this part of MS 589 shall mean a plug in accordance with MS 589-1.

NOTE. Figures in this standard was to be maintained as the previous version.

## **5 General conditions for type testing**

### **5.1 All tests shall be type tests.**

Unless otherwise specified in this part of MS 589 the socket-outlets shall be tested as delivered by the manufacturer or responsible vendor and under normal conditions of use, at the ambient temperature of  $27\text{ °C} \pm 5\text{ °C}$  after being conditioned at normal laboratory temperature and humidity levels for at least 4 days.

Unless otherwise stated by the manufacturer, flush-mounted socket-outlets shall be tested when mounted on a corresponding insulated box conforming to the dimensional requirements of BS 4662, the fixing screws being tightened with a torque of 0.6 Nm ± 10 %.

Other types shall be mounted according to the manufacturer's instructions.

Socket-outlets having a declared IP rating shall be tested as a complete assembly (socket-outlet and enclosure) when mounted in accordance with manufacturer's instructions and conditions of use.

The socket-outlets used for the tests shall be representative of normal production items in respect of all details which may affect the test results.

Non-rewirable socket-outlets shall be supplied with an appropriate flexible cable which shall be at least 1 m long.

Socket-outlets shall be deemed to conform if no sample fails in the complete series of tests given in Table 1.

**Table 1. Schedule of tests**

Sequence	Samples	Test	Clause no.
1	3	Inspection, measurement, gauging and manipulation	5, 6, 7, 9.1, 11.1 (except 11.10), 9.2, 9.4, 10.1, 13.1, 13.2, 13.3, 13.9, 13.10, 13.12, 13.14, 13.15, 3.16, 13.17, 13.18, 13.20, 19.2, 19.3, 19.4, 19.6, 8 (except Annex C), 21
2	3	General	5, 9.3, 21.3, (10.2, 10.3 only), 19.1, 14.2, 13.13 (9.1.1 only), 13.4.1a), 13.4.1b), 13.5, 13.6
3	3		5, 13.13, (20.1.2 only), 17, 13.11, (13.11.1 only), 16, 19.5
4	3		5, 14.1, 15, 18.1.2, [9.1, 16, 13.19, 15, 13.4.1a), 10.2, 13.6, 13.7, 13.8]
5	3		5, 14.2, 18.1.3, 20
6	3		Materials
7	3	5, 23.2, 8.2 (Annex C only)	
8	3	5, 24	
9 <sup>a</sup>	3	Positive break	5, 13.11.2
10	3	Ingress protection	5, 13.22, 13.23, 14.3
11	3	Electric vehicle charging	5, 14.1, 17.2, 18.2
12	3		5, 26
13	3	Additional tests for rewirable fixed socket-outlets with screwless terminals	5, 14.1, 11.10
NOTE. The order of tests given in sequence no. 1 above is preferred but not mandatory except where required within the text of the appropriate clause.			
<sup>a</sup> An additional new set of three samples prepared with the contacts closed is supplied by the manufacturer for this test.			

## MS 589-2:2018

If one sample fails in the complete series of tests given in Table 1, then socket-outlets of that type shall be deemed to have failed to conform to this part of MS 589, unless the socket-outlets are shown to be not representative of normal production or design, in which case a further type test sample shall be submitted to the test or tests in that particular group. If there is no failure in this retest then socket-outlets of that type shall be deemed to conform to this part of MS 589.

If more than one sample fails in the complete series of tests given in Table 1 then socket-outlets of that type shall be deemed not to conform to this part of MS 589.

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

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

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

**5.3** Gauges in accordance with Figures 11, 12, 14, and 16 shall be considered to conform to the dimensional requirements if the results of the measured values are within the specified dimensions and the uncertainty of measurement at not less than 95 % confidence level does not exceed  $\pm 0.005$  mm.

## 6 Classification

**6.1** The rated current of all socket-outlets shall be 13 A.

**6.2** Socket-outlets shall be classified as follows:

a) according to the number of gangs:

- i) single; or
- ii) multiple.

b) according to switching capability:

- i) switched; or
- ii) unswitched.

c) according to fusing capability:

- i) fused; or
- ii) unfused.

- d) according to method of mounting:
  - i) fixed flush;
  - ii) fixed surface;
  - iii) panel-mounting;
  - iv) portable rewirable; or
  - v) portable non-rewirable.
- e) according to indicator type:
  - i) with indicator lamp; or
  - ii) without indicator lamp.
- f) according to the IP rating if declared:
  - i) having an IP rating with the plug inserted; or
  - ii) having an IP rating only when no plug is inserted.
- g) according to the type of terminal:
  - i) with screw-type terminals;
  - ii) with screwless terminals for rigid conductors only;
  - iii) with screwless terminals for flexible conductors only; or
  - iv) with screwless terminals for rigid and flexible conductors.
- h) according to suitability for electric vehicle charging:
  - i) intended for electric vehicle charging, applicable to fixed socket-outlets only; or
  - ii) not intended for electric vehicle charging.
- i) according to incorporation of electronic components:
  - i) with electronic components; and
  - ii) without electronic components.

## 7 Marking and labelling

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

## MS 589-2:2018

- a) either the name, trade mark or identification mark of the manufacturer or responsible vendor, which may be duplicated on a removable fuse carrier;
- b) the number of this Malaysian Standard, i.e MS 589<sup>1)</sup>
- c) for portable socket-outlets the number of this Malaysian Standard shall be followed by “/A”.
- d) for socket-outlets for electric vehicle charging, the number of this Malaysian Standard shall be followed by “/EV”, this shall only be marked on the rear of a fixed socket-outlet;
- e) on rewirable socket-outlets the terminals intended for the connection of the various conductors shall be identified by the symbols given in 7.5;
- f) for fused socket-outlets, the words “FUSE” or “FUSED” or the symbol (given in 7.5) on the engagement surface of a socket-outlet;
- g) fixed fused multiple socket-outlets shall be marked on the engagement surface with the maximum rated current of 13 A (e.g. MAX. 13 A);
- h) all socket-outlets shall be marked with the following:
  - i) rated current “13 A”;
  - ii) rated volts; and
  - iii) nature of supply.
- i) for socket-outlets with screwless terminals:
  - i) an appropriate marking indicating the length of insulation to be removed before insertion of the conductor into the screwless terminal;
  - ii) an indication of the suitability to accept rigid conductors only for those socket-outlets having this restriction; and
  - iii) an indication of the suitability to accept flexible conductors only for those socket-outlets having this restriction.
- j) where the declared IP classification is higher than IP20 then the IP classification shall be marked. The marking shall be discernible when the socket-outlet is mounted and wired as in normal use.

Portable socket-outlets shall be marked on the accessible external surface.

---

<sup>1)</sup> Marking MS 589-2 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

Such a declaration is not to be confused with second or third-party certification of conformity. Further testing and conformity certification remains at the discretion of the manufacturer and is not a requirement of this standard.



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

Flexible cable nom cross-sectional area (mm <sup>2</sup> )	Rated current (A)	Test current ( $\pm 0.4$ A)	Fuse rating (A)	Load for flexing test + 2 %, - 0 % (kg)	Cord grip tests	
					Load + 2 %, - 0 % (kg)	Torque <sup>a</sup> (Nm)
1 <sup>b)</sup>	13	14	13	2	3	0.25
1.25	13	14	13	2	6	0.30
1.5	13	14	13	2	6	0.35

<sup>a)</sup> The recording of a measured value of torque in accordance with this table is considered to conform to this part of MS 589 on condition that the uncertainty of measurement is not less than 95 %, and confidence level does not exceed  $\pm 10$  %.

<sup>b)</sup> The flexible cable size which may be used with a maximum length of 2 m.

**7.1.1** Conformity shall be checked by inspection and by rubbing the markings for approximately 15 s with a cloth soaked in water, and again for approximately 15 s with a cloth soaked in an aliphatic solvent hexane with a content of aromatics of maximum 0.1 % by volume, a Kauri-butanol value of 29, initial boiling point of approximately 69 °C, and relative density of approximately 0.68.

The marking shall remain legible. Markings produced by an engraving or moulding process shall be deemed to conform without test.

**7.2** Portable socket-outlets fitted with a flexible cable shall be supplied with a label or instruction indicating the colour coding of the cores of the flexible cable.

Cores or conductors in the mains shall be coloured in accordance with MS 2112-5 or with the following code:

Green-yellow	Earth
Blue	Neutral
Brown	Line




**7.2.1** Conformity shall be checked by inspection.

**7.3** Rewirable portable socket-outlets shall be provided with adequate instructions for the safe connection of the appropriate 3 core flexible cord, including clear instructions for the removal of insulation from the conductors.

**7.3.1** Conformity shall be checked by inspection.

## MS 589-2:2018

7.4 If symbols are used they shall be as follows:

Amperes	A
Volts	V
*alternating current (a.c)	~
*direct current (d.c)	
Line	L
Neutral	N
*Earth	 (preferred)
*fuse	

For screwless  
terminals suitable  
for rigid conductors  
only

r

For screwless  
terminals suitable  
for flexible  
conductors only

f

Degree of  
protection, where  
relevant

IPXX

### NOTES:

1. IEC 60417-DB gives details of symbols marked\*.
2. For the marking of the rated current and rated voltage of the socket-outlet, figures may be used alone, the figures for the current rating being placed before or above that of the rated voltage and separated by a line.

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

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

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

7.5 Instructions for installation and use of socket-outlets having an IP classification greater than IP20 shall be provided.

## 8 Clearances, creepage distances and solid insulation

Socket-outlets shall be so constructed that the clearances, creepage distances and solid insulation are adequate to withstand the electrical stresses taking into account the environmental influences that may occur. Clearances, creepage distances and solid insulation shall conform to the relevant requirements of 8.1, 8.2, 8.3 and 8.4.

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

Socket-outlets conforming to the requirements for basic insulation shall be deemed to meet the requirements of this clause. If the manufacturer declares an insulation level exceeding basic insulation, the socket-outlet shall be tested accordingly.

### NOTES:

1. The requirements and tests are based on MS IEC 60664-1.
2. Product insulation consists of basic insulation and protective earthing as required by IEC 61140 for Class I equipment. Mechanical strength equivalent to that which would be provided by reinforced insulation as listed in IEC 61140 is achieved in MS 589 products through specific mechanical and material tests.

### 8.1 Clearances

Socket-outlets energised directly from the low-voltage supply fall into Overvoltage Category III.

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

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

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

#### 8.1.1 Clearances for basic insulation

The clearances for basic insulation shall not be less than the values given in Table 3 except as described below.

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

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

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

**8.1.2 Clearances for functional insulation**

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

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

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

**8.1.3 Clearances for supplementary insulation**

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

Conformity shall be checked by inspection, and if necessary by measurement, or by the test of Annex F. If clearance distances are to be measured, this shall be carried out in accordance with Annex B.

**Table 3. Minimum clearances for basic insulation**

<b>Rated impulse withstand voltage (kV<sup>a</sup>)</b>	<b>Minimum clearance in air up to 2 000 m above sea level (mm)</b>
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

a) See Annex D. This voltage is:  
a) for functional insulation: the maximum impulse voltage expected to occur across the clearance;  
b) for basic insulation directly exposed to or significantly influenced by transient overvoltage from the low-voltage mains: the rated impulse withstand voltage of the socket-outlet; and  
c) for other basic insulation: the highest impulse voltage that can occur in the circuit.

b) Minimum clearance values are based on MS IEC 60664-1.

**8.1.4 Clearance for reinforced insulation**

The clearances for functional insulation shall not be less than the values specified for basic insulation in 8.1.1 but using the next higher step for rated impulse withstand voltage given in Table 3.

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

**8.1.5 Contact gap**

The minimum contact gap shall be 1.2 mm in the open position, except for the electronic switches covered by J.5 of Annex J.

Conformity shall be checked by measurement.

**8.2 Creepage distances**

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

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

<http://www.china-gauges.com/>

**NOTES:**

1. Moveable parts are, for example hexagonal nuts, the position of which cannot be controlled throughout an assembly.
2. A creepage distance cannot be less than the associated clearance.

Creepage distances are measured in accordance with Annex B.

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

Material group I	$600 \leq \text{CTI/PTI}$
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 are determined in accordance with Annex C.

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

**8.2.1 Creepage distances for basic insulation**

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

Conformity shall be checked by measurement.

**Table 4. Minimum creepage distances (mm) for basic insulation**

Rated voltage <sup>a</sup> V (r.m.s) Up to and including	Pollution Degree 2 <sup>b</sup>			Pollution Degree 3 <sup>b</sup>		
	Material group			Material group		
	I	II	III <sup>a</sup> /III <sup>b</sup>	I	II	III <sup>a</sup>
250	1.3	1.8	2.5	3.2	3.6	4.0
<sup>a</sup> This voltage is the voltage rationalised through Table F3a and Table F3b of MS IEC 60664-1:2014 based on the nominal voltage of the supply system. <sup>b</sup> Details of pollution degrees are given in Annex E.						

**8.2.2 Creepage distances for functional insulation**

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

Conformity shall be checked by measurement.

**8.2.3 Creepage distances for supplementary insulation**

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

Conformity shall be checked by measurement.

**8.2.4 Creepage distances for reinforced insulation**

The creepage distances for reinforced insulation shall not be less than those derived from twice the distance specified for basic insulation in Table 4.

This requirement shall not be applied to the sleeves of the plug pins.

Conformity shall be checked by measurement.

**8.3 Solid insulation**

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

No minimum thickness is specified for solid insulation.

**8.3.1** Conformity shall be checked by tests in accordance with 15.1.3 using the values given in Table 5.

**Table 5. Withstand voltages for insulation types**

<b>Insulation</b>	<b>Test voltage [V (r.m.s)]</b>
Functional insulation	1 500
Basic insulation	1 500
Supplementary insulation	1 500
Reinforced insulation	3 000

**8.4 Requirements for printed wiring boards and equivalent construction**

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

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

<http://www.china-gauges.com/>

## 9 Accessibility of live parts

**9.1** Socket-outlets shall be so designed that when they are mounted and wired as in normal use, live parts are not accessible.

**9.1.1** Conformity shall be checked by the application of the test pin shown in Figure 1 perpendicular to the accessible external surface of the socket-outlet with a force of  $5_{-1}^0$  N. It shall not be possible to touch live parts.

**9.2** Socket-outlets shall be designed and constructed so as to protect the user against accidental contact with live parts during insertion or withdrawal of plugs.

**9.2.1** Conformity shall be verified by satisfying the dimensional and gauging requirements of this part of MS 589.

**9.3** Resilient accessible external surfaces of socket-outlets shall be so designed and constructed that when assembled and wired as in normal use, there is no risk that, as a result of undue pressure, live parts could penetrate the accessible external surfaces or become so disposed as to reduce creepage and clearances below those given in Clause 8.

**9.3.1** Conformity shall be checked by the following test (an example of a suitable test apparatus is shown in Figure 2).

The design of the apparatus shall be such that a steady force of  $240_{-10}^0$  N can 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 is subjected to the force at each chosen place in turn. During each application of force, a test voltage of  $2\ 000\text{ V} \pm 60\text{ V}$  50 Hz of substantially sinusoidal waveform is applied for  $60_{0}^{+5}$  s between all live parts bonded together and the earthed test pressure block.

During the test no flashover or breakdown shall occur.

After the test 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.

**9.4** It shall not be possible to introduce a conducting device through the earthing socket aperture(s) of a socket-outlet in such a manner that there is a risk of making contact with any live conductor, with or without insulation.

**9.4.1** Conformity shall be checked by introducing a rigid metal pin,  $1_{-0.05}^0$  mm diameter x 60 mm  $\pm$  1 mm long, through the earthing socket aperture or apertures of a socket-outlet mounted and wired within an appropriate enclosure, applying a force of  $5_{-1}^0$  N, with the conductors in the most unfavourable positions.

## 10 Provision for earthing

**10.1** Socket-outlets shall be so constructed that, when inserting the plug, the earth connection is made before the current-carrying pins of the plug become live. When withdrawing the plug, the current-carrying parts shall separate before the earth contact is broken.

**10.1.1** Conformity shall be checked by inspection and electrical test.

**10.2** All accessible metal parts of socket-outlets shall be in effective electrical contact with the earthing socket contact, except that metal parts on, or screws in or through, non-conducting material, and separated by such material from current-carrying parts in such a way that in normal use they cannot become live, need not be in effective electrical contact with the earthing socket contact.

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

**10.2.1** Conformity shall be checked by inspection and the following:

- a) for metal parts insulated from live parts, by the test described in 15.1.3;
- b) for metal parts connected to an earthing terminal by the following test. A current of  $25 \text{ A} \pm 0.75 \text{ A}$ , derived from an a.c. source having a no-load voltage not exceeding 12 V, is passed for  $60^{+5}_0$  s between the earthing terminal and an earthing plug pin inserted in the earthing socket contact;
- c) the resistance between the earthing terminal and any other nominated part shall not exceed  $0.05 \Omega$ .

**10.3** If means are provided for electrically bonding the mounting box to the earthing circuit of the socket-outlet by means of the fixing screws, the connection between the screws and earthing terminal shall be of low resistance.

**10.3.1** Compliance shall be checked by the test described in 10.2.1 b) applied between the socket-outlet earthing terminals and any fixing screw in electrical contact with the earthing circuit. For the purpose of this test the socket-outlet shall be attached to its appropriate mounting box, the fixing screws being tightened to a value of two-thirds those given in Table 6.



Table 6. Torque values for screws and nuts

Declared diameter of screw thread (mm)	Torque (see Note 1)		
	For metal screws (see Note 2) (Nm)	For other metal screws and nuts (Nm)	For screw of insulating material (Nm)
Up to and including 2.8	0.2	0.4	0.4
Over 2.8, up to and including 3	0.25	0.5	0.5
Over 3, up to and including 3.2	0.3	0.6	0.6
Over 3.2, up to and including 3.6	0.4	0.8	0.6
Over 3.6, up to and including 4.1	0.7	1.2	0.6
Over 4.1, up to and including 4.7	0.8	1.8	0.9
Over 4.7, up to and including 5.3	0.8	2.0	1.0
Over 5.3, up to and including 6	-	2.5	1.25

NOTES:

1. The recording of a measured value given in this table is considered to conform to this part of MS 589 on condition that the uncertainty of measurement at not less than 95 % confidence level, and does not exceed  $\pm 10$  %.
2. This column applies to metal screws without heads if the screw when tightened does not protrude from the hole, and to other metal screws which cannot be tightened by means of a screwdriver with a blade wider than the diameter of the screw.

## 11 Terminals and terminations

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

11.1.1 Conformity shall be checked in accordance with 11.2 to 11.10, according to the type of terminal or termination.

11.2 Rewirable portable socket-outlets shall be provided with terminals as defined in 3.20.

11.2.1 Conformity shall be checked by inspection.

11.3 Non-rewirable portable socket-outlets shall be provided with soldered, welded, crimped or similar terminations; for all these methods of termination, not more than one strand of a 0.5 mm<sup>2</sup> or two strands of other size conductors shall be fractured during connection.

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

11.3.1 Conformity shall be checked by inspection and measurement.

11.4 Terminals in rewirable portable socket-outlets shall be of screw-type and permit the connection, without special preparation, of flexible cables having nominal conductor cross-sectional areas of 1 mm<sup>2</sup> and 1.5 mm<sup>2</sup> as given in MS 2112-5 or BS EN 50525-2-11:2011 and BS EN 50525-2-12:2011.

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

## MS 589-2:2018

**11.5** Line and neutral terminals in fixed socket-outlets shall permit the connection, without special preparation, of one, two or three 2.5 mm<sup>2</sup> solid or stranded or of one or two 4 mm<sup>2</sup> stranded conductors as given in Table 4 of BS 6004:2012.

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

**11.6** Earthing terminals in fixed socket-outlets shall permit the connection, without special preparation, of one, two or three 1.5 mm<sup>2</sup> or 2.5 mm<sup>2</sup> solid or stranded or of one or two 4 mm<sup>2</sup> stranded conductors.

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

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

**11.7.1** Conformity shall be checked by inspection and measurement.

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

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

**11.8.1** Conformity shall be checked by inspection and measurement.

**11.9** In rewirable portable socket-outlets terminals shall be so located or shielded that if a stray strand of a flexible conductor escapes when the conductors are fitted, there is negligible risk of accidental connection between live parts and accessible external surfaces, or a stray strand by passing the fuse link if any.

**11.9.1** Conformity shall be checked by inspection, and by the following test.

A length of insulation in accordance with the manufacturer's instructions is removed from the end of a flexible conductor having a nominal cross-sectional area of 1.5 mm<sup>2</sup>. One free strand of the flexible conductor is left free and the other strands are fully inserted into and clamped in the terminal. The stray strand is bent, without tearing the insulation back, in every possible direction, but without making sharp bends round barriers unless a bend is reproduced by the replacement of the cover.

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

- a) touch any metal part, so as to bypass any fuse link;
- b) touch any metal part which is accessible or is connected to an accessible metal part; and
- c) reduce creepage distances and clearances to accessible surfaces to less than 1.3 mm.

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

**11.10 Screwless terminals for fixed socket-outlets**

**11.10.1** Screwless terminals for fixed socket-outlets shall be provided with clamping units which allow the proper connection of conductors as specified in 11.4, 11.5 or 11.6 as appropriate.

The terminals shall be of the type suitable for the following:

- a) rigid (solid or stranded) copper conductors only; or
- b) flexible copper conductors only; or

c) both rigid (solid or stranded) and flexible copper conductors. Conformity shall be checked by inspection and by fitting the appropriate conductors.

For screwless terminals intended to be suitable for the connection of both rigid and flexible copper conductors the tests given in 11.10 shall be carried out with rigid conductors first and then repeated with flexible conductors.

Screwless terminals shall be such that the conductor can be connected without special preparation.

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

Conformity shall be checked by inspection.

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

The conductor shall be clamped between metal surfaces.

Conformity shall be checked by inspection and by the test of 11.10.7.

**11.10.3** It shall be clear how the conductors are to be inserted and disconnected. The intended disconnection of a conductor shall require an operation, other than a pull on the conductor, which can be effected manually with or without the help of a tool in normal use.

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

Conformity shall be checked by inspection and by the test of 11.10.7.

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

- a) during the connection or disconnection, the conductors can be connected or disconnected either at the same time or separately; and
- b) each conductor is introduced in a separate clamping unit (not necessarily in separate holes).

## MS 589-2:2018

Conformity shall be checked by inspection and by tests with the appropriate number and size of conductors as specified in 11.10.1.

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

Marking indicating the length of insulation to be removed before the insertion of the conductor into the screwless terminal shall be given on the socket-outlet.

Conformity shall be checked by inspection and by the test of 11.10.7.

**11.10.6** Screwless terminals shall be properly fixed to the socket-outlet.

When tested in accordance with 11.10.7, screwless terminals shall not work loose when the conductors are inserted or disconnected during installation.

Conformity shall be checked by inspection and the test of 11.10.7.

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

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

The appropriate copper conductors shall be used, first conductors having the largest cross-sectional area, and then conductors having the smallest cross-sectional area specified in 11.4, 11.5 or 11.6 as appropriate.

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

- a) pushed as far as possible into the terminal; or
- b) inserted so that adequate connection is obvious.

After each insertion, the conductor shall be subjected to a pull of  $30_{-1}^0$  N. The pull shall be applied in one smooth and continuous motion for  $60 \pm 5$  s, in the direction of the longitudinal axis of the conductor space.

During the application of the pull, the conductor shall not come out of the screwless terminal and the terminal shall not have become detached from the socket-outlet.

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

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

Both tests shall be carried out with new copper conductors.

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

The test shall be carried out on each clamping unit.

During the test the current shall not be passed through the socket-outlet, but only through the terminals. Immediately after this period, the voltage drop across each screwless terminal shall

be measured with  $13 \begin{smallmatrix} 0 \\ -0.2 \end{smallmatrix}$  A flowing.

In no case shall the voltage drop exceed 15 mV.

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

NOTE. The samples may be prepared by the manufacturer.

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

When performing the test and taking the measurements, care shall be taken to ensure that the conductors and the measurement equipment are not moved.

**11.10.8.2** The screwless terminals, after being subjected to the determination of the voltage drop in accordance with 11.10.8.1 shall be tested as follows.

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

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

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

- a) with the current flowing for approximately 30 min; and
- b) with no current flowing for approximately a further 30 min.

The voltage drop in each screwless terminal shall be determined in accordance with the test in 11.10.8.1 after every 24 temperature cycles and after 192 temperature cycles have been completed.

In no case shall the voltage drop exceed 22.5 mV.

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

The mechanical stress test in accordance with 11.10.7 shall be repeated. All samples shall withstand the mechanical stress test.

## 12 (Not used)

### **13 Construction of socket-outlets**

**13.1** The disposition of the socket contacts shall be as shown in Figure 3.

The engagement surface shall be substantially flat. Any steps or profile contours on the engagement surface shall not result in the surface deviating from the plane of engagement by more than 3 mm. Holes not exceeding 8 mm diameter for the purpose of assembly fixing shall be deemed acceptable. There shall be no projection on the engagement surface of a socket-outlet such as would prevent the full insertion of a plug. If raised marking is used it shall not project more than 0.5 mm from the engagement surface of a socket-outlet and shall allow conformity with 13.2. The spacing of the socket contacts shall correspond with that of plug pins as specified in MS 589-1.

**13.1.1** Conformity shall be checked by inspection, measurement and the use of the gauges shown in Figure 11.

**13.2** The line and neutral socket contact in socket-outlets shall be so positioned as to make satisfactory contact with the corresponding pins of a plug in all positions that the contacts may occupy when the plug is correctly and fully inserted.

**13.2.1** Conformity shall be checked by inspection and the use of the gauge shown in Figure 12 and the circuit shown in Figure 13. Both indicator lamps shall light.

**13.3** On insertion of a plug into a socket-outlet, the travel of the end of either current-carrying pin from the front face of the socket-outlet to the first point of contact with the appropriate socket contact, in any position the socket contacts may occupy, shall be not less than 9.6 mm.

**13.3.1** Conformity shall be checked by inspection and the use of the gauge shown in Figure 14 and the circuit shown in Figure 13. Neither indicator shall light.

**13.4** Socket contacts shall be self-adjusting as 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 rely on any insulating material in contact with the socket contact. Each socket contact shall be reliably connected to the fixed parts of its terminal or termination.

**13.4.1** Conformity shall be checked by the following tests and Clause 16.

- a) The voltage drop between any individual line or neutral socket contact and the corresponding plug pin is measured between the terminal connecting strap at a point immediately adjacent to the socket contact and the corresponding plug pin. The voltage drop shall not exceed 25 mV at  $13\text{ A} \pm 0.4\text{ A}$ .
- b) The withdrawal pull of a gauge as shown in Figure 16b from any individual line or neutral socket contact is checked ensuring that neither the shutter mechanism, nor any insulating material in contact with the socket contact have any effect on the results of the test. The socket contact shall retain the gauge for not less than 30 s when the socket-outlet is held horizontally with the gauge hanging vertically downwards.

**13.5** Line and neutral socket contacts shall withstand the stresses imposed upon them by the use of socket-outlet adaptors and the like.

**13.5.1** Conformity shall be checked by the following test.

The socket-outlet is mounted with the engagement surface of the socket-outlet in the vertical plane and with the major axis of the line and neutral pins horizontal ensuring that the shutter mechanism does not have any effect on the results of the test. The end E of the gauge shown in Figure 15 is inserted into the line socket aperture as far as the pin D and a mass of  $750 \text{ g} \pm 5 \text{ g}$  is suspended from pin C for  $30^{+5}_0 \text{ s}$ .

The socket-outlet is rotated through  $180^\circ$  approximately about an axis perpendicular to the engagement surface of the socket-outlet and the load applied to pin C for a further  $30^{+5}_0 \text{ s}$ .

The test is repeated with a gauge inserted in the neutral socket aperture. After the test the socket contact shall retain the weight gauge shown in Figure 16b for not less than 30 s when the engagement surface of the socket-outlet is held horizontally, with the gauge hanging vertically downwards. After the gauge is inserted, if any insulating material touches the moving parts of the contact, the test shall be repeated with this insulation removed.

**13.6** Earth socket contacts shall withstand the stress imposed upon them by the attempted incorrect insertion of plugs.**13.6.1** Conformity shall be checked by the following test.

The socket-outlet is mounted with the engagement surface of the socket-outlet in the vertical plane and with the major axis of the earth pin aperture horizontal ensuring that the shutter mechanism does not have any effect on the results of the test. The end A of the gauge shown in Figure 15 is inserted into the earth socket aperture as far as the pin B, and a mass of  $750 \text{ g} \pm 5 \text{ g}$  is suspended from pin D for  $30^{+5}_0 \text{ s}$ . The socket-outlet is rotated through  $180^\circ$  approximately about an axis perpendicular to the engagement surface of the socket-outlet and the load applied to pin D for a further  $30^{+5}_0 \text{ s}$ .

After the test the earth socket contact shall retain the weight gauge shown in Figure 16a for not less than 30 s when the engagement surface of the socket-outlet is held horizontally with the gauge hanging vertically downwards. After the gauge is inserted, if any insulating material touches the moving parts of the contact, the test shall be repeated with the insulation removed.

**13.7** The construction of the socket-outlet shall be such that when a plug is withdrawn from it, the current-carrying socket contacts are automatically screened by shutters. One socket aperture shutter shall not be capable of closing independently of the other aperture shutter. The shutters shall be operated either by the insertion of the earthing pin or by the simultaneous insertion of any two or more pins of the plug, provided that the gauge [see Figure 16b)] inserted into any current-carrying socket aperture shall not open the shutter. Conformity shall be checked by the test of 13.7.1.

It shall not be possible to operate a shutter by inserting a 2-pin plug into a 3-pin socket-outlet. Conformity shall be checked by the test of 13.7.2.

## MS 589-2:2018

**13.7.1** Conformity shall be checked by inspection, by the test described in 18.1.2, and by the application of the gauge shown in Figure 16b. The gauge and the test pin, shown in Figure 1, are applied to the shutter using a force of  $5 \begin{smallmatrix} 0 \\ -1 \end{smallmatrix}$  N applied perpendicular to the engagement surface of the socket-outlet.

It shall not be possible to touch current-carrying parts.

**13.7.2** Earth pin operated shutters and 3-pin operated shutters shall be deemed to conform to this requirement without testing. For other shutter designs, conformity shall be checked by the following test.

A 2-pin plug conforming to BS EN 50075 shall be applied to the socket line and a neutral apertures with a force  $30 \begin{smallmatrix} 0 \\ -2 \end{smallmatrix}$  N. The plug pins, when applied in any direction, shall not make contact with live parts.

**13.8** The construction of socket-outlet shall be such as to allow for easy withdrawal of the plug.

**13.8.1** Conformity shall be checked by the following test.

A plug is inserted into and withdrawn from the socket-outlet ten times with the socket-outlet mounted as in normal use.

The plug is then inserted into the socket-outlet and a force is gradually exerted in a direction parallel to the axis of the pins.

It shall not be possible to reach a pull of 36 N without the plug coming out of the socket-outlet.

NOTE. Care should be taken to remove any grease from the plug pins and socket contacts prior to the tests.

**13.9** Apertures for the reception of the line and the neutral plug pins shall not exceed 7.2 mm x 4.8 mm and for the earthing plug pin 8.8 mm x 4.8 mm. It is permissible to shape apertures at their front edges to facilitate insertion of plugs conforming to MS 589.

The holes for the line and the neutral plug pins in metal plates shall have sufficient insulating material around them to ensure conformity with Clause 8.

Earth socket contacts may be flush with the front face of covers or cover plates but shall not depend for their effectiveness on insulating material of the cover. In such a case the aperture shall be measured between the contact faces at the maximum separation.

**13.9.1** Conformity shall be checked by inspection and measurement.

**13.10** No part of the aperture intended for the reception of the line or neutral pin shall be less than 9.5 mm from the periphery of the engagement surface of a socket-outlet. When a shutter is operated by the simultaneous insertion of the current-carrying pins this dimension shall be increased to not less than 18 mm from the lower edge of the socket-outlet.

Where the 9.5 mm and 18 mm dimensions includes a peripheral edge radius, it shall not exceed 1 mm.



**13.10.1** Conformity shall be checked by inspection and measurement.

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

The switch in any switched socket-outlet shall disconnect at least the supply to the line socket contact.

Double pole switches shall make or break each pole with one movement of the actuator.

**13.11.1** Conformity shall be checked by inspection and by the following test.

Following the test described in Clause 17, the circuit is broken a further ten times, each time moving the actuating member by hand for a period of approximately 2 s in a manner such as to attempt to stop the moving contact in an intermediate position causing arcing. The actuating member shall be released after approximately 2 s and any arcing shall cease.

**13.11.2** The actuating member of a switch shall not remain at rest in the 'off' position whilst the switch contacts remain closed. The actuating mechanism shall be so constructed that when operated the switch can remain only in a position giving adequate contact or adequate separation of contacts. For socket-outlets that cannot be dismantled after assembly an additional new set of three samples prepared with the contacts closed is supplied by the manufacturer for this test.

**13.11.3** Conformity shall be checked by inspection and by the end of 13.11.4.

The necessary force  $F$  to switch off shall first be measured and the force shall be applied to the extremity of the actuating member.

With the actuating member of the switch in the closed position, the fixed and moving contacts of each pole shall be mechanically fixed together to provide the most onerous condition.

**13.11.4** The method for fixing the contacts shall not unduly affect the test result. The test sample may be dismantled where necessary in preparation for this test and the test sample and components shall not be damaged during this preparation.

The actuating member shall be subjected to a test force as defined in Table 7. This force shall be applied in one smooth and continuous motion to the extreme point of the actuating member in the most favourable direction to open the contacts for a period of 10 s.

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

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

Table 7. Actuator test force

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

**13.12** Multiple socket-outlets shall be capable of simultaneous use of all socket-outlets.

<http://www.china-gauges.com/> 13.12.1 Conformity shall be checked by inspection and by fitting gauges as shown in Figure 11 in adjacent socket-outlets or the multiple socket-outlet.

**13.13** If a fuse link is fitted to a socket-outlet it shall conform to BS 1362 and shall be mounted in suitable contacts between the line terminal or terminations and the corresponding socket contact or contacts or the switch.

The design shall be such that the fuse link cannot be displaced accidentally during use or be left in incorrect contact when the fuse cover or fuse carrier is replaced and secured in position. It shall be possible to remove and replace the fuse link whilst passing current without dismantling the socket-outlet and no live parts shall become accessible during its removal or replacement.

The contact for a fuse link connected to the line terminal, or to a switch, shall be formed in one piece with a fixed part of that terminal or the switch, or connected to them in such a way that efficient electrical connection is made that cannot work loose in normal use. The other contact for the fuse link shall be similarly connected to the corresponding socket contact or contacts.

**13.13.1** Conformity shall be checked by inspection and by the application of the standard test probe B of MS IEC 61032 and the test pin shown in Figure 1 applied in accordance with 9.1.1. Fuse link clips in socket-outlets shall be checked for mechanical strength by the insertion and withdrawal test described in 20.1.2.

Current making and breaking of fuse links shall be checked by the test described in 17.1.4 after which the temperature-rise test described in Clause 16 shall be carried out.

**13.14** Conductive component parts of socket-outlets shall be so located and separated that, in normal use, they cannot be displaced so as to affect adversely the safety or proper operation of the socket-outlet.

**13.14.1** Conformity shall be checked by inspection and manipulation.

**13.15** For flush socket-outlets, the size of the base or bases shall be such that the clearance for the purpose of wiring between the base or bases and the inside walls of the box or enclosure is not less than 6 mm and such that the clearance between the overall depth of the base or bases and the bottom of a 35.0 mm deep box or enclosure, or box or enclosure specified in the manufacturer's instructions and/or literature, is not less than 14 mm, when the box or enclosure and the socket-outlet are in the relative positions they will occupy in use, except that encroachments on these clearances shall only be acceptable if there is no interference with at least one conduit or cable entry on each face of the box or enclosure.

There shall be no live metal protruding from or flush with the socket-outlet base. Any exposed live metal part shall be recessed to give the necessary clearance distance from any earthed metal or with the lugs of a mounting box as described in BS 4662 which could come into contact with the base when the socket-outlet is installed in accordance with the manufacturer's instructions. This requirement shall be met when the terminals are fitted with the conductors described in 11.5 and with terminal screws tightened to the values given in Table 6.

NOTE. If the terminals are arranged for front wiring after fixing the base then the 14 mm clearance need not apply.

**13.15.1** For socket-outlets for use in other enclosures, the clearance between the socket-outlet and the appropriate box or enclosure shall provide adequate wiring space according to the method of entry of all the necessary cables.

The socket-outlet base holes shall be capable of accepting three 2.5 mm<sup>2</sup> or two 4.00 mm<sup>2</sup> conductors with their insulation, the sheath, if any, having been removed.

**13.15.2** Conformity shall be checked by inspection and measurement.

**13.16** Fixed surface-mounted socket-outlets shall be provided with means to ensure proper seating on a flat surface and with fixing holes which will accept screws having a nominal diameter of 3.5 mm, or other suitable fixing means specified in the manufacturer's installation instructions.

Flush or semi-flush mounted socket-outlet plates shall have provision for two M3.5 fixing screws at centres of 60.3 mm ± 0.2 mm on the horizontal or vertical centrelines for boxes intended to accommodate 1-gang socket-outlets, 120.6 mm ± 0.3 mm on the horizontal or vertical centrelines for boxes intended to accommodate 2-gang socket-outlets of 180.9 mm ± 0.4 mm on the horizontal or vertical centrelines for boxes intended to accommodate 3-gang socket-outlets in accordance with BS 4662.

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

**13.16.1** Conformity shall be checked by inspection and measurement.

**13.17** Flush socket-outlet plates either of insulating material or metal, or a combination of both, shall be 82.5 mm x 82.5 mm minimum for single socket-outlets and 82.5 mm x 142.5 mm minimum for multiple socket-outlets.

**13.17.1** Conformity shall be checked by inspection and measurement.

**13.18** The base and cover of non-rewirable portable socket-outlets shall be permanently attached to each other, such that the flexible cable cannot be separated without making the portable socket-outlet permanently useless, and the portable socket-outlet cannot be opened by hand or by using a general purpose tool, for example a screwdriver used as such. A portable socket-outlet is considered to be permanently useless when for reassembling the portable socket-outlet parts or materials other than the original have to be used.

The base and cover of rewirable portable socket-outlets shall be firmly secured to each other, such that they cannot be detached from each other without the aid of a tool.

**13.18.1** Conformity shall be checked by inspection.

## MS 589-2:2018

**13.19** Portable socket-outlets shall be so designed and constructed that they cannot be deformed to allow access to live parts or to allow separated metal parts to be brought into contact with each other.

**13.19.1** Conformity shall be checked by inspection and by use of test probe 11 of MS IEC 61032 applied with a force of  $30 \begin{smallmatrix} 0 \\ -2 \end{smallmatrix}$  N immediately after the appropriate temperature rise test described in Clause 16.

**13.20** For non-rewirable portable socket-outlets means shall be provided to prevent loose strands of a conductor connected to current-carrying parts from reducing the minimum insulation thickness requirements between such parts and all accessible external surfaces of the socket-outlet.

**13.20.1** Conformity shall be checked by inspection and the test described in 15.2.

**13.21** For non-rewirable portable socket-outlets internal connections shall not be made by means of screws.

**13.22** Socket-outlets having an IP classification higher than IP20 shall be so constructed so that when they are fixed and wired as in normal use there are no free openings in their enclosures according to their classification.

Conformity shall be checked by inspection and the tests in accordance with 14.3.

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

**13.23** Surface mounted socket-outlets having an IP classification higher than IP20 shall maintain their IP classification when fitted with conduits or with sheathed cables as in normal use.

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

If a socket-outlet is provided with a drain hole, it shall be not less than 5 mm in diameter, or 20 mm<sup>2</sup> in area with a width and a length not less than 3 mm.

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

Lid springs, if any, shall be corrosion resistant.

**13.24** Conformity shall be checked by inspection, measurement and by the relevant tests of 14.3. Conformity of lid springs shall be checked by inspection and if necessary by the test of 24.2.1.

NOTES:

1. The IP classification may be achieved by means of a lid when the plug is not in position.
2. This requirement does not imply that the lid, if any, or the entry openings for the pins need be closed when the plug is not in position, provided that socket-outlets pass the relevant test for the verification of the ingress of water.
3. A drain hole in the back of the enclosure is deemed to be effective only if the design of the enclosure ensures a clearance of at least 5 mm from the mounting surface or provides a drainage channel of at least the size specified.

**13.25** Portable socket-outlets having an IP classification higher than IP20 shall be adequately enclosed when fitted with a flexible cable as for normal use and without a plug in engagement.

Lid springs, if any, shall be corrosion resistant.

**13.26** Conformity shall be checked by inspection, measurement and by the relevant tests of 14.3. Conformity of lid springs shall be checked by inspection and if necessary by the test of 24.2.1.

NOTES:

1. The IP classification may be achieved by means of a lid when the plug is not in position.
2. This requirement does not imply that the lid, if any, or the entry openings for the pins need be closed when the plug is not in position, provided that the socket-outlet passes the relevant test for the verification of the ingress of water.

## **14 Resistance to ageing, resistance to humidity and protection provided by enclosures**

### **14.1 Resistance to ageing**

Socket-outlets shall be resistant to ageing.

**14.1.1** Conformity shall be checked by the following test.

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

Socket-outlets having an IP classification higher than IPX0 shall be tested after having been mounted and assembled as specified in 14.3.2. For socket-outlets having an IP rating higher than IPX0 when a plug is inserted, the test shall be performed with a plug wired with a 3-core 1.5 mm<sup>2</sup> flexible cable to MS 2112-5 or BS EN 50525-2-11 inserted. For socket-outlets having a lid intended to be closed to maintain the IP rating, the test shall be performed with the lid closed.

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

The samples are kept in the cabinet for 168 <sup>+2</sup>/<sub>0</sub> h.

## MS 589-2:2018

### NOTES:

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

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

- a) lead to non-conformity with this standard;
- b) impair safety; and
- c) prevent further use.

<http://www.china-gauges.com/>

### 14.2 Resistance to humidity

Socket-outlets shall be resistant to humid conditions which may occur in normal use.

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

Rewirable portable socket-outlets are fitted with 1 000 mm  $\pm$  50 mm of 3-core 1.25 mm<sup>2</sup> PVC flexible cable as specified in MS 2112-5 or BS EN 50525-2-11. Non-rewirable portable socket-outlets shall be tested with 1 000 mm  $\pm$  50 mm of the flexible cable with which they are supplied. Fixed socket-outlets are tested as delivered.

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

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

The sample is kept in the cabinet for  $68^{+1}_0$  h.

### NOTES:

1. In most cases, samples may be brought to the chosen reference temperature by keeping them at this temperature for at least 4 h before the humidity treatment.
2. A relative humidity of between 85 % and 95 % can be obtained by placing in the humidity cabinet a saturated solution of potassium nitrate (KNO<sub>2</sub>) or sodium sulphate (Na<sub>2</sub>SO<sub>4</sub>) in water having a sufficiently large contact surface with the air.

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

The tests described in Clause 15 shall be made in the humidity cabinet or immediately after removal of the sample from the cabinet in a room where the specified temperature is maintained. Inspection shall not reveal any damage to the sample which would impair its use or safety within the requirements of this part of MS 589.

### 14.3 Protection provided by enclosures

#### 14.3.1 General

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

Conformity shall be checked by the tests of 14.3.2 and 14.3.3.

#### 14.3.2 Protection against access to hazardous parts and against harmful effects due to ingress of solid foreign objects

##### 14.3.2.1 General

For socket-outlets having a classification of IP5X, Category 2 of MS IEC 60529 applies.

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

Socket-outlets shall be mounted as in normal use in accordance with the manufacturer's instructions and for rewirable socket-outlets with conductors of the smallest cross-sectional area specified in Clause 11.

Socket-outlets having an IP classification with a plug inserted in the socket-outlet shall be tested according to the following arrangements.

- a) One sample shall be tested with a rewirable plug fitted with 2-core 0.5 mm<sup>2</sup> flexible cable as given in MS 2112-5 or BS EN 50525-2-11.
- b) One sample shall be tested with a rewirable plug fitted with 3-core 1.5 mm<sup>2</sup> flexible cable as given in MS 2112-5 or BS EN 50525-2-21.
- c) One sample shall be tested without a plug fitted.

Socket-outlets having an IP classification with no plug inserted shall be tested for this arrangement.

Mounting screws for boxes or enclosures and screws for fixing socket-outlets to boxes or enclosures shall be tightened with a torque according to the manufacturer's instructions. In the absence of such instructions, the screws shall be tightened with a torque equal to two thirds of the values given in Table 6.

Socket-outlets with screwed glands or membranes shall be fitted with circular cables having a code H07RN-F and a cross-sectional area of 1.5 mm<sup>2</sup> as given in MS 2112-5 or BS EN 50525-2-21. Glands shall be tightened with a torque according to the manufacturer's instructions. In the absence of such instructions glands shall be tightened with a torque equal to two thirds of the values given in Table 8.

## MS 589-2:2018

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

Parts which can be removed without the aid of a total shall be removed.

**Table 8. Tightening torque values for cable glands**

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

NOTE. The recording of a measured value given in this table is considered to conform to this part of MS 589 on condition that the uncertainty of measurement at not less than 95 % confidence level does not exceed  $\pm 10$  %.

### 14.3.2.2 Protection against access to hazardous parts

The appropriate test according to MS IEC 60529 shall be performed.

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

**14.3.2.3** The appropriate test according to MS IEC 60529 shall be performed. For socket-outlets classified as IP5X, the enclosure shall be deemed to be category 2.

Test probes are not applied to drain holes.

### 14.3.3 Protection against harmful effects due to ingress of water

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

Socket-outlets shall be mounted as in normal use in accordance with the manufacturer's instructions.

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

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

Surface mounted socket-outlets shall be mounted as in normal use on a vertical surface and fitted with circular cables having a code H07RN-F and a cross-sectional area of 1.5 mm<sup>2</sup> as given in MS 2112-5 or BS EN 50525-2-21:2011.

Socket-outlets having an IP classification with a plug inserted in the socket-outlet shall be tested according to the following arrangements.

- a) One sample shall be tested with a rewirable plug fitted with 2-core 0.5 mm<sup>2</sup> flexible cable as given in MS 2112-5 or BS EN 50525-2-11:2011.



- b) One sample shall be tested with a rewirable plug fitted with 3-core 1.5 mm<sup>2</sup> flexible cable as given in MS 2112-5 or BS EN 50525-2-21:2011.
- c) One sample shall be tested without a plug fitted.

Socket-outlets having an IP classification with no plug inserted shall be tested for this arrangement.

Mounting screws for boxes or enclosures and screws for fixing socket-outlets to boxes or enclosures shall be tightened with a torque according to the manufacturer's instructions. In the absence of such instructions, the screws shall be tightened with a torque equal to two thirds of the values given in Table 6.

Socket-outlets with screwed glands or membranes are fitted with circular cables having a code H07RN-F and a cross-sectional area of 1.5 mm<sup>2</sup> as given in MS 2112-5 or BS EN 50525-2-21:2011. Glands shall be tightened with a torque according to the manufacturer's instructions. In the absence of such instructions glands shall be tightened with a torque equal to two thirds of the values given in Table 8.

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

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

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

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

Within 5 min of completion of the test the samples shall withstand an electric strength test as specified in 15.1.3.

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

- a) be sufficient to interfere with the correct operation of the equipment or impair safety;
- b) deposit on parts of insulating material where it could lead to tracking along the creepage distances;
- c) reach live parts not designed to operate when wet; and
- d) accumulate near the cable end or enter the cable if any.

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

## **15 Insulation resistance and electric strength**

**15.1** The insulation resistance and electric strength of socket-outlets shall be adequate.

## MS 589-2:2018

**15.1.1** Conformity shall be checked by the tests described in 15.1.2 and 15.1.3.

**15.1.2** The insulation resistance is measured using a d.c. voltage of  $500 \pm 250_0$  V the measurement being made for  $60 \pm 5_0$  s after application of the voltage.

The insulation resistance is measured consecutively between:

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

The insulation resistance shall be not less than the following:

- i) 5 M $\Omega$  between parts of opposite polarity;
- ii) 5 M $\Omega$  between parts of opposite polarity connected together, and other parts, including earthed metal, intended to be insulated from them;
- iii) 2 M $\Omega$  across switch contacts with the switch open (where applicable).

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

Where terminals/terminations are not directly accessible, e.g. in non-rewirable portable socket-outlets, these tests shall be made using accessible parts, e.g. socket-outlets contacts, known to be connected to the terminations.

**15.1.3** A 50 Hz voltage of substantially sinusoidal waveform is applied as described in 15.1.2. Initially, not more than 1 000 V is applied, the voltage then being raised to  $2\ 000\text{ V} \pm 60\text{ V}$ . The high voltage source used shall be such that when the output is adjusted to  $2\ 000\text{ V} \pm 60\text{ V}$  for  $60 \pm 5_0$  s and is then short-circuit, the output current is not less than 200 mA. Any overcurrent protection shall not operate at a current less than 100 mA.

During the test no flashover or breakdown shall occur. Glow discharges without drop in voltage shall be ignored.

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

**15.2** Non-rewirable portable socket-outlets shall withstand a high voltage test, for which the test voltage shall be alternating, (50 Hz to 60 Hz) applied between all current-carrying parts connected together and a conducting electrode in contact with the entire outer accessible surface. This test shall be carried out at  $6\,000\text{ V} \pm 100\text{ V}$  for a period between 3 s and 5 s.

During the test no breakdown or flashover shall occur.

Glow discharges without drop in voltage shall be ignored.

**16 Temperature rise**

<http://www.china-gauges.com/>

**16.1** Socket-outlets and their surroundings shall not attain excessive temperatures in normal use.

**16.1.1** Conformity shall be checked by the tests described in 16.1.2, and 16.1.3 for fixed socket-outlets and portable socket-outlets respectively.

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

For these tests, where conductors are connected to terminals, the terminal screws shall be tightened with a torque equal to two thirds of the values given in Table 6.

During the tests temperature rises are measured at the terminals or terminations and where overheating might result in a hazard and the values measured shall not exceed the values given in Table 9. Temperature rises are determined by means of fine wire thermocouples so chosen and positioned that they have minimum effect on the temperature of the part under test. The thermocouples are attached by means of a mixture of equal parts of resin adhesive and zinc oxide, by soldering, or by other equally effective means.

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

If, in order to fix thermocouples a non-rewirable portable socket-outlet is dissected to give access to the appropriate positions, the removed parts shall be replaced and if necessary shall be cemented in place such that no additional air spaces are created.

**Table 9. Permitted temperature rises**

Measurement point	Temperature rise K
Terminals or terminations	52
Accessible external surface	52
NOTES: 1. The recording of a measured value up to and including the specified maximum permissible limit for temperature rise is considered to conform to the requirements of the standard on condition that the uncertainty of measurement at not less than 95 % confidence level, and does not exceed $\pm 2\text{ }^{\circ}\text{C}$ . 2. The temperature rise values and test arrangements are for socket-outlets connected to conductors intended to operate at a temperature not exceeding $70\text{ }^{\circ}\text{C}$ .	

## MS 589-2:2018

**16.1.2** Surface-mounted fixed socket-outlets are mounted as in use with their accompanying mounting block or backplate fixed to a vertical plywood board having a nominal thickness of 24 mm and having a surface extending at least 150 mm in each direction beyond the extremity of the socket-outlet.

Flush-mounted socket-outlets having one or two sets of socket contacts and designed for use with flush-mounted socket-outlet boxes as shown in either Figure 1b) or Figure 2b) of BS 4662:2006+A1:2009 are mounted on a test fixture designed to simulate normal conditions of use, comprising such a metal box having a nominal internal depth of 35 mm, which is fixed into a block of wood, so that the front edges of the metal box are between 2.5 mm to 5 mm below the front surface of the block. The size of the block shall be such that there is a minimum of 25 mm of wood surrounding the box on all four sides and the back. The socket-outlet is then mounted by means of its fixing screws so that the rear of the plate is flush with the surface of the block.

Other types of fixed socket-outlets are mounted according to the manufacturer's instructions or, in the absence of such instructions, in the position of normal use considered to give the most onerous conditions. For socket-outlets that have an IP classification higher than IPX0, the test is carried out with any lids closed if the design permits this when in use.

The line, neutral and earth terminals of a single socket-outlet are connected to an incoming and outgoing 2.5 mm<sup>2</sup> 2-core and earth PVC insulated and sheathed cable as given in Table 4 of BS 6004:2012.

A twin unfused socket-outlet is connected as described above.

A multiple unfused socket-outlet having more than two sets of socket contacts is connected to an incoming 4 mm<sup>2</sup> 2-core and earth PVC insulated and sheathed cable as given in Table 4 of BS 6004:2012. There shall be no outgoing cable.

A fused socket-outlet having more than one set of socket contacts is connected to an incoming and outgoing 2.5 mm<sup>2</sup> 2-core and earth PVC insulated and sheathed cable as given in Table 4 of BS 6004:2012.

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

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

The fuse link, if any, incorporated in a multiple fused socket-outlet is replaced by a calibrated link, constructed and calibrated in accordance with Annex A.

Socket-outlets under test shall be subjected to electrical loading as given in Table 10. Where a plug is specified it shall be a special test plug, constructed and calibrated whilst carrying a load in accordance with Annex G. During the test the resistor of the test plug shall be connected to a d.c. source of supply equivalent to the 'calibration voltage'. USB battery charging outlets shall be loaded with their rated currents  $\left( \begin{matrix} +10 \\ 0 \end{matrix} \% \right)$  for the duration of this test.

Table 10. Loading of socket-outlets for temperature-rise test

Number of outlets	Plugs with connected loads ( $\pm 0.4$ A)	Balance of load $\pm 0.4$ A (A)	Total load on supply cable (nominal) (A)
1	1 x 14 A	6	20
2	1 x 14 A + 1 x 6 A	-	20
> 1 (fused)	1 x 14 A	6	20
> 2 (unfused)	2 x 14 A	-	28

NOTE. The tolerance values for current take account of an uncertainty of measurement of not greater than  $\pm 5\%$  at a confidence level of not less than 95%.

In the case of socket-outlets having more than one outlet, the disposition of the plugs shall be so arranged as to give the most onerous test conditions with regard to the position of terminals and fuses.

In the case of fused socket-outlets in which the number of outlets is greater than two, the test is then repeated, the total test current being divided equally between each of the test plugs, one inserted into each set of socket contacts in the socket-outlet.

The socket-outlet is subjected to the loading given in Table 10 for a minimum continuous period of 4 h or longer until stability is reached with a maximum duration of 8 h, stability being taken as less than 1 K rise within 1 h.

Rewirable portable socket-outlets are tested with 1 000 mm  $\pm$  50 mm of 1.25 mm<sup>2</sup> 3-core PVC flexible cable as given in BS EN 50525-2-11:2011, non-rewirable portable socket-outlets are tested with 1 000 mm  $\pm$  50 mm of the flexible cable supplied with them.

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

The portable socket-outlet is placed in its intended position of normal use on a horizontal plywood board having a nominal thickness of 24 mm and having a surface extending at least 150 mm in each direction beyond the extremities of the socket-outlet.

A test current appropriate to the flexible cable fitted as given in Table 2 is passed through the portable socket-outlet by means of a special test plug constructed and calibrated in accordance with Annex G. In the case of a multiple portable socket-outlet the plug shall be placed in the set of socket contacts considered to give the most onerous conditions. USB battery charging outlets shall be loaded with their rated currents  $\left( \begin{smallmatrix} +10 \\ 0 \end{smallmatrix} \% \right)$  for the duration of this test. The socket-outlet is operated as described for a minimum continuous period of 4 h or longer until stability is reached with a maximum duration of 8 h, stability being taken as less than 1 K rise within 1 h.

In the case of a multiple portable socket-outlet, the test is then repeated, the total test current being divided equally between each of the test plugs, one inserted into each set of socket contacts in the portable socket-outlet. For portable socket-outlets with more than four outlets, the test shall be performed with four test plugs inserted into four sets of socket contacts, selected to give the most onerous conditions. The remaining outlets shall have nothing inserted into them.

**16.1.3** Fixed and panel mounted socket-outlets with more than one terminal for line and/or neutral connections (i.e. internal connections could form part of an external ring circuit) or having screwless terminals shall be subjected to an additional temperature rise test, as described in 16.1.2 except: incoming and outgoing conductors (2.5 mm<sup>2</sup> 2-core and earth PVC insulated and sheathed cable as given in Table 4 of BS 6004:2012) are fitted to separate terminals. A test current of 20 A is applied without any plug being engaged with the socket-outlet.

Following this test, the resistance between each line terminal and between each neutral terminal shall be measured using a current of  $25^{+0.75}_0$  A derived from an a.c. source having a no-load voltage not exceeding 12 V, passed for  $60^{+5}_0$  s. The resistance shall not exceed 0.05 Ω.

## **17 Breaking capacity of socket-outlets**

**17.1** The breaking capacity of socket contacts, switches, and fuse contacts incorporated in socket-outlets, shall be adequate.

**17.1.1** Conformity shall be checked by the tests described in 17.1.2, 17.1.3 and 17.1.4 as applicable, which shall be completed with the socket-outlets connected and mounted as in normal use.

**17.1.2** The socket contacts shall make and break a current of 1.25 times rated current ± 0.4 A [i.e. (1.25 x 13) ± 0.4 A] in a substantially non-inductive a.c. circuit at 250 V ± 5 V, ten times in succession at intervals of approximately 30 s, a plug being withdrawn from the socket-outlet at a speed of approximately 150 mm/s immediately after insertion. For the purpose of the test the fuse link may be replaced by a link of negligible impedance.

After the test, the socket-outlet shall be capable of satisfying the subsequent tests detailed in Table 1 for the appropriate test sample.

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

After the test, the socket-outlet shall be capable of satisfying the subsequent tests detailed in Table 1 for the appropriate test sample.

**17.1.4** The fuse contacts shall make and break a current by insertion and removal of a fuse in a substantially non-inductive a.c. circuit at  $275 \text{ V} \pm 5 \text{ V}$ , ten times in succession at intervals of approximately 30 s, the values of the current being 1.25 times rated current  $\pm 0.4 \text{ A}$  [i.e.  $(1.25 \times 13) \pm 0.4 \text{ A}$ ] for fuses in single socket-outlets and 1.6 times rated current  $\pm 0.4 \text{ A}$  for fuses in multiple socket-outlets. Standard 13 A fuse links in accordance with BS 1362 are used for this test, and may be replaced if necessary during the test. For the test, all metal parts not in contact with line contacts shall be connected to the earth pole of the test circuit.

After the test, the socket-outlet shall be capable of satisfying the subsequent tests detailed in Table 1 for the appropriate test sample.

**17.2** For socket-outlets intended for electric vehicle charging, the tests of 17.1.2 and 17.1.3 are performed at a power factor of  $0.6^{+0}_{-0.05}$  lagging.

**17.2.1** Conformity shall be checked by the tests described in 17.1.2 and 17.1.3 as applicable, with the socket-outlets connected and mounted as in normal use but at a power factor of  $0.6^{+0}_{-0.05}$  lagging.

## 18 Normal operation of socket-outlets

**18.1** Socket-outlets shall withstand without excessive wear or other harmful effects, the electrical and mechanical stresses occurring in use.

**18.1.1** Conformity shall be checked by the tests described in 18.1.2 and 18.1.3.

**18.1.2** The combination of plugs having solid pins and the socket-outlet under test with the engagement surface substantially vertical shall make and break their rated current  $\pm 0.4 \text{ A}$  at  $250 \text{ V} \pm 10 \text{ V}$  a.c. 15 000 times (30 000 movements) in a substantially non-inductive circuit. Each plug is inserted into and withdrawn from the socket-outlet 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 are approximately equal. The plug pins are renewed after each 5 000 insertions and withdrawals. For the purpose of this test no lubrication is applied to the plug or socket under test.

After the test the shutter shall be operating satisfactorily, the socket contacts safely shielded and the socket-outlet shall be in accordance with 9.1, Clause 16, 13.19, Clause 15, 13.4.1a), 10.2, 13.6, 13.7 and 13.8. The permitted value of voltage drop described in 13.4.1a) is increased to not greater than 13.4.1a) 40 mV.

**18.1.3** In switched socket-outlets the voltage drop across each switched pole, measured at points immediately adjacent to the switch, shall not exceed 60 mV at rated current.

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

## MS 589-2:2018

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

The switch shall also be in accordance with Clause 15, the test voltages of 15.1.3 being reduced by 25 %.

**18.2** For socket-outlets intended for electric vehicle charging the test of 18.1.2 and 18.1.3 are performed at a power factor of  $0.6^{+0}_{-0.05}$  lagging and the number of cycles is 5 000.

**18.2.1** Conformity shall be checked by the tests described in 18.1.2 and 18.1.3 as appropriate with the power factor and number of cycles as stated in 18.2.

After the test of 18.1.2 and 18.1.3 the socket-outlet shall be tested in accordance with Clause 16 only.

## 19 Connection of flexible cables and cable anchorage

**19.1** Provision shall be made for the entry and effective clamping without bending of 3-core flexible cables for rewirable portable socket-outlets, as given in MS 2112-5 or BS EN 50525-2-21:2011 and BS EN 50525-2-11:2011, having nominal conductor cross-sectional areas not exceeding  $1.5 \text{ mm}^2$ .

For non-rewirable portable socket-outlets provision shall be made for the entry and adequate retention of the 3-core flexible cable with which the socket-outlet is supplied.

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

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

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

**19.1.1** Conformity shall be checked by inspection and by the following tests.

- a) Rewirable portable socket-outlets are fitted with a 3-core flexible cable having a nominal cross-sectional area of  $0.5 \text{ mm}^2$  as given in MS 2112-5 or BS EN 50525-2-11:2011. The conductors are introduced into the terminals and the terminal screws tightened to one third of the torque values listed in Table 6. The cable anchorage is used in the normal way, the clamping screws, if any, being tightened to a torque of two thirds of that given in Table 6. The assembly is then left untouched for a minimum of 24 h.

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



The flexible cable is then subjected 25 times to the pull given in Table 2. The pulls are applied in one smooth and continuous motion in the most unfavourable position momentarily. Immediately afterwards, the flexible cable is subjected for  $60^{+5}_0$  s to the appropriate torque shown in Table 2 at a minimum starting distance of 150 mm from the cable entry measured along the length of the cable.

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

These tests are then repeated but with the portable socket-outlet fitted with a 3-core flexible cable having a nominal conductor cross-sectional area of  $1.5 \text{ mm}^2$  as given in MS 2112-5 or BS EN 50525-2:11:2011.

- b) For non-rewirable portable socket-outlets the test is carried out with the flexible cable with which it is supplied, using the appropriate load and torque as given in Table 2. The conductors of the flexible cable are severed at the point of termination prior to the test.

During this test the insulation of the flexible cable shall not be damaged.

A voltage of  $3\,750 \text{ V} \pm 75 \text{ V}$  is applied for  $60^{+5}_0$  s between the conductors. Breakdown or flashover is considered to indicate damage to the flexible cable.

- c) After the tests given in a) and b) the flexible cable shall not have been displaced by more than 2 mm.

For the measurement of longitudinal displacement a mark is made on the flexible cable whilst it is subjected to the pull at a distance of approximately 20 mm from the anchorage before starting the tests. After the test the displacement of the mark on the flexible cable in relation to the cable anchorage is measured whilst the flexible cable is again subject to the pull.

**19.2** Cable anchorages in rewirable portable socket-outlets shall anchor the flexible cable securely to the socket-outlet. The design shall ensure the following:

- a) the cable anchorage cannot be released from the outside without the use of a tool;
- b) it shall not be possible to touch cable anchorage screws, if any, with test probe B of MS IEC 61032 when the socket-outlet is energised;
- c) the flexible cable is not clamped by a metal part bearing directly on the flexible cable;
- d) at least one part of the anchorage is securely fixed to the socket-outlet;
- e) clamping the flexible cable does not require the use of a special purpose tool; and
- f) the cover may be correctly fitted without damage when the portable socket-outlet is wired with the largest specified flexible cable and all screws are tightened to the torque specified in Table 6.

**19.2.1** Conformity shall be checked by inspection and test.

## MS 589-2:2018

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

**19.3.1** Conformity shall be checked by inspection.

**19.4** Non-rewirable portable socket-outlets shall be fitted with 3-core flexible cables conforming to MS 2112-5 or BS EN 50525-2-11:2011, or BS EN 50525-2-12:2011, or BS EN 50525-2-21:2011 or BS EN 50525-2-71:2011. Connections shall be as given in Table 11.

**19.4.1** Conformity shall be checked by inspection and continuity test.

<http://www.china-gauges.com/> Table 11. Connection of flexible cords

Termination	Conductor insulation colour: 3-core
Earth	Green-Yellow
Line	Brown
Neutral	Blue

**19.5** Non-rewirable portable socket-outlets shall be so designed that the flexible cable is not subjected to excessive bending where it enters the portable socket-outlet.

**19.5.1** Conformity shall be checked by the following test using an apparatus similar to that shown in Figure 18. The portable socket-outlet is fixed to the oscillating member of the apparatus so that when this is vertical the axis of the flexible cable at the point of entry is vertical and passes through the axis of oscillation.

The flexible cable is loaded with a weight as given in Table 2.

The distance between the point of entry to the portable socket-outlet and the axis of oscillation is adjusted so that the weight makes the minimum lateral movement as the oscillating member moves. A current appropriate to the flexible cable fitted, as given in Table 2, is passed through the line and neutral conductors, the voltage between them being  $250 \text{ V} \pm 10 \text{ V}$  a.c. The earthing conductor shall be connected at one end to the neutral conductor.

The oscillating member is moved backwards and forwards through an angle of  $45^\circ \pm 3^\circ$  on either side of the vertical, number of flexings being 10 000 at a rate of  $60 \frac{0}{10}$  per minute. After 5 000 flexings, socket-outlets are turned through  $90^\circ \pm 5^\circ$  about the flexible cable entry centreline.

NOTE. A flexing is one movement through  $90^\circ$ , either backwards or forwards.

During the test there shall be no interruption of the current passing through the conductors and no short-circuit between them.

After the test the sample shall show no damage except that breakage of no more than 10 % of the total number of conductor strands in any core is ignored provided they have not pierced the insulation.

**19.6** The flexible cable entry to rewirable portable socket-outlets shall be so shaped as to prevent damage to the flexible cable.

**19.6.1** Conformity shall be checked by inspection.

## **20 Mechanical strength**

**20.1** Socket-outlets shall have adequate mechanical strength and be so constructed as to withstand such handling as may be expected in normal use.

**20.1.1** Conformity shall be checked by the tests described in 20.1.2, 20.1.3, 20.1.4 and 20.1.5 as appropriate.

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

**20.1.2** A solid link of stainless steel as shown in Figure 19 is inserted and withdrawn from the fuse clips of a fused socket-outlet 20 times in succession in a normal manner at a rate not exceeding ten per minute. A standard fuse link conforming to BS 1362 is then fitted and the appropriate mechanical strength test completed.

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

The striking element has a hemispherical face made of polyamide having a Rockwell hardness of  $85 \leq \text{HRR} \leq 100$ , or hornbeam, and a radius of  $10 \text{ mm} \pm 0.5 \text{ mm}$  (see Figure 21b). The design of the apparatus is such that a force of between 1.9 N and 2 N has to be applied to the face of the hammer to maintain the pendulum in a horizontal position.

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

The mounting support (see Figure 21c), having a mass of  $10 \text{ kg} \pm 1 \text{ kg}$ , is mounted on a rigid bracket by means of pivots. The bracket is mounted on a frame which is fixed to a solid wall.

The design of the mounting assembly shall be such that:

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

The socket-outlet is mounted on the plywood as in normal use.

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

## MS 589-2:2018

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

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

The socket-outlet is placed so that the point of impact lies in the vertical plane through the axis of the pivot of the pendulum. For all tests the hammer falls from a height of  $150 \begin{smallmatrix} 0 \\ -5 \end{smallmatrix}$  mm measured vertically between the point of impact on the sample and the face of the hammer at the point of release. Ten blows are applied to points evenly distributed over the socket-outlet. Any lens incorporated in a socket-outlet receives one blow of the hammer at a point approximately at its centre. One of the ten blows of the hammer is applied to the actuating member, if any. For socket-outlets that have an IP classification higher than IPX0 the test is carried out with any lid open. The lid is then closed, and an additional three blows in total applied to the most onerous points of the lid.

NOTE. The test sample might need to be rotated through 180° to prevent the lid interfering with the impact hammer for tests with lid open.

After the test the socket-outlet shall still be in accordance with Clauses 8, 9 and 15 and, for socket-outlets having an IP classification greater than IP20, shall show no damage which impairs its ingress protection. After the test on a lens, the lens may be cracked and/or dislodged but it shall not be possible to touch live parts using the test pin shown in Figure 1 applied with a maximum force of 5 N, applied in accordance with 9.1.1.

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

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

**20.1.4** Rewirable single and twin portable socket-outlets are fitted with 3-core PVC 1.25 mm<sup>2</sup> flexible cable as given in BS EN 50525-2-11:2011, the terminals and cover screws being tightened with the torque in Table 6. Non-rewirable single and twin portable socket-outlets are tested as delivered.

The flexible cables attached to socket-outlets are cut to a length of 150 mm ± 5 mm measured from the nearest edge of the socket-outlet, precoiled flexible cables being extended before measurement.

They are tested in the tumbling barrel shown in Figure 20. The barrel is turned at a rate of approximately 5 r/min, (approximately ten drops per minute).

Only one socket-outlet is tested at a time. The number of drops is 5 000.

After the test the portable socket-outlet shall show no external damage which might affect safety and no components shall have become detached.

Conformity shall be checked by inspection and the test described in 13.4b) and Clauses 15 and 16.

Small chips and dents which do not adversely affect the protection against electric shock shall be ignored.

For the repeat test in accordance with Clause 16, the attached flexible cable is retained without disturbing the terminal connections, but the conductor insulation and sheath are removed only as far as is necessary for the attachment of a 1 000 mm  $\pm$  50 mm length of flexible cable of the same type as that already attached to the socket-outlet, the connection being made by means of a connector having a current rating appropriate to that of the flexible cable.

**20.1.5** Rewirable portable socket-outlets with more than two outlets are fitted with 3-core 1.25 mm<sup>2</sup> flexible cable as given in BS EN 50525-2-11:2011.

Non-rewirable socket-outlets are tested as delivered.

The free end of the flexible cable which is approximately 2 250 mm long is fixed to a wall at a height of 400  $\begin{matrix} 0 \\ -10 \end{matrix}$  mm above the floor as shown in Figure 22. The sample is held so that the cable is approximately horizontal and then it is allowed to fall on to a concrete floor eight times, the flexible cable being rotated through approximately 45° and its fixing each time.

After the test, the socket-outlet shall show no external damage which might affect safety, no components shall have become detached and the portable socket-outlet shall satisfy the tests described in 13.4 b) and Clauses 15 and 16. For the repeat test in accordance with Clause 16 the attached flexible cable is reduced to 1 000 mm  $\pm$  50 mm without disturbing the terminal connections.

Small chips and dents which do not adversely affect the protection against electric shock are ignored.

## 21 Screws, current-carrying parts and connections

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

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

Contact pressure in electrical connections within the socket-outlet and between the socket-outlet and the cable or flexible cable connected to it shall not be transmitted through insulating material other than ceramic, pure mica or other material with characteristics no less suitable, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or yielding of the insulating material.

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

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

The screw is tightened and loosened as follows:

## MS 589-2:2018

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

When testing terminal screws and nuts a 1.5 mm<sup>2</sup> flexible conductor is placed in the terminal in the case of portable socket-outlets, and a 2.5 mm<sup>2</sup> solid conductor is placed in the terminal in the case of fixed socket-outlets. The conductor is moved each time the screw is loosened. The test is made by means of a suitable test screwdriver, applying a torque as given in Table 6 in one smooth and continuous motion. The shape of the blade of the test screwdriver shall suit the head of the screw being tested.

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

**21.2** Thread-cutting and/or thread-forming screws shall not be used for the making of current-carrying or earth continuity connections.

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

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

**21.2.1** Conformity shall be checked by inspection and by manual test.

NOTES:

1. Spring washers and the like may provide satisfactory locking.
2. For rivets a non-circular shank or an appropriate notch may be sufficient.

**21.3** Current-carrying parts and earthing contacts shall be of brass, copper, phosphor-bronze or other metal at least equivalent with regard to its conductivity, resistance to abrasion and resistance to corrosion, except for screws, nuts, washers, clamping plates and similar parts of terminals, nor to parts of socket-outlets used for earth continuity purposes.

**21.3.1** Conformity shall be checked by inspection and by the relevant tests described in 10.2, 10.3, Clauses 16 and 24.

## 22 Resistance to heat

**22.1** Socket-outlets shall be resistant to heat.

**22.1.1** Conformity shall be checked by the test described in 22.1.2 or 22.1.3.

Parts made from rubber or ceramics in fixed socket-outlets shall not be subjected to these tests.

**22.1.2** For complete socket-outlets and for separate ancillary components samples are kept for  $60^{+5}_0$  min in a heating cabinet maintained at the following temperatures:

- a)  $70\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  for portable socket-outlets, mounting boxes, separate covers and separate cover plates; and
- b)  $100\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  for all other socket-outlets.

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

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

After the test the socket-outlet shall still conform to 9.2.1 and 15.1.3, and it shall not be possible to touch live parts with test probe 11 of MS IEC 61032 applied with a force of

<http://www.china-gauges.com/>

**22.1.3** Portable socket-outlets with external parts of resilient material, e.g. thermoplastics and rubber, are subjected to a pressure test by means of an apparatus similar to that shown in Figure 23, the test being made in a heating cabinet at a temperature of  $70\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ .

The socket-outlet is clamped between the jaws in such a way that these press against it in the area where it is gripped in normal use, the centreline 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 is  $20\text{ }_{-1}^{0}\text{ N}$ .

After  $60\text{ }_{0}^{+5}\text{ s}$  the jaws are removed and the socket-outlets shall satisfy the tests described in 15.1.2b)i) and 15.1.3 and shall accept the gauges of Figure 11.

**22.2** Parts of insulating material shall be sufficiently resistant to heat having particular regard to their location and function in the complete socket-outlet.

**22.2.1** Conformity shall be checked as follows:

- a) parts of ceramic material are deemed to conform without testing;
- b) external parts of socket-outlets tested according to 22.1.3, are deemed to conform without further testing;
- c) all other parts of insulating material shall be subjected to the ball pressure test in accordance with IEC 60695-10-2.

The test temperatures shall be as given below.

For parts of insulating material necessary to retain current-carrying parts in position and the material forming the front surface of socket-outlets, within a zone of 2 mm around line and neutral pin entry holes, the test temperature shall be:

- a) for fixed socket-outlets:  $125\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ ;
- b) for portable socket-outlets:  $75\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ .

## MS 589-2:2018

For parts of insulating material not necessary to retain current-carrying parts in position, even though they may be in contact with them, the test temperature shall be  $75\text{ °C} \pm 5\text{ °C}$  for fixed and portable socket-outlets.

### 23 Resistance to abnormal heat and fire

#### 23.1 General

Socket-outlets shall be resistant to abnormal heat and fire.

**23.1.1** Conformity shall be checked by the test described in 23.2. The tests shall not be made on parts of ceramic material or metal.

#### 23.2 Glow-wire test

The test shall be performed in accordance with IEC 60695-2-11 and at the test temperature given in Table 12.

**Table 12. Application of glow-wire test**

Part	Temperature of glow wire	
	Portable socket-outlets (°C)	Fixed socket-outlets (°C)
Parts necessary to retain live parts in position	$750 \pm 10$	$850 \pm 15$
Parts not necessary to retain live parts in position (although they may be in contact with live parts)	$650 \pm 10$	$650 \pm 10$

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

Small parts (see 3.39), parts of insignificant mass (see 3.38), parts unlikely to be subjected to abnormal heat and parts whose failure to pass these tests would not materially affect the safety of the socket-outlet are not subjected to this glow-wire test.

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

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

The test shall be made on one sample.

In case of doubt, the test shall be repeated on two further samples. The test is made, applying the glow-wire once.



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

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

The sample shall be regarded as having passed the glow-wire test if any of the following apply:

- a) there is no visible flame and no sustained glowing; and
- b) flames and glowing of the sample extinguish within 20 s after the removal of the glow-wire;

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

## 24 Resistance to excessive residual stresses and to rusting

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

**24.1.1** Conformity shall be checked by the following test.

The sample is degreased in a suitable alkaline degreasing solution or organic solvent, then immersed in an aqueous solution of mercurous nitrate containing 10 g of  $\text{Hg}_2(\text{NO}_3)_2$  and ten moles of  $\text{HNO}_3$  (relative density 1.42) per litre of solution for  $30 \text{ min} \pm 1 \text{ min}$  at a temperature of  $27 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ .

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

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

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

**24.2** Ferrous parts, the rusting of which might cause the socket-outlet to become unsafe, shall be adequately protected against rusting.

**24.2.1** Conformity shall be checked by the following test.

The sample is degreased in a suitable alkaline degreasing solution or organic solvent; the parts are then immersed for  $10 \text{ min} \pm 0.5 \text{ min}$  in a 10 % solution of ammonium chloride in water at a temperature of  $27 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ .

Without drying but after shaking off any drops, the parts are placed for  $10 \text{ min} \pm 0.5 \text{ min}$  in a box containing air saturated with moisture at a temperature of  $27 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ . After the parts have been dried for at least 10 min in a heating cabinet at a temperature of  $100 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ , their surfaces shall show no signs of rust.

## MS 589-2:2018

### NOTES:

1. Traces of rust on sharp edges and any yellowish film removable by rubbing should be ignored.
2. For small helical springs and the like, and for parts exposed to abrasion, a layer of grease may provide sufficient protection against rusting. Such parts are only subjected to the test if there is doubt about the effectiveness of the grease film and the test should then be made without previous removal of the grease.

## 25 (Not used)

<http://www.china-gauges.com/>

### 26 Cyclic loading test

**26.1** Socket-outlets classified as being suitable for electric vehicle charging shall withstand the associated electrical and mechanical stresses.

**26.1.1** Conformity shall be checked by the test described in 26.1.2.

**26.1.2** The socket-outlet shall be wired in accordance to 16.1.2 using 2.5 mm<sup>2</sup> 2-core and earth PVC insulated and sheathed cable as given in MS 2112-4 or BS 6004:2012, except that there shall be no outgoing cable.

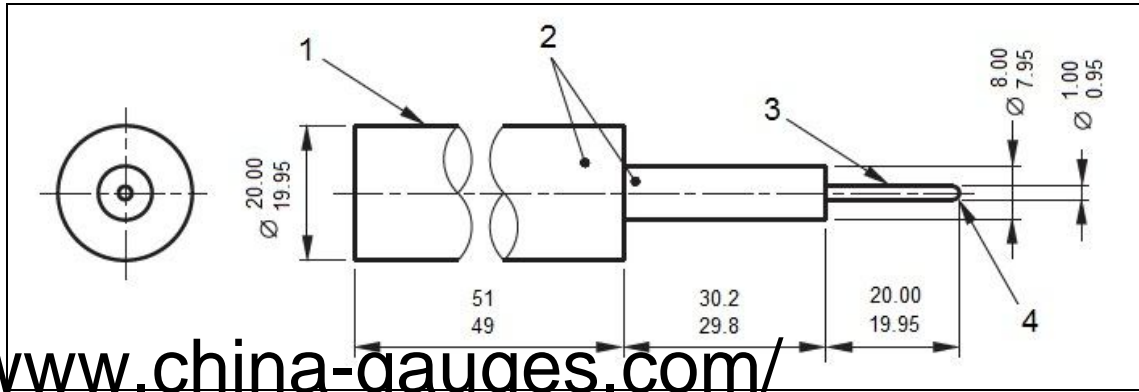
The test shall be carried out at rated voltage.

The plug shall be connected to a load of  $13^{+0.4}_0$  A using the special test plug constructed and calibrated in accordance with Annex G.

The test shall be conducted for 28 continuous cycles; each cycle consisting of 8 h 'on', 1 h 'off', 8 h 'on' and 7 h 'off'. The plug shall remain engaged throughout the duration of the test.

At the end of the 28 continuous cycles, the socket-outlet shall then be checked by inspection, and shall be in accordance with Clause 16, and the socket-outlet shall accept the gauges of Figure 11.

Dimensions are in millimetres

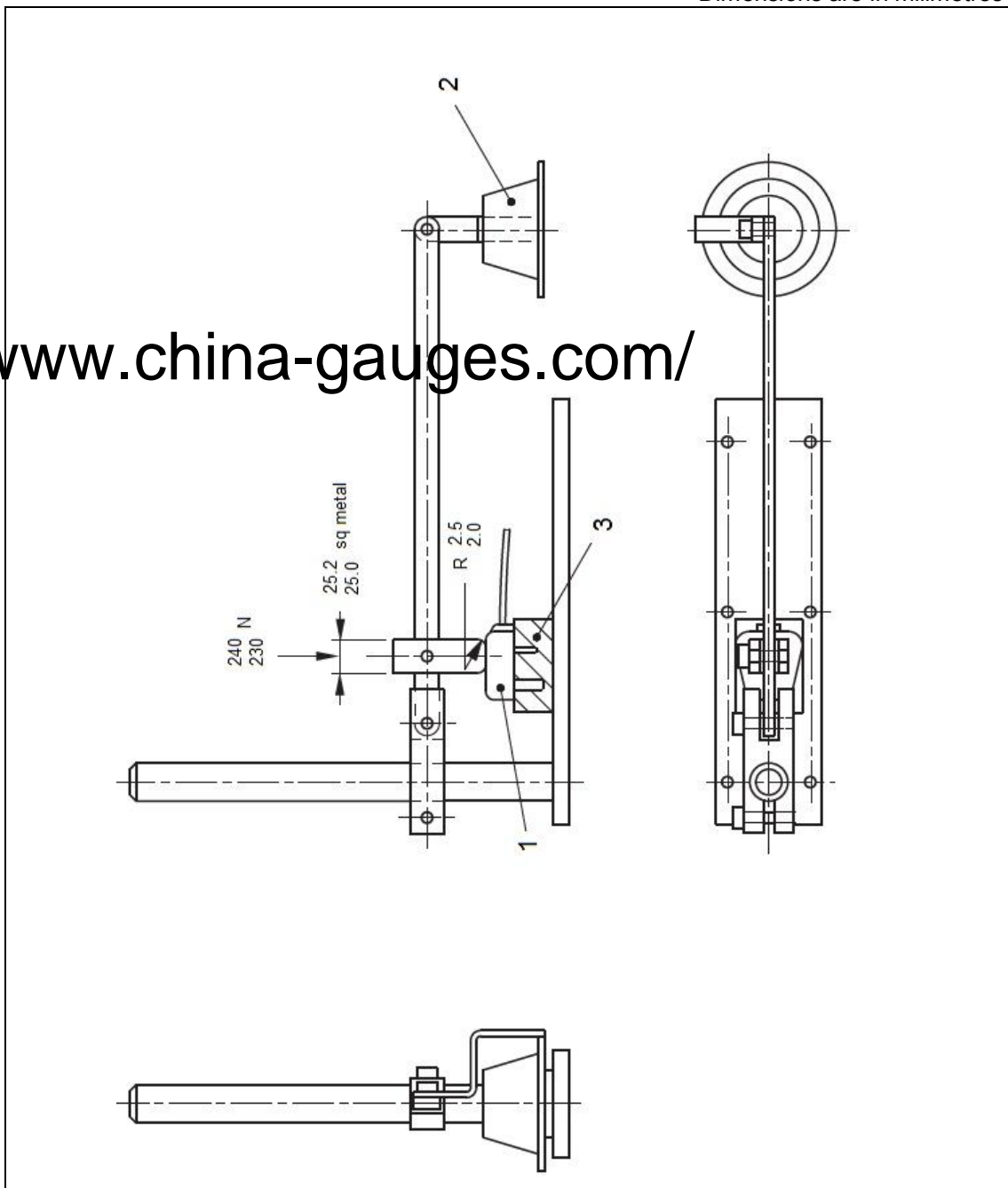


Key

- 1 Handle
- 2 Insulating material
- 3 Steel
- 4 Spherical radius (SR)

Figure 1. Test pin (see Clause 12)

Dimensions are in millimetres



**Key**

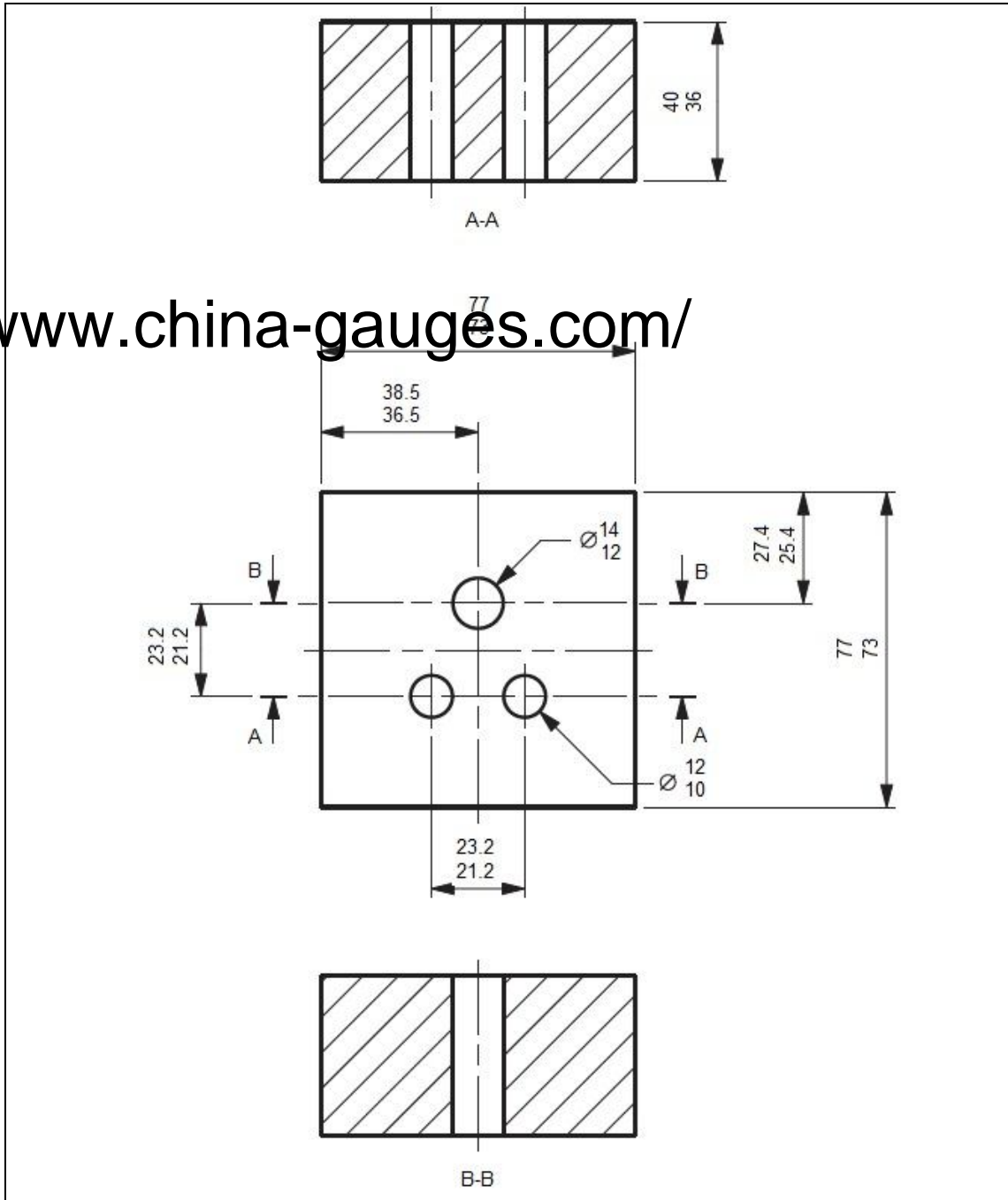
- 1 Sample under test
- 2 Weight
- 3 Hardwood block (see Figure 2b)
- 4 Spherical radius (SR)

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

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

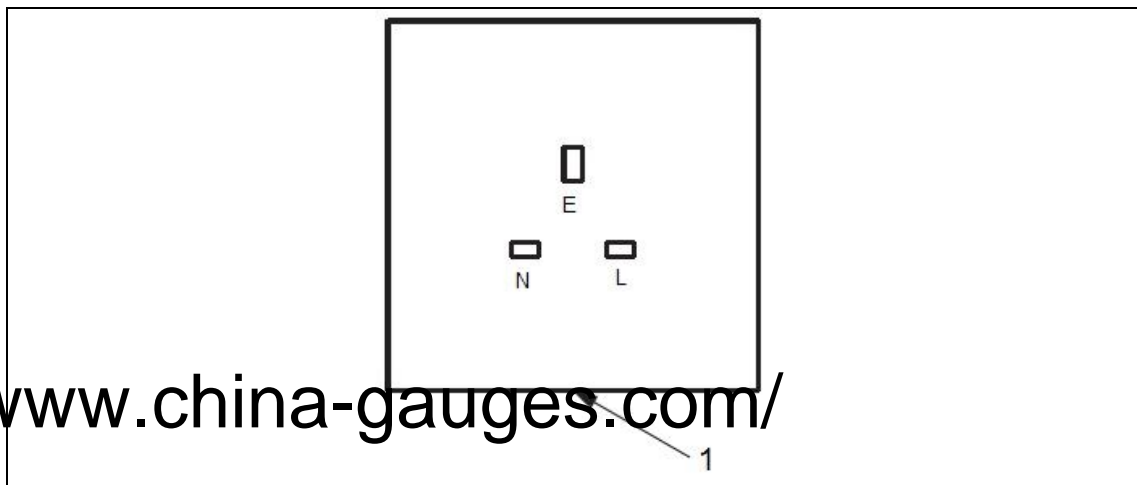
<http://www.china-gauges.com/>

Dimensions are in millimetres



<http://www.china-gauges.com/>

Figure 2b. Hardwood block for Figure 2a



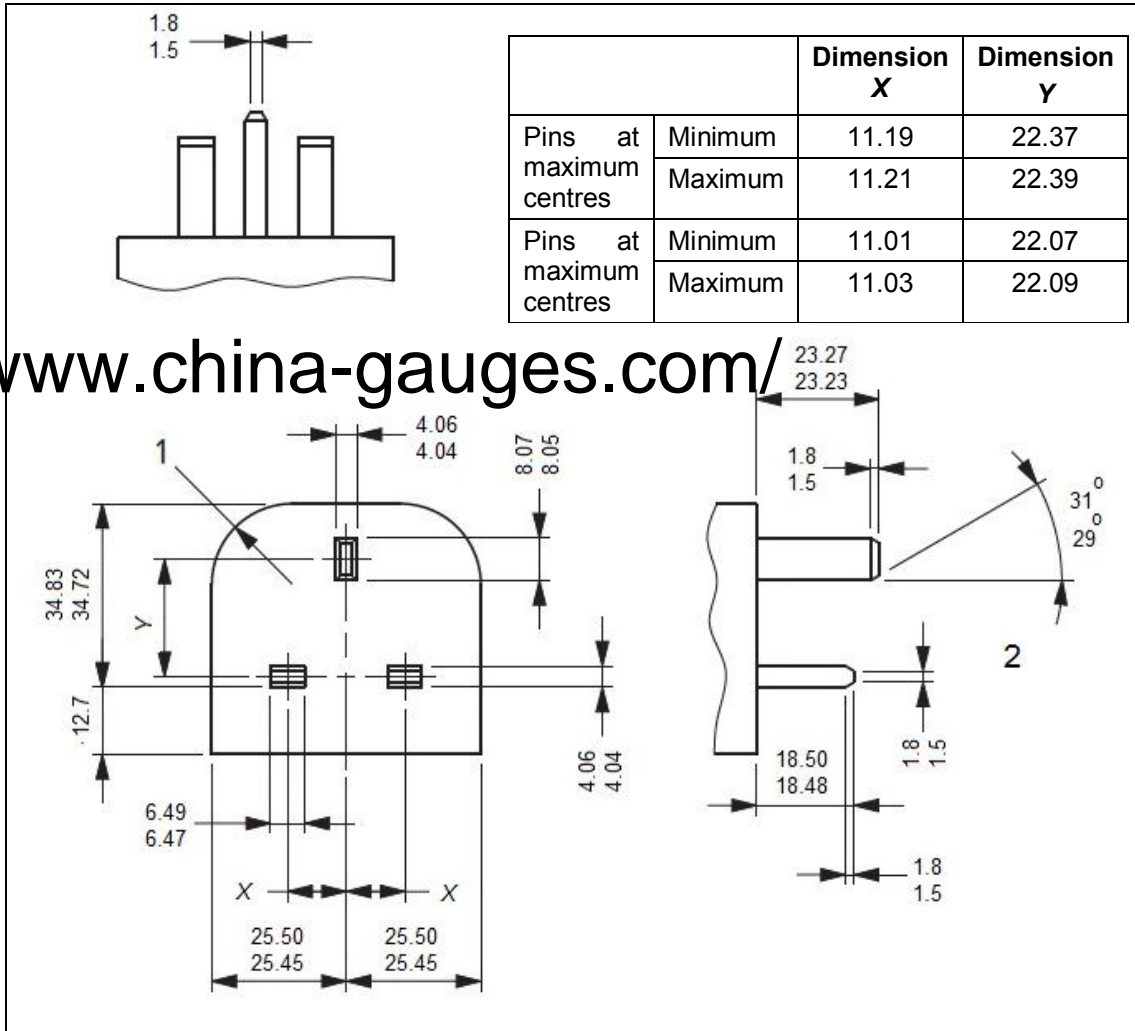
**Key**

1 Lower edge

NOTE. The diagram shows the disposition of the socket contacts as viewed from the front of the socket-outlet.

**Figure 3. Disposition of socket contacts (see Clause 13)**

Dimensions are in millimetres



<http://www.china-gauges.com/>

**Key**

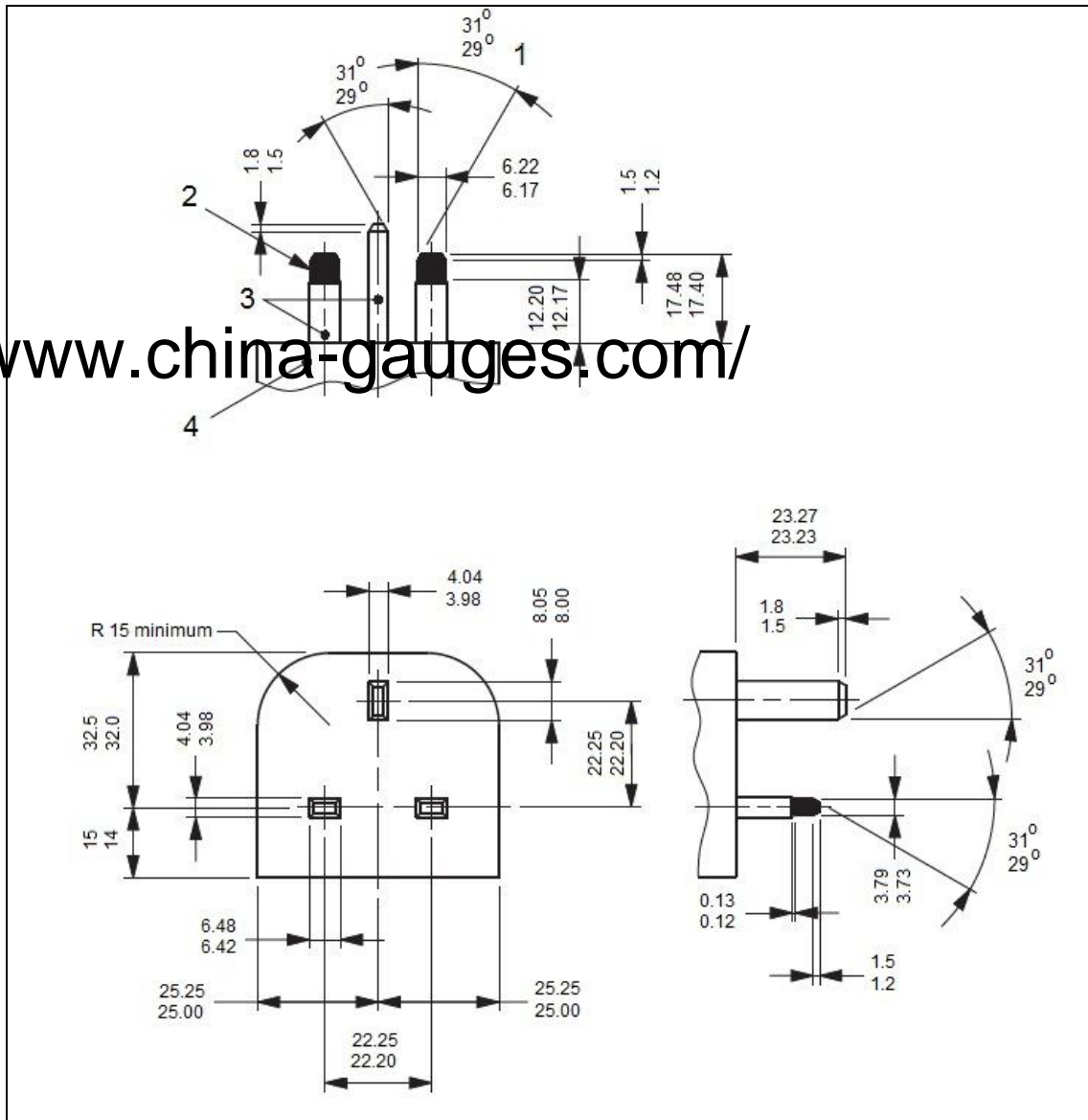
- 1 R 15.2 TP (true profile) with a tolerance zone 0.1 from the TP; the form of this contour is to blend smoothly with the sides
- 2 This may be chamfer or part of the surface of a cone

**NOTES:**

- 1. All sharp edges of the shaped portion of all the pins of the socket-outlet are slightly rounded.
- 2. The surface of the gauge in which the pins are mounted are flat to within 0.025 mm.

**Figure 11. Go gauge for socket-outlet (see Clause 13)**

Dimensions are in millimetres



**Key**

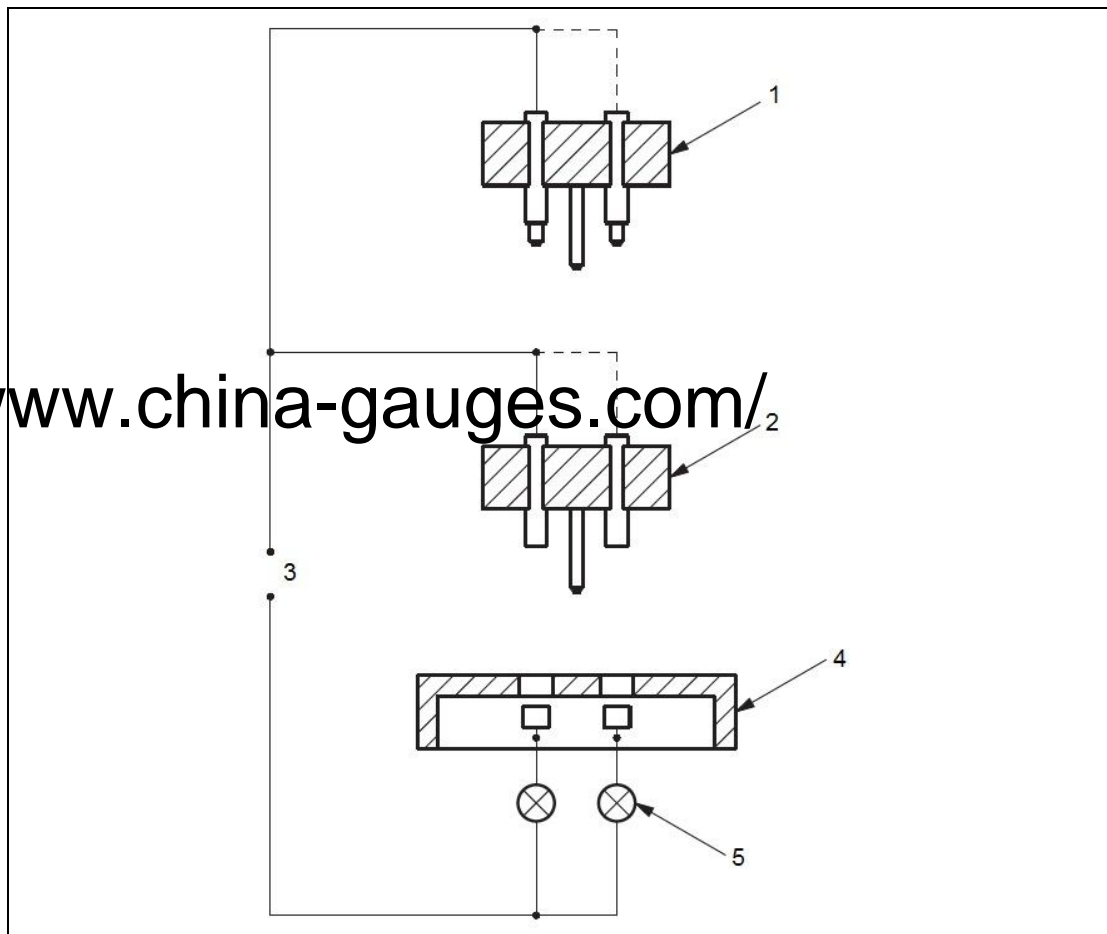
- 1 May be rounded
- 2 Insulating material
- 3 Suitable conducting material
- 4 Insulating or conducting material

**NOTES:**

- 1. All sharp edges of the chamfered portion and ends of the gauge pins are slightly rounded.
- 2. Insulated ends of pins may require suitable protection against wear.

**Figure 12. Contact test gauge (see Clause 13)**





**Key**

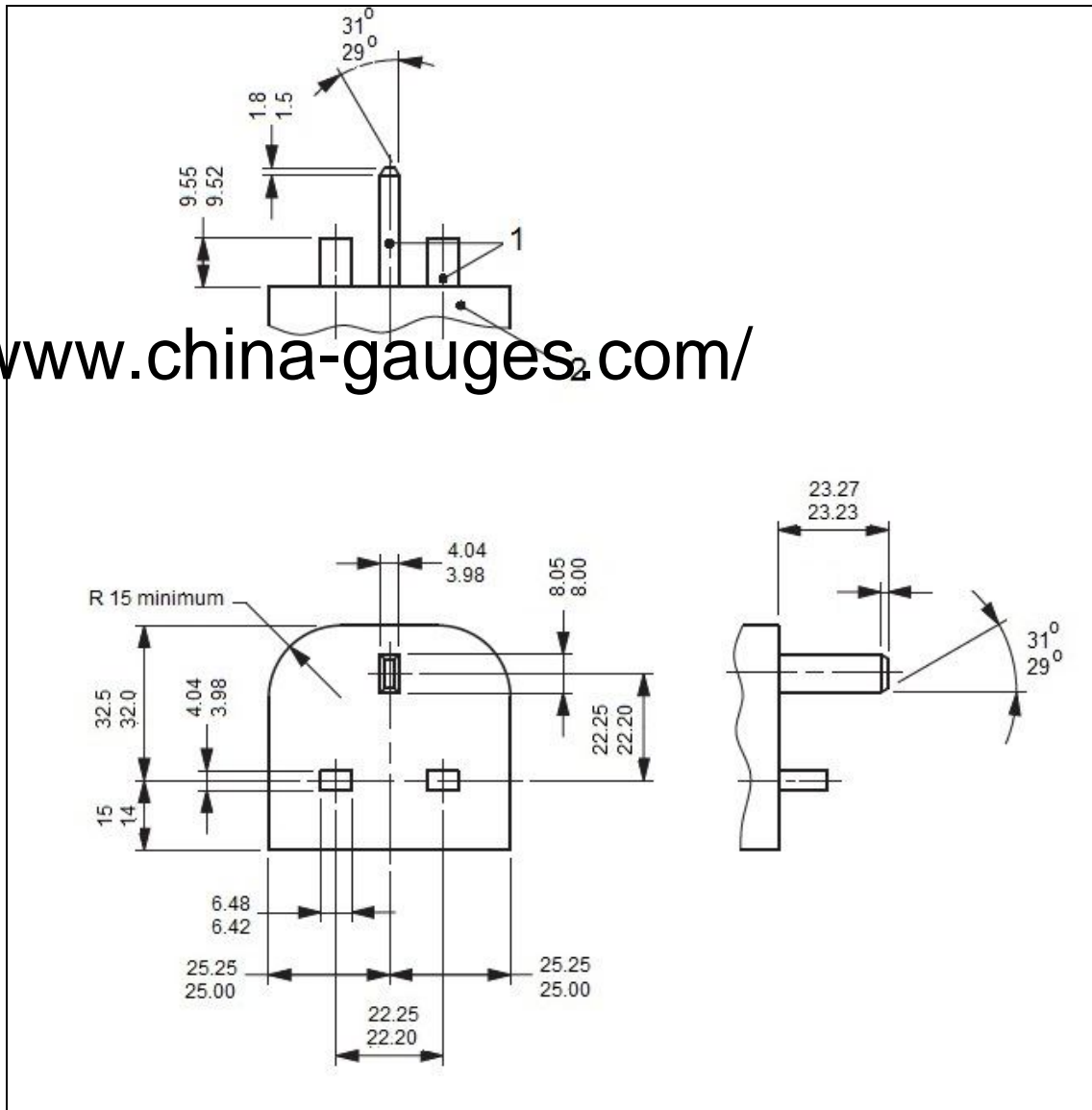
- 1 "Contact" test gauge
- 2 "Non-contact" test gauge
- 3 40 V supply
- 4 Sample socket-outlet under test
- 5 Indicating lamps

**NOTES:**

- 1. For details of contact test gauge, see Figure 12.
- 2. For details of non-contact test gauge, see Figure 14.
- 3. Dotted show additional connections when gauge body is made from insulating material.
- 4. The figure shows a typical test apparatus and is not intended to be specific.

**Figure 13. Test apparatus and circuit for use with contact and non contact gauges (see Clause 13)**

Dimensions are in millimetres



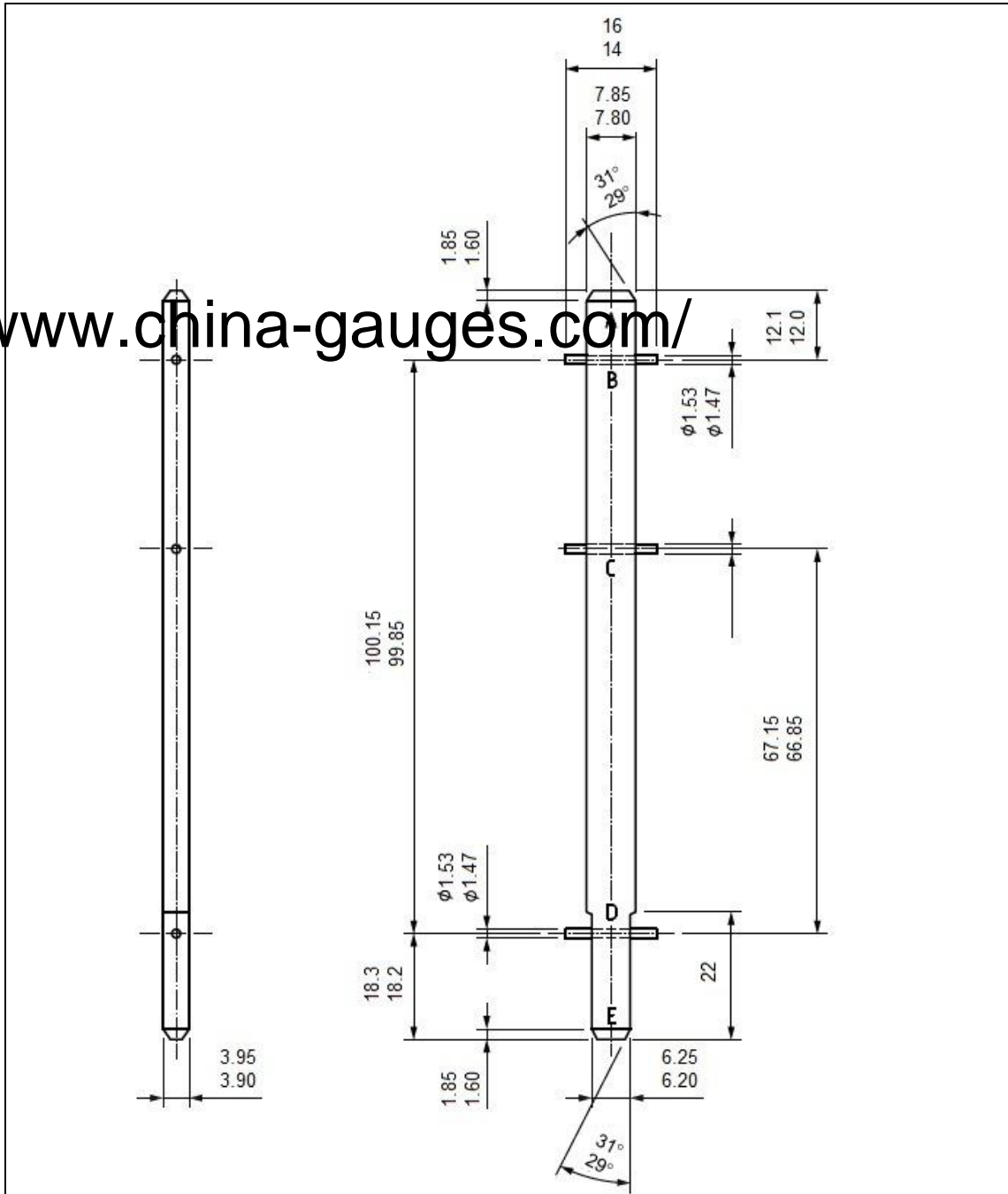
**Key**

- 1 Suitable conducting material
- 2 Insulating or conducting material

NOTE. All sharp edges are chamfered proof and the ends of the gauge pins are slightly rounded.

**Figure 14. Non contact test gauge (see Clause 13)**

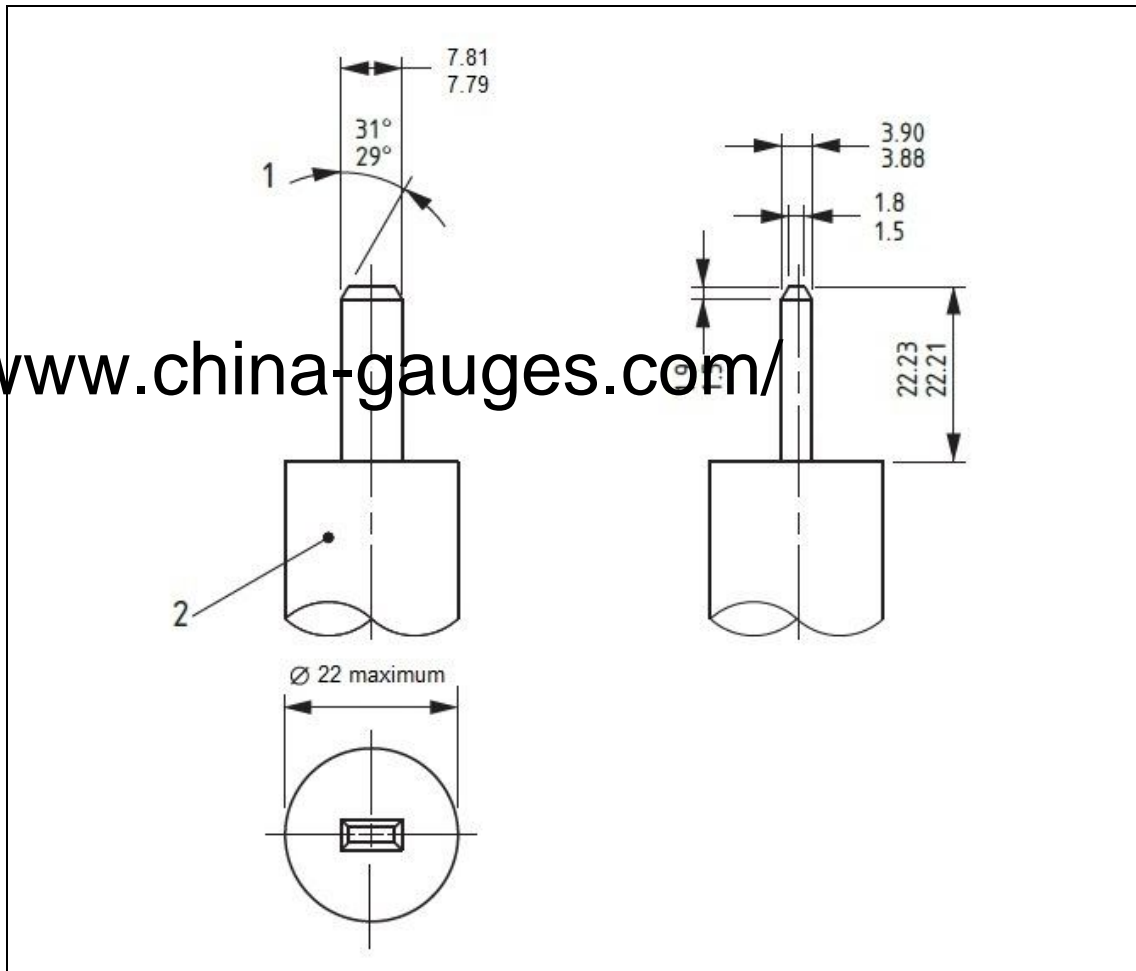
Dimensions are in millimetres



NOTE. The material is of steel.

Figure 15. Turning moment gauge (see Clause 13)

Dimensions are in millimetres

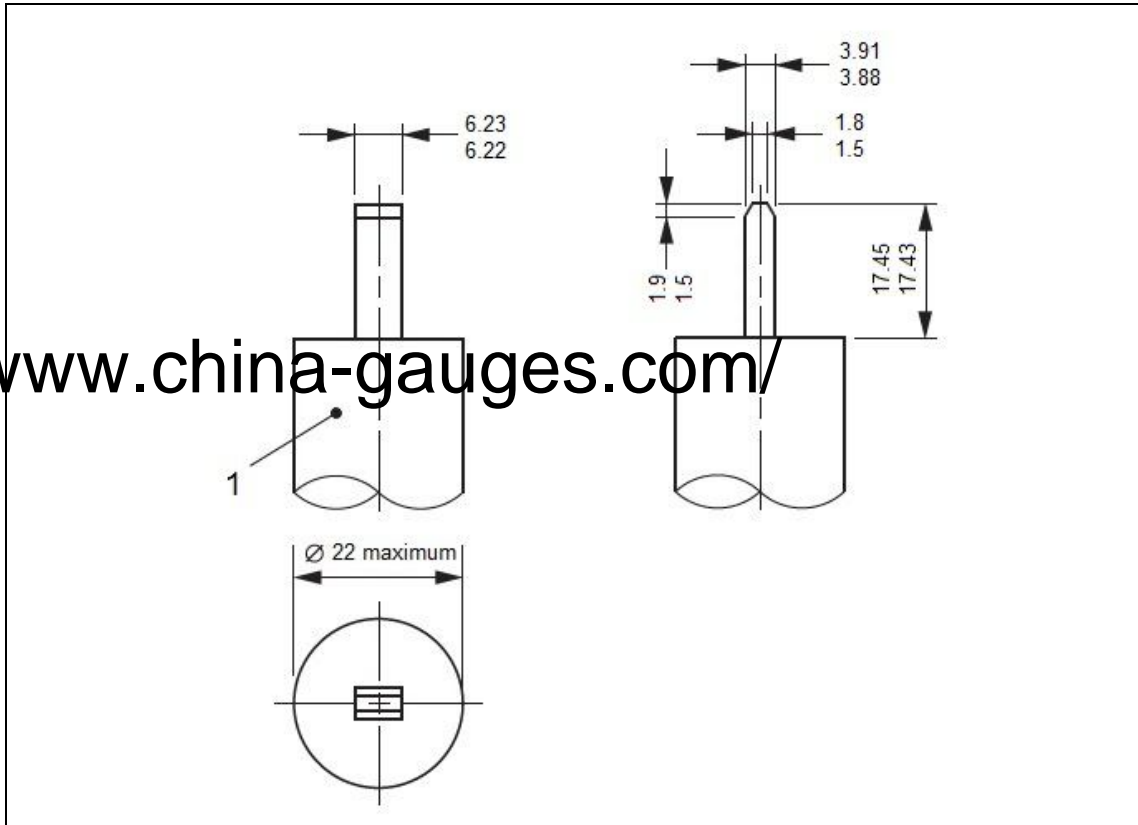


**Key**

- 1 This may be a chamfer or part of the surface of a cone
- 2 Length to make total mass of gauge  $227 \begin{smallmatrix} +1.5 \\ 0 \end{smallmatrix} \text{g}$

**Figure 16a. Withdrawal pull gauges for effectiveness of contact: Gauge for earthing socket contact (see Clause 13)**

Dimensions are in millimetres

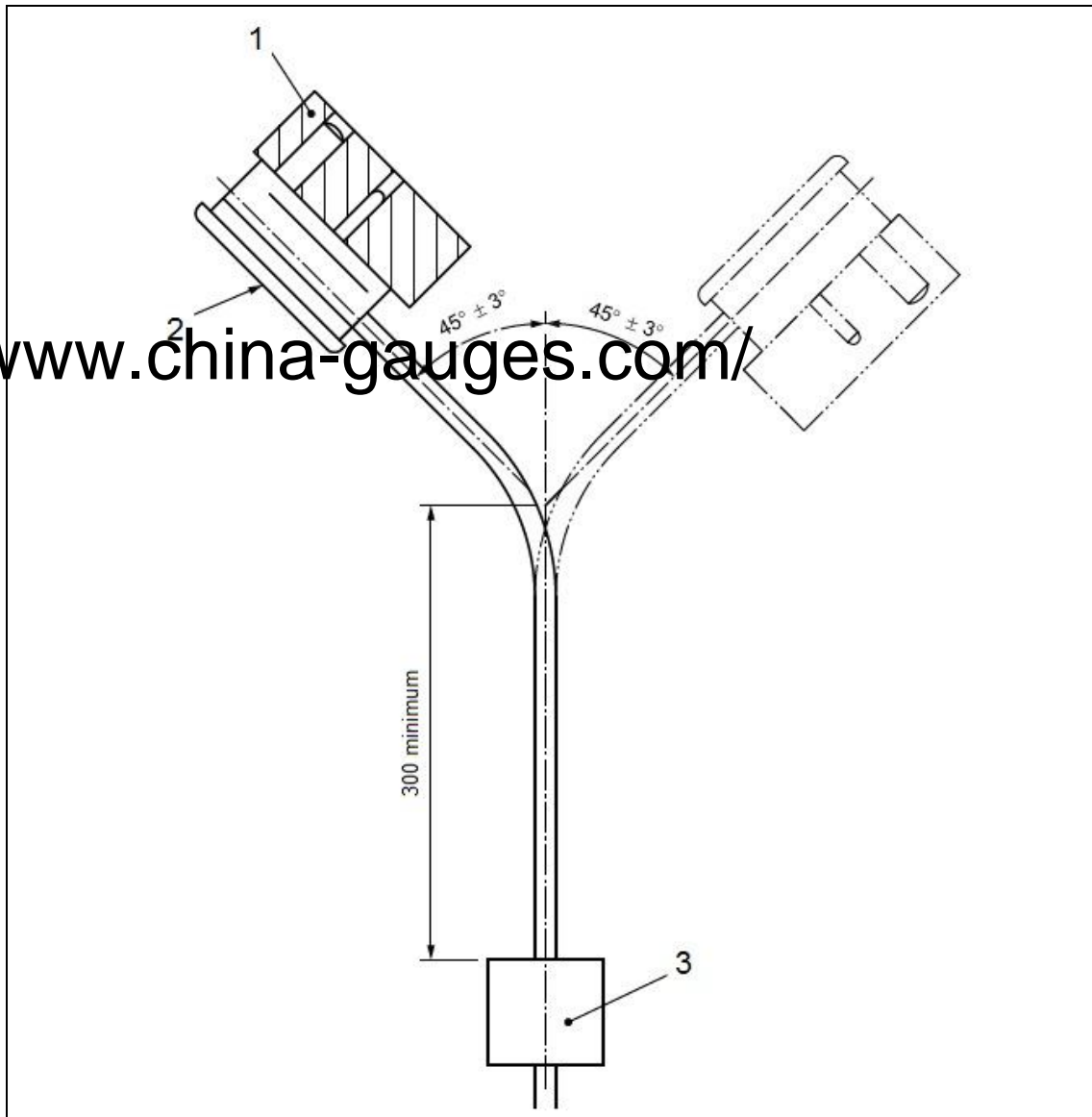


**Key**

- 1 Length to make total mass of gauge  $227^{+1.5}_0$  g

**Figure 16b. Withdrawal pull gauges for effectiveness of contact: Gauge for line and neutral current-carrying socket contacts (see Clause 13)**

Dimensions are in millimetres



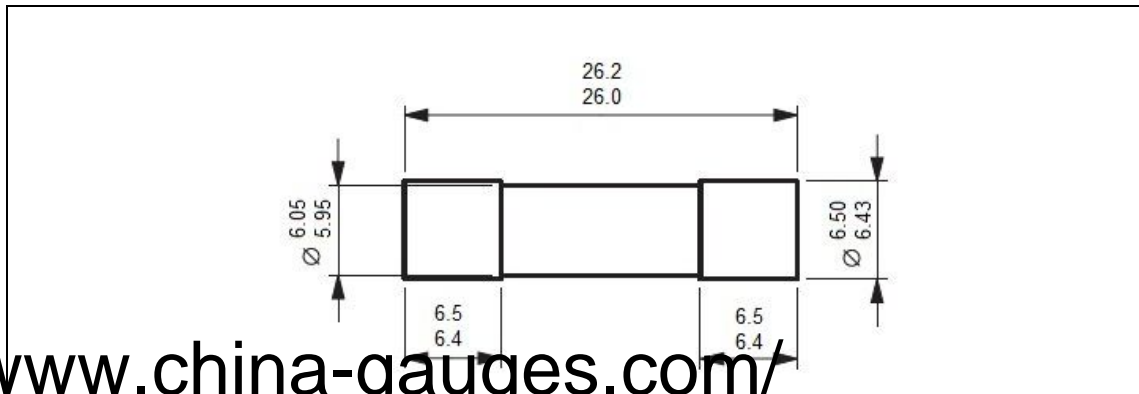
**Key**

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

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

**Figure 18. Apparatus for flexing test (see Clause 19)**

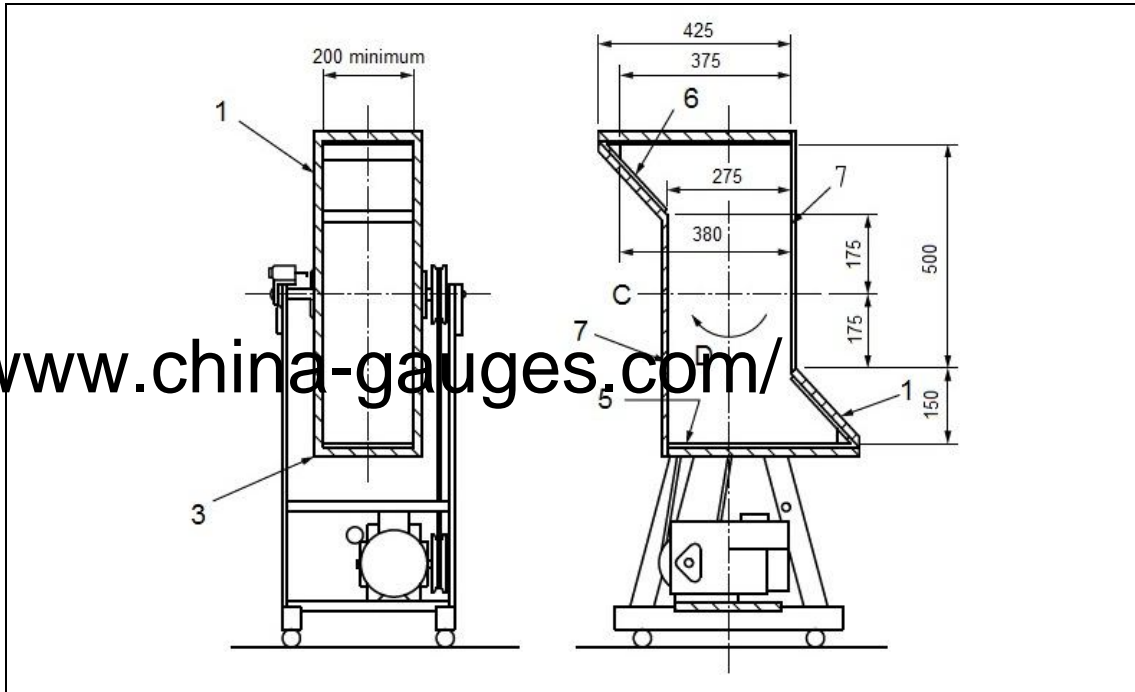
Dimensions are in millimetres



NOTE. Finish: Polished and sharp corners removed.

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

Dimensions are in millimetres



**Key**

- C Centre of axis
- D Direction of rotation
- 1 19 mm nominal thick blockboard all suitable alternative
- 3 19 mm nominal thick blockboard can be removable for the replacement of the impact plates
- 5 Impact base 9mm nominal thick plywood to be replaceable (both ends)<sup>a</sup>
- 6 Shelf faced with non-gripe material
- 7 Transparent sheet for observation purposes; may be removable for loading

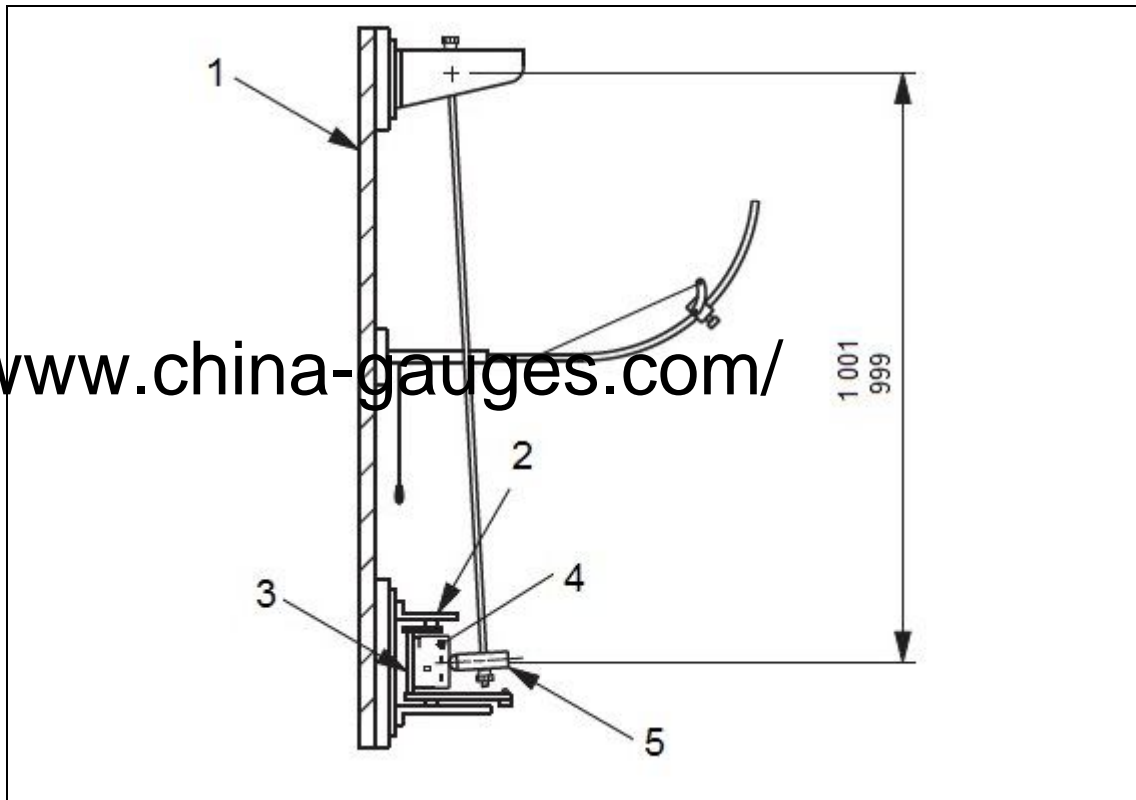
**NOTES:**

1. This drawing is not intended to govern design, except as regards the dimensions and specific requirements shown.
  2. All dimensions are subject to tolerance  $\pm 3.0$  except for material thickness.
- <sup>a</sup> 9mm nominal plywood having an impact face of birch, 1.4 mm nominal thickness and of 5 ply construction.

**Figure 20. Tumbling barrel (see Clause 20)**



Dimensions are in millimetres

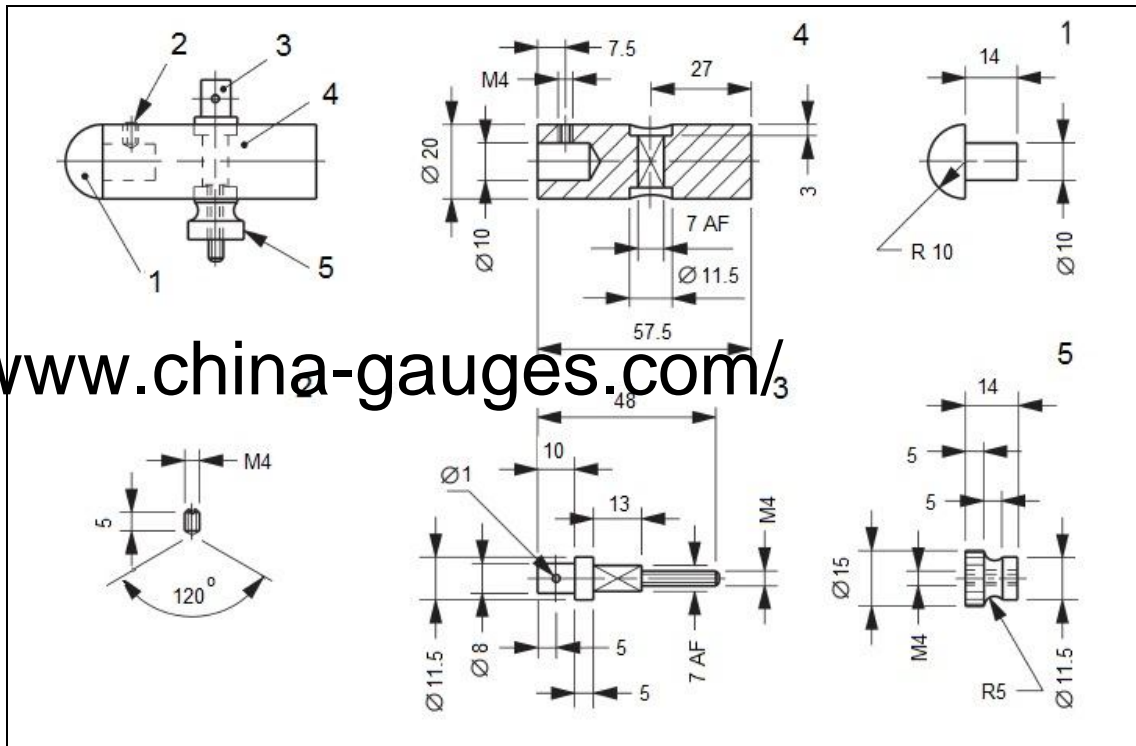
**Key**

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

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

**Figure 21a. Pendulum impact test: General view apparatus (see Clause 20)**

Dimensions are in millimetres



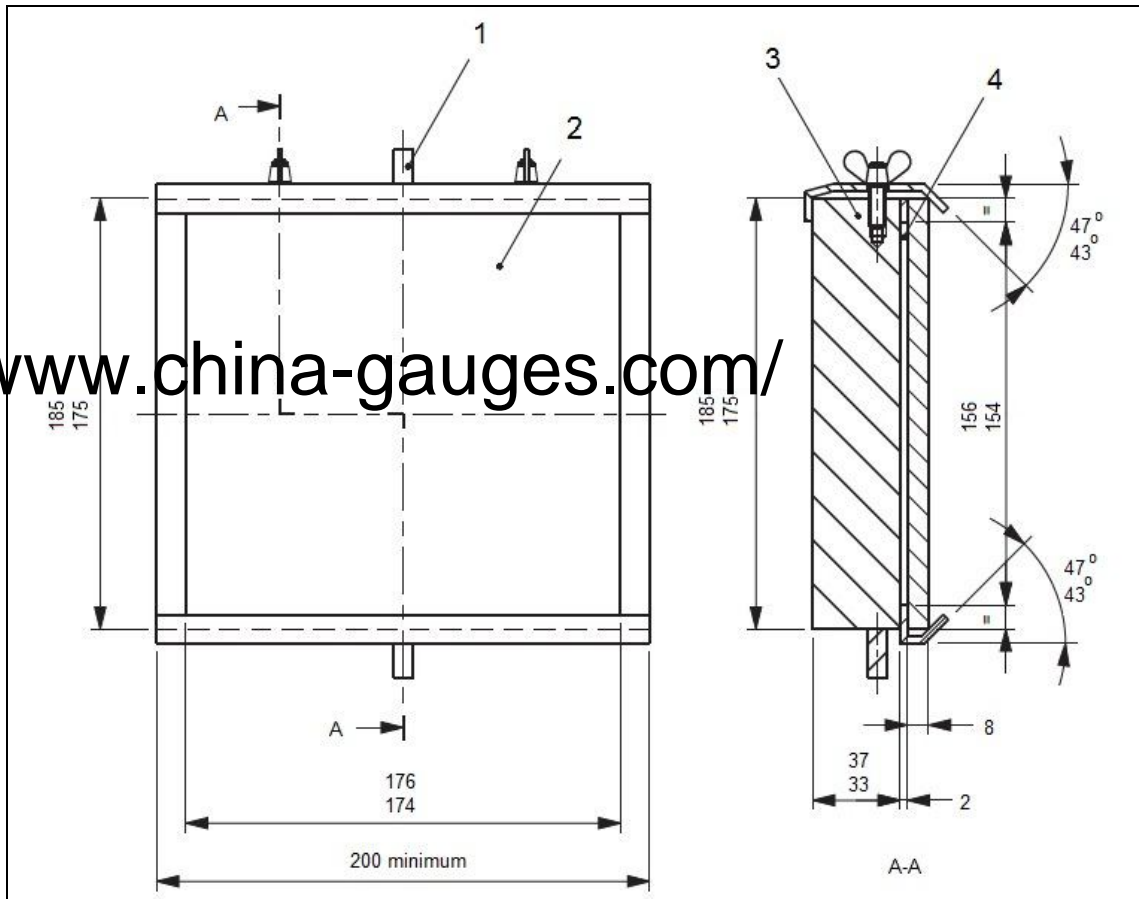
**Key**

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

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

**Figure 21b. Pendulum impact test: Constructional details of striking elements (see Clause 20)**

Dimensions are in millimetres



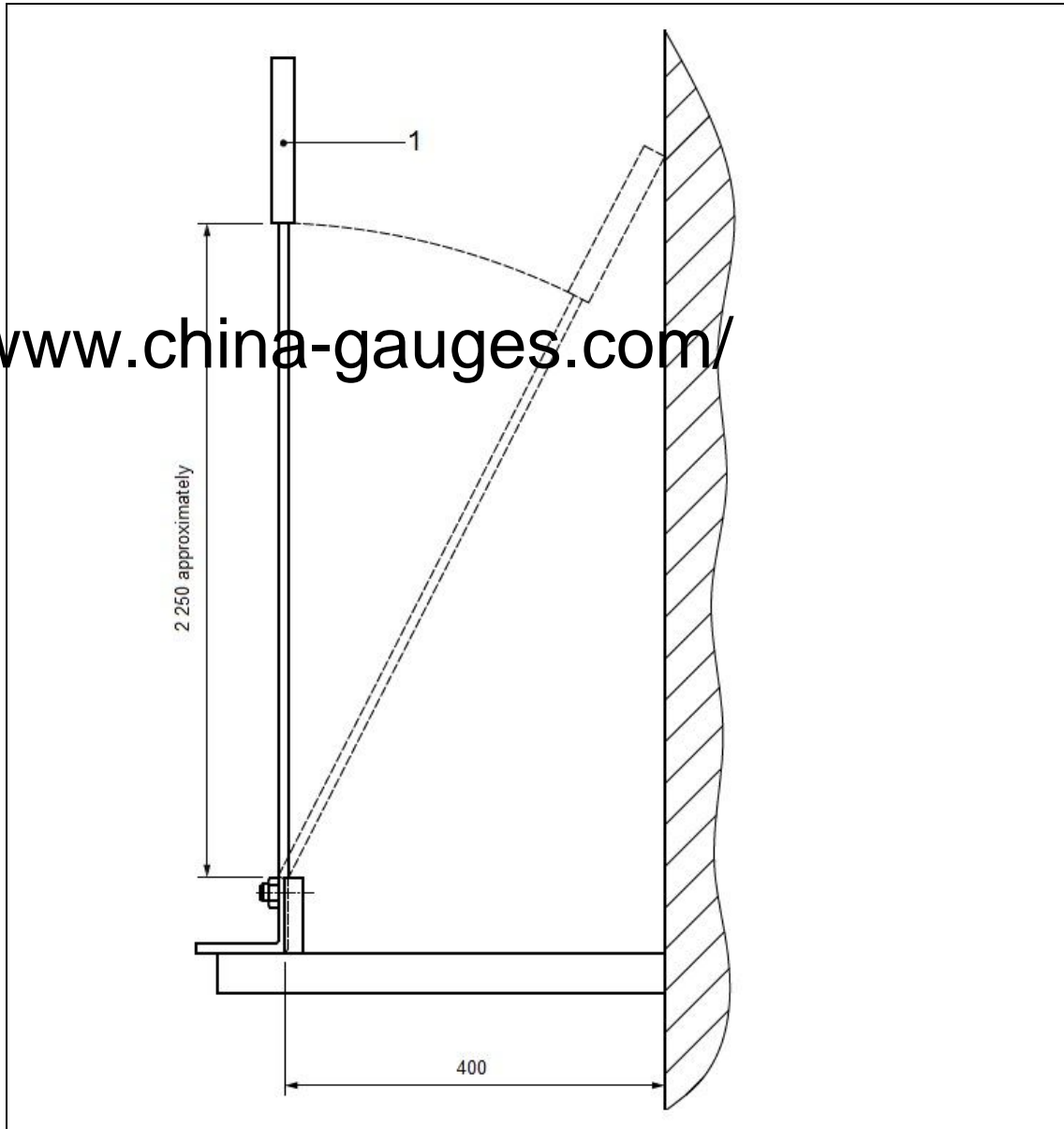
**Key**

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

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

**Figure 21c. Pendulum impact test: Constructional details of mounting support for test samples (see Clause 20**

Dimensions are in millimetres



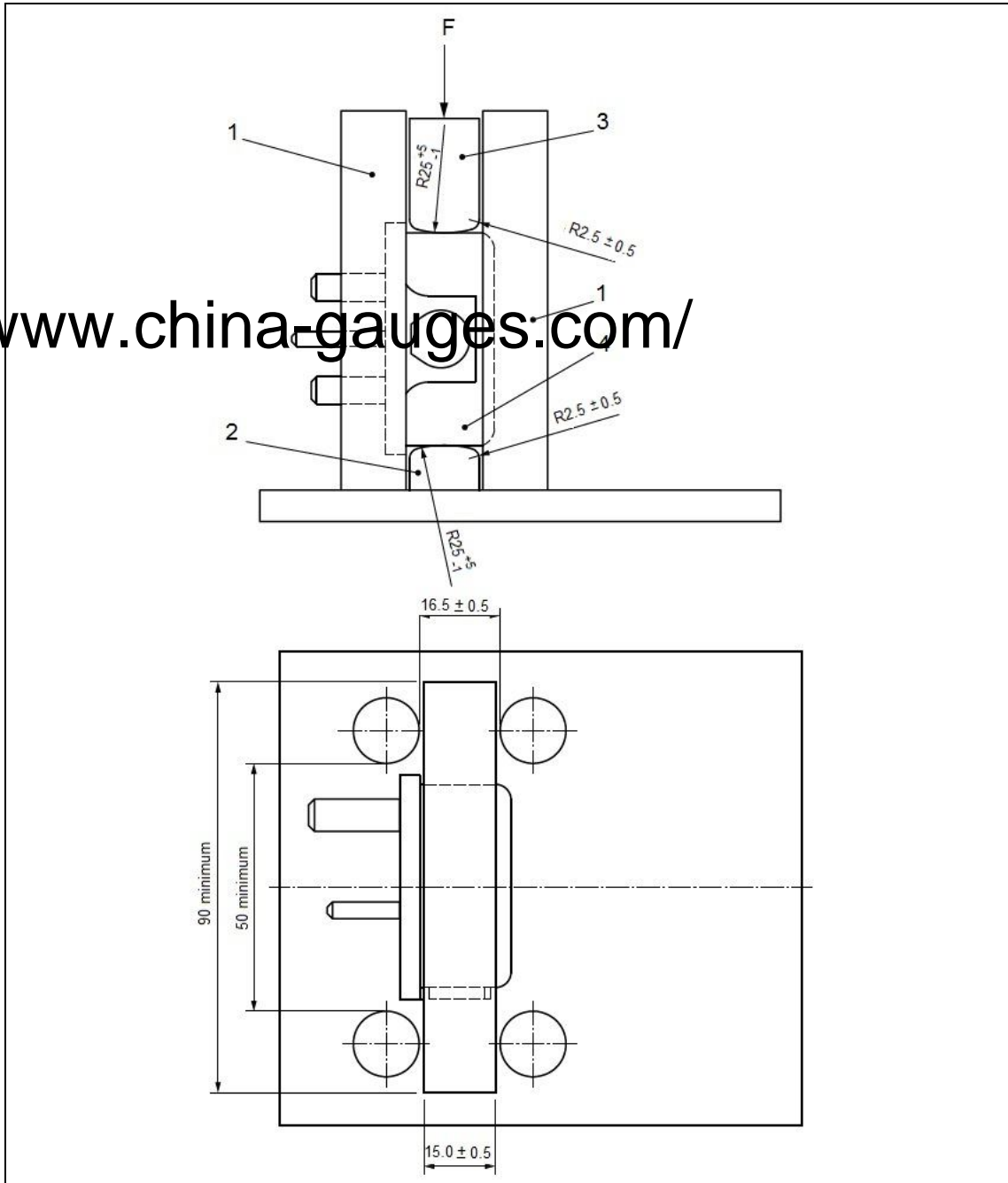
**Key**

- 1 Sample

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

**Figure 22. Arrangements for mechanical strength test for portable socket outlets (see Clause 20)**

Dimensions are in millimetres

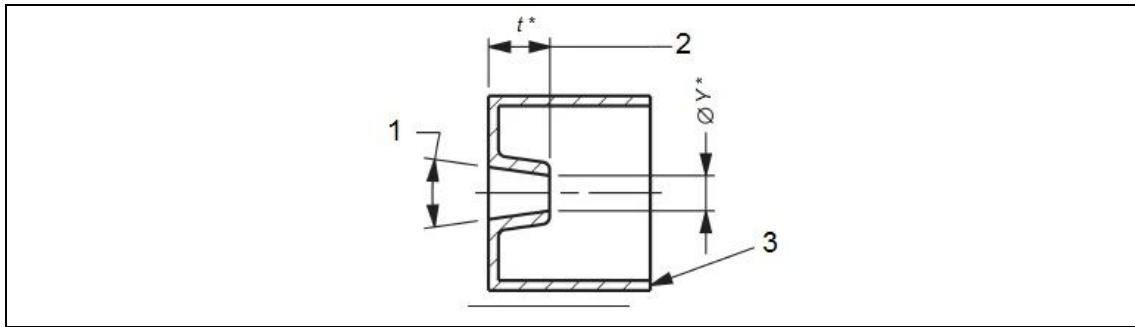


**Key**

- |             |              |
|-------------|--------------|
| 1 Force     | 4 Moving jaw |
| 2 Guide     | 5 Sample     |
| 3 Fixed jaw |              |

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

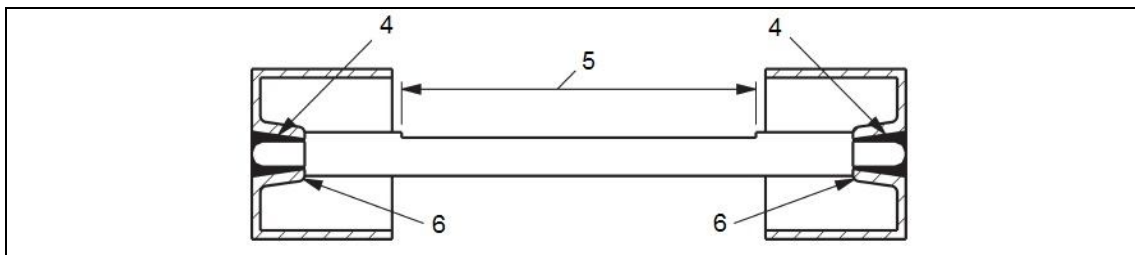
**Figure 23. Apparatus for pressure test (see Clause 22)**



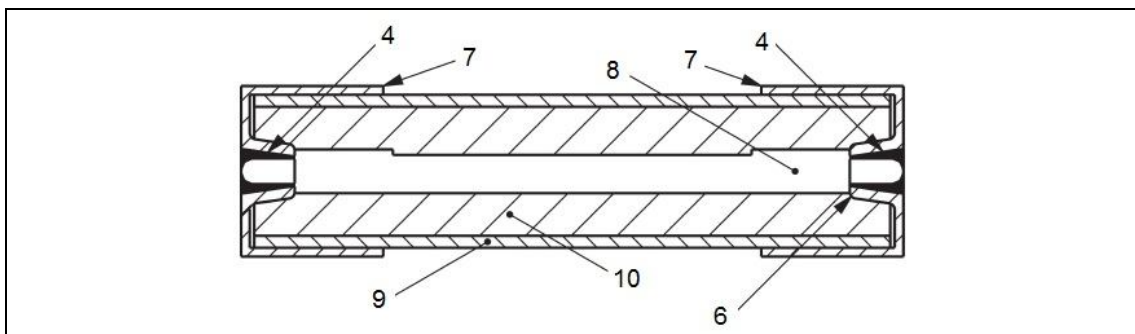
a) Modified standard end cap (section)



b) Calibrated link: Resistive element Cu Ni



c) Calibrated link: Assembly for calibration (section)



d) Calibrated link: Assembled link (section)

**Key**

- |  |                                      |
|--|--------------------------------------|
| 1 Taper ream to facilitate soldering     | 6 End caps butt to element shoulders |
| 2 End wall thickness                     | 7 End caps                           |
| 3 Hard-bright silver plated 0.025 thick  | 8 Resistive element                  |
| 4 Solder                                 | 9 Standard ceramic tube              |
| 5 Filing length for watt-loss adjustment | 10 Standard filling                  |

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

**Figure 28. Calibrated link (see A.1)**

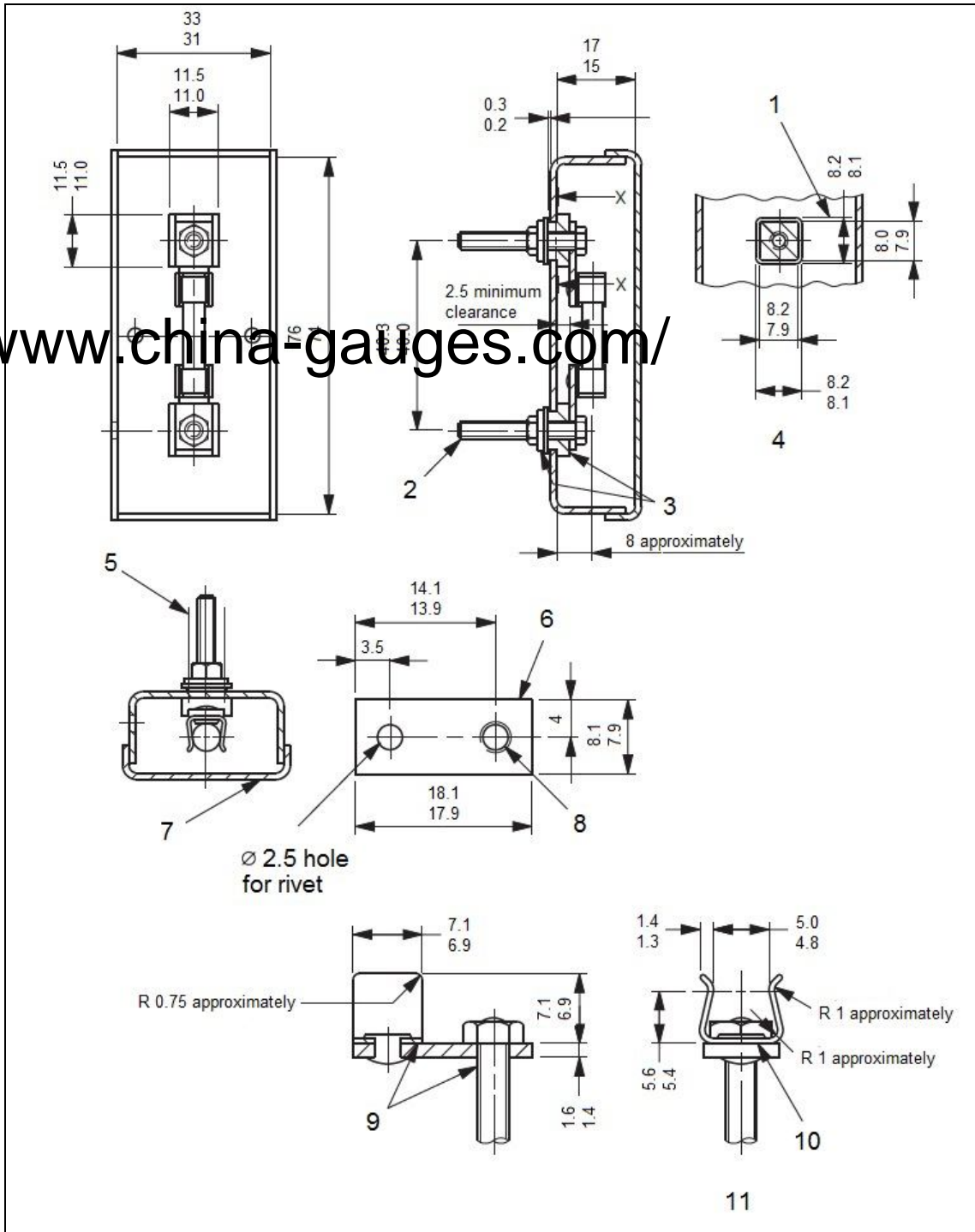


Figure 29. Calibration jig for calibrated link (see A.2) (1 of 2)

## MS 589-2:2018

### Key

- |   |                               |    |  |
|---|-------------------------------|----|--|
| 1 | Float                         | 7  | Cover <sup>b, c</sup>  |
| 2 | Terminal stem M3 x 25         | 8  | Hole tapped M3 for terminal stamp                                    |
| 3 | Insulating material           | 9  | Joints between clip, contact plate and terminal stem to be soldered. |
| 4 | Part section X-X <sup>a</sup> | 10 | Fuse clip <sup>d</sup>   |
| 5 | Groove to fit contact plate   | 11 | Contact assembly   |
| 6 | Contact place, brass          |    |  |

<sup>a</sup> The end float and clearance between the insulation and the box is to allow the contacts to be self aligning.

<sup>b</sup> Box and cover made from 1.25 mm brass sheet, clean natural finish.

<sup>c</sup> Cover shall be a push fit on box and shall not be rigidly attached.

<sup>d</sup> Fuse clip made from beryllium copper of 5 mm thick and heat treated (110 HV minimum). Base of clip to be flat; finish, silver plated.

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



<http://www.china-gauges.com/>

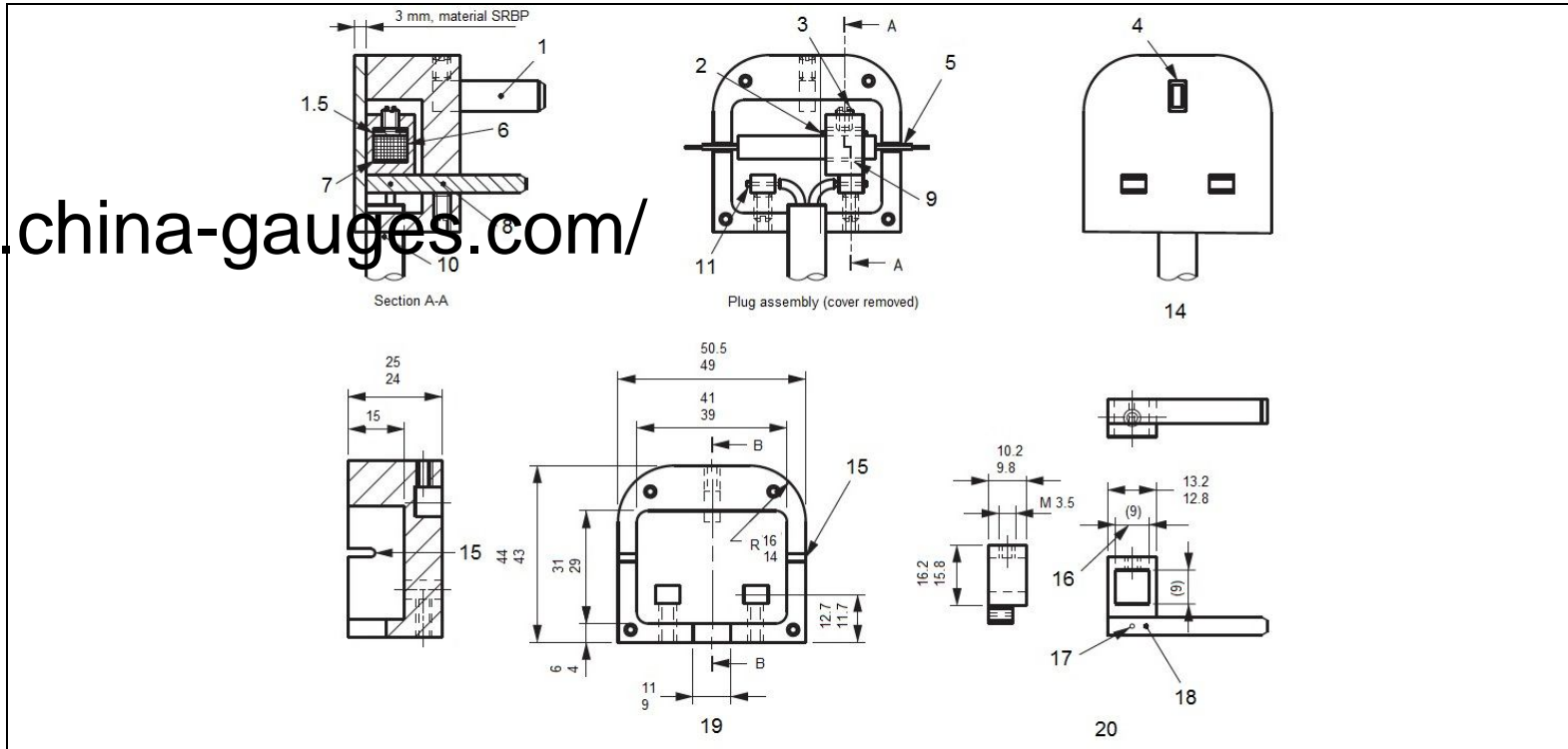


Figure 30. Test plug for temperature rise (see Annex G)

**Key**

- |    |  |    |  |
|----|--|----|--|
| 1  | Earth pin (not connected) secured via grub screw                                       | 11 | Conductors of flexible cable soldered to pins    |
| 2  | 1.5 thick clamp plate (brass)  | 14 | View on engagement face                          |
| 3  | Tighten to 0.2 Nm  | 15 | Slot for resistor leads                          |
| 4  | Projection size and disposition of pins to be as MS 589-1:2018, Figure 4               | 16 | To suit resistor                                 |
| 5  | Resistor leads brought out of side or cover and sealed                                 | 17 | Hole for flexible conductor                      |
| 6  | Wire-wound ceramic coated resistor (e.g. 7 W 56 $\Omega$ )                             | 18 | Pin MS 589-1:2018, Figure 4 brazed to clamp body |
| 7  | Thermal contact compound   | 19 | Body: material SRBP <sup>a</sup>                 |
| 8  | Pin/clamp assembly secured via grub screw  | 20 | L – Pin/clamp sub-assembly: material brass       |
| 9  | Thermal contact compound   |    | N – Pin only                                     |
| 10 | Flexible cable 1.25 mm <sup>2</sup> 2-core 1 m length<br>(as in BS EN 50525-2-11:2011) |    |  |

<sup>a</sup> Material SRBPs such as defined in BS 2572:1990 or BS EN 60893-3-4:2004+A1:2012.

**Figure 30. Test plug for temperature rise (see Annex G) (continued)**

## Annex A (normative)

### The construction and calibration of a calibrated link

#### A.1 Construction

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

- <http://www.china-gauges.com/>
- a) ceramic body (as standard);
  - b) filling (as standard); and
  - c) end caps (modified standard cap as shown in Figure 28a).

The resistive element shall be of copper nickel wire having a resistivity value between  $44 \mu\Omega\cdot\text{cm}$  and  $49 \mu\Omega\cdot\text{cm}$ . The overall length shall be  $25.4^{+0.8}_{-0.4}$  mm and the diameter such as to allow a small reduction in the cross-sectional area to adjust the watts loss to the required value. The ends are turned down so that the distance between the shoulders so formed shall be  $25.4^{+0.8}_{-0.4}$  mm less twice the end cap end wall thickness  $t$  (see Figure 28b).

The resistive element shoulders shall be firmly butted to the inside faces of the end caps and soldered using a tin silver solder, grade 96S as specified in BS 219. The assembly thus formed (see Figure 28c) shall be checked for watts loss in accordance with A.2. Metal shall then be carefully filed from the resistive element over as long a length as is possible and the assembly rechecked until the desired watts loss is achieved.

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

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

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

## A.2 Calibration

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

The surroundings shall be free from draughts and the ambient air temperature, measured by a suitable thermometer or thermocouple at a horizontal distance of 1 m to 2 m from the calibrated link, shall be in the range of 15.00 to 20.00 °C. The calibrated link shall be inserted into the clips provided in the calibration jig and the cover replaced. A current of 13 A  $\pm$  0.1 A is then passed continuously through the calibrated link for 60 min  $\pm$  5 min. At the end of this time the temperatures measured by the thermocouples are noted, the cover of the jig is then removed and the millivolt drop between the end surfaces of the end caps of the calibrated link is measured whilst it is still carrying the test current.

Alternating current (a.c.) shall be used for the calibration.

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

- a) the product of the measured millivolt drop multiplied by the test current 0.00 give a result of  $1^{+0.00}_{-0.05}$  W; and
- b) the temperature difference between the fuse contact clips does not exceed 2 °C.

**Annex B**  
(normative)

**Measurement of clearances and creepage distances**

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

**Table B.1. Minimum values of width 'X'**

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

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

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

The following assumptions are made:

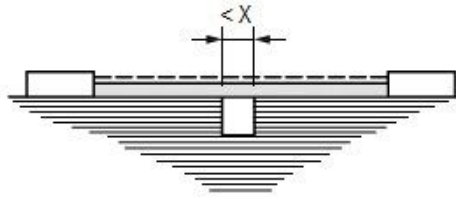
- a) any recess is assumed to be bridged with an insulating link having a length equal to the specified width X and being placed in the most unfavourable position (see Example 3);
- b) where the distance across a groove is equal to or larger than the specified width X, the creepage distance is measured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

**Explanation for Examples 1 to 11**



All dimensions are in millimetres

## MS 589-2:2018

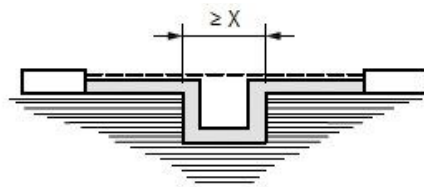


### EXAMPLE 1

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 are measured directly across the groove as shown.

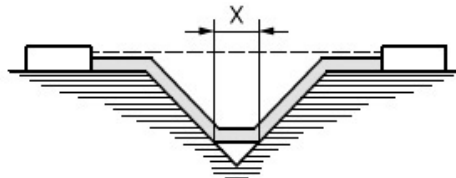
<http://www.china-gauges.com/>



### EXAMPLE 2

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

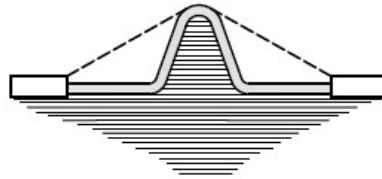
Rule: Clearance is the "line of sight" distance. Creepage path follows the contour of the groove.



### EXAMPLE 3

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

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

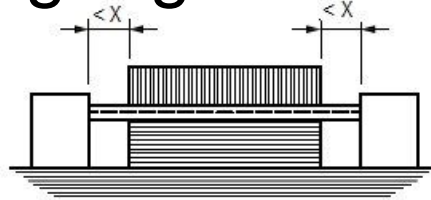


EXAMPLE 4

Condition: Path under consideration includes a rib.

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

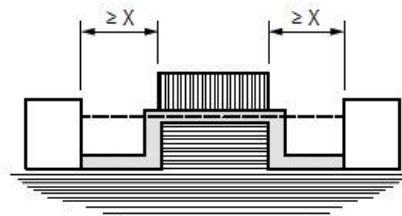
<http://www.china-gauges.com/>



EXAMPLE 5

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

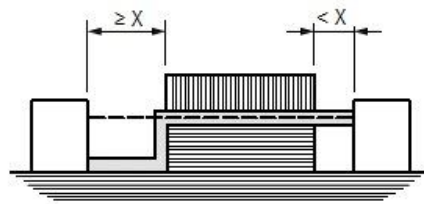
Rule: Creepage and clearance path is the “line of sight” distance shown.



EXAMPLE 6

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

Rule: Clearance path is the “line of sight” distance. Creepage follows the contour of the grooves.

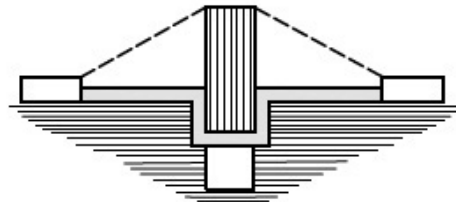


EXAMPLE 7

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

Rule: Clearance and creepage paths are as shown.

<http://www.china-gauges.com/>

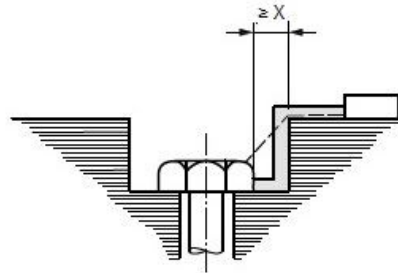


EXAMPLE 8

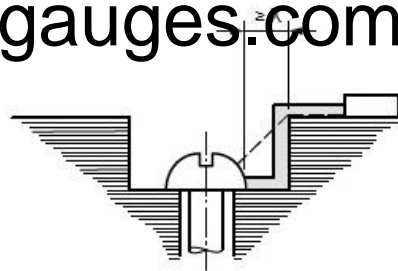
Condition: Path under consideration includes a barrier with an uncemented joint. The creepage distance through the uncemented joint is less than the creepage distance over the barrier.

Rule: Clearance is the shortest direct air path over the top of the barrier. The creepage paths follows the contour of the joint.





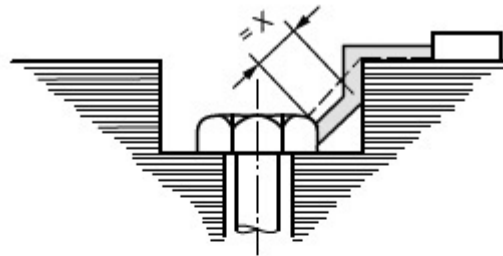
<http://www.china-gauges.com/>



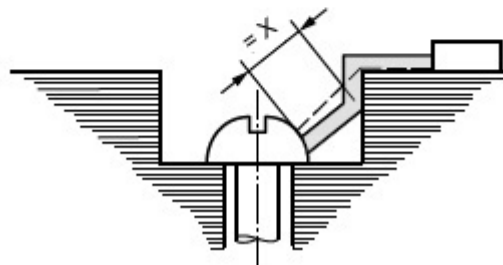
EXAMPLE 9

Condition: Gap between head of screw and wall of recess wide enough to be taken into account (greater than or equal to "X" mm).

Rule: Clearance and creepage paths are as shown.



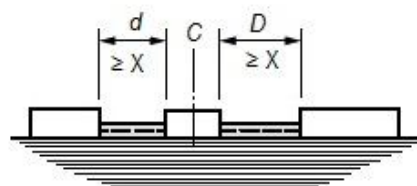
<http://www.china-gauges.com/>



EXAMPLE 10

Condition: Gap between head of screw and wall of recess too narrow to be taken into account (less than “X” mm).

Rule: Measurement of clearance and creepage distance is from the screw head to the point on the wall which is at a distance equal to “X” mm (as shown).



EXAMPLE 11

Condition: Path under consideration includes a floating part, “C”, with different sized grooves either side, each greater than or equal to “X” mm.

Rule: Clearance and creepage distance are both distance  $d + D$ .

**Annex C**  
(normative)

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

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

- <http://www.china-gauges.com/>
- a) In Clause 5 of IEC 60112:2003+A1:2009, Test sample:
    - i) Note 3 and the last paragraph also apply to PTI.
    - ii) If the surface 15 mm × 15 mm cannot be obtained because of the small dimensions of the PT system then special samples made with the same manufacturing process may be used.
  - b) The test solution “A” described in 7.3 of IEC 60112:2003+A1:2009 shall be used:
  - c) In Clause 8 of IEC 60112:2003+A1:2009, Procedure, either CTI or PTI is determined.
    - i) CTI is determined in accordance with Clause 11 of IEC 60112:2003+A1:2009.
    - ii) The PTI test of Clause 10 of IEC 60112:2003+A1:2009 is performed on five samples at the voltage referred to in 10.1 of BS EN 60112:2003+A1:2009 based on the appropriate creepage distance, material group, pollution degree conditions and on the rated voltage of this standard declared by the manufacturer.

**Annex D**  
(normative)

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

**Table D.1. Rated impulse withstand voltage for socket-outlets energised directly from the low voltage mains**

Nominal voltage of the supply system based in IEC 60038 <sup>a</sup> (V)	Voltage line to neutral derived from nominal voltages a.c. or d.c. up to and including (V)	Rated impulse withstand voltage (V)		
		Overvoltage Category		
		I	II	III
230/400	300	1 500	2 500	4 000
<p>NOTES:</p> <p>1. For more information concerning supply systems, see MS IEC 60664-1.</p> <p>2. For more information concerning Overvoltage Category, see MS IEC 60664-1.</p> <p>3. Socket-outlets fall into Overvoltage Category III. Parts of socket-outlets where appropriate overvoltage reduction is provided fall into Overvoltage Category I, energy consuming equipment falls into Overvoltage Category II.</p> <p><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.</p>				

**Annex E**  
(normative)

**Pollution degree**

**E.1 General**

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

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

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

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

**E.2 Degrees of pollution in the micro-environment**

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

i) Pollution degree 1

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

ii) Pollution degree 2

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

iii) Pollution degree 3

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

**Annex F**  
(normative)

**Impulse voltage test**

The purpose of this test is to verify that clearances will withstand specified transient overvoltage. The impulse withstand voltages test shall be carried out with a voltage having a 1.2/50  $\mu$ S waveform as specified in MS IEC 61180-1 and is intended to simulate overvoltage of atmospheric origin. It also covers overvoltages due to switching of low voltage equipment.

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

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

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

NOTES:

1. The output impedance of the impulse generator should be not higher than 500  $\Omega$ .
2. The expression "discharge" is used to cover the phenomena associated with the failure of insulation under electric stress, which include current flow and a drop in voltage.

The impulse shall have the following characteristics:

- a) the waveform 1.2/50  $\mu$ S for the no-load voltage with amplitudes equal to the values given in Table F.1.

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

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

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

NOTES:

1. When testing clearances, associated solid insulation will be subjected to the test voltage. As the impulse test voltage of Table F.1 is increased with respect to the rated impulse withstand voltage, solid insulation will have to be designed accordingly. This results in an increased impulse withstand capability of the solid insulation.
2. The test may be made with the pressure adjusted to the value corresponding to the altitude of 2 000 m (80 kPa) and 20 °C with the test voltage corresponding to the rated impulse withstand voltage. In this case, solid insulation will not be subjected to the same withstand requirements as when testing at sea level.
3. Explanations concerning the influencing factors (air pressure, altitude, temperature humidity) with respect to electric strength of clearances are given in MS IEC 60664-1.

<http://www.china-gauges.com/>

**Annex G**  
(normative)

**Test plug for temperature-rise test**

**G.1 General**

The test plug consists of a body made from insulating material and pins of brass. The pin dimensions and centres are as shown in Figure 4 of MS 589-1:2018.

Inside the test plug a ceramic-covered wire-wound resistor is clamped to the line pin making no electrical contact between the pin and the resistor element, though good thermal contact is essential. Thermal contact compound shall be used on the interface between the ceramic resistor body and the metal clamp. The M3.5 clamp screw shall be tightened to a torque of  $0.2 \text{ Nm} \pm 0.02 \text{ Nm}$ . The resistor leads pass through the sides or cover of the test plug.

Approximately 1 000 mm of 3-core flexible cable as given in MS 2112-5 or BS EN 50525-2-11:2011 with nominal cross-section  $1.25 \text{ mm}^2$  is connected to the plug by soldering the line and neutral cores to their respective plug pins. The earth core of the flexible cable is not fitted to the earth pin. Details are shown in Figure 30.

**G.2 Calibration**

The test plug is mounted in the dummy front plate (see Figure 17 in MS 589-1:2018) and the test carried out in accordance with 16.1.2 with  $14 \text{ A} \pm 0.2 \text{ A}$  flowing through the flexible cable attached to the plug. At the same time a separate low voltage d.c. supply is connected to the resistor and the voltage adjusted until the temperature rise on the plug pin spacer stabilises at  $35 \text{ K} \pm 1 \text{ K}$ . The value of the voltage applied to the resistor is noted. The calibration voltage is applied to the resistor when checking the temperature rise of a socket-outlet.



**Annex H**  
(informative)

**Specific structure of BS EN 50525 and its derivation from British Standards and from HD 21 and HD 22 (BS EN 50525-1:2011, National Annex NA)**

Part number of BS EN 50525	Short title	Derivation		
		BS	(NOTE 1)	HD
1	General requirements	(NOTE 1)	(NOTE 1)	HD 21.1:HD 22.1
2-11	PVC flexible cables	BS 6500	26, 27, 28, 29	HD 21.5:HD 21.12
		BS 7919	40, 41	
2-12	Extensible leads	BS 6500	Clause 8	HD 21:10
2-21	Rubber flexible cable	BS 6500	12, 13, 15, 16	HD 22.4, HD 22.10, HD 22.11, HD 22.12, HD 22.16
		BS 7919	10-17, 20, 21.23, 24	
2-22	Braided flexible cables	-	-	HD 22.14 (Clause 6)
2-31	PVC conduit wire	BS 6004	4a), 4b), 5, 11a), 11b), 12	HD 21.3, HD 21.7
2-41	Rubber single core-SiR	BS 6007	8, 9, 10	HD 22.3
2-42	Rubber single core-EVA	BS 6007	3, 4, 5, 6, 7	HD 22.7
2-51	PVC sheathed wiring	BS 6004	13	HD 21.13
		BS 7919	42, 43	
2-71	Tinsel flexible cables	BS 6500	24	HD 21.5 (Clause 2)
2-72	PVC separable flat	-	-	HD 21.11
2-81	Welding cables	BS 638-4	1, 2	HD 22.6
2-82	Lighting chains	-	-	HD 22.8
2-83	SiR flexible	BS 7919	22	HD 22.15
3-11	Halogen-free flexible (T/P)	-	-	HD 21.14
3-21	Halogen-free flexible (X/L)	BS 7919	18, 19	HD 22.13
3-31	Halogen-free single core (T/P)	-	-	HD 21.15
3-41	Halogen-free single core (X/L)	BS 7211	3a), 3b), 4a), 4b)	HD 22.9
NOTE. General requirements are given in each relevant BS as appropriate.				

**Annex J**  
(normative)

**Requirements for incorporated electronic components**

**J.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 with this standard.

**J.2 Electromagnetic compatibility (EMC) requirements**

Socket-outlets incorporating electronic circuits, apart from inherently benign components, shall conform to the immunity and emission requirements of the relevant product or generic MS IEC 61000 standard series. In particular:

- a) MS IEC 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, inductors. This list is not exhaustive.

No additional EMC immunity or emission tests are required if the following conditions are fulfilled.

- a) the incorporated devices and components conform to the requirements for EMC as required by the relevant product or generic EMC standard; and
- b) the internal installation and wiring is carried out in accordance with the devices and component manufacturer's instructions (arrangement with regard to mutual influences, cable, screening, earthing etc.).

In all other cases the EMC requirements are to be verified by tests, in particular as per MS IEC 61000-6-1; and MS IEC 61000-6-3.

**J.3 USB circuits intended for charging portable devices**

**J.3.1 General**

USB circuits incorporated in a socket-outlet shall conform to the requirements of:

- a) MS IEC 60950-1; or
- b) IEC 62368-1; or
- c) IEC 61558-2-16 and MS IEC 61558-2-6; and

d) IEC 62680-1-1.

The USB circuit shall be tested as a component or sub-assembly to MS IEC 60950-1 or IEC 62368-1 or IEC 61558-2-16 and MS IEC 61558-2-6 and when incorporated into the socket-outlet the USB circuit shall meet the requirements of MS IEC 60950-1 or IEC 62368-1 or IEC 61558-2-16 (used in conjunction with MS IEC 61558-2-6) as applicable. Where a particular requirement is not considered to be applicable, or alternative means of meeting a requirement is used, then this shall not result in a lesser degree of safety with particular regard to reduction of the risks of fire, electric shock or injury for the operator or layman who may come into contact with the socket-outlet.

The following requirements relating to the appropriate use of the component or sub-assembly in the socket-outlet shall be met.

#### **J.3.1.1 Power rating and identification markings**

The input voltage rating of the USB circuit shall not be marked on the socket-outlet and shall not be less than the rated voltage of the socket-outlet.

##### **J.3.1.1.1 Marking of the USB circuit output**

The following marking shall be visible after the socket-outlet 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.

#### **J.3.2 Overcurrent and earth fault protection in primary circuits**

Overcurrent protection shall be provided on the primary side of the USB circuit. Where overcurrent protection is not provided within the USB circuit itself, provision shall be made for appropriate overcurrent protection in the supply to the USB circuit within the socket-outlet. The USB circuit shall not rely on the building or installation protection device for overcurrent protection.

NOTE. Provision for overcurrent protection provided within the USB circuit can be verified by reference to the original test report.

##### **J.3.2.1 Number and location of protective devices**

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 socket-outlet.

##### **J.3.2.2 Electrical insulation**

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 socket-outlet, double or reinforced insulation shall be provided between the primary circuit and accessible parts of the socket-outlet.

**J.3.2.3 Clearances, creepage distances and distances through insulation**

The USB circuit shall be designed and constructed to conform to the requirements of Overvoltage Category III. USB circuits of Overvoltage Category II can be used where additional overvoltage protection is provided within the socket-outlet i.e. a varistor or equivalent.

NOTES:

1. USB circuits are generally tested as Overvoltage Category II whereas socket-outlets are Overvoltage Category III.
2. BS EN 60664 gives guidance on the use of appropriate overvoltage reduction.

**J.3.3 Disconnection from the mains supply**

The requirement in MS IEC 60950-1 for the provision of a disconnect device shall not apply.

NOTE. The disconnect device specified in MS IEC 60950-1 is for servicing purposes and is achieved by disconnection of the socket-outlet from the low voltage supply for fixed socket-outlets and by disconnection by the plug for portable socket-outlets.

**J.3.4 Mechanical strength**

The requirements of MS 589-2:2016, Clause 20 shall be applied to the USB circuit when incorporated in the socket-outlet. The mechanical strength requirements of MS IEC 60950-1 are not applicable.

**J.3.4.1 Reducing the risk of ignition and spread of flame**

Method 1: A fire enclosure shall be provided which meets the requirements of MS IEC 60950-1; or

Method 2: Assessment and testing of all possible single fault tests shall be applied. 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 material requirements of MS 589-2:2016, Clauses 22 and 23 are also applicable.

**J.3.4.2 Performance requirements**

USB circuits intended for charging portable devices shall conform to the requirements for dedicated charging ports (DCP) of IEC 62680-1-1.

**J.3.5 Conformity**

Conformity to J.3.1 to J.3.4 shall be checked by inspection of conformity evidence or by test.

## J.4 Surge protective devices

### J.4.1 General

Surge protective devices incorporated in MS 589-2:2016 socket-outlets shall conform to the requirements in J.4.2.

NOTES:

1. The use of SPDs, variously known as voltage dependant resistors (VDRs), gas discharge tubes, avalanche breakdown diodes and similar devices, might have particular applications and restrictions in their use in many safety standards. Restrictions are applied where the disconnection of earth is possible as a single fault condition (applicable for example, to domestic pluggable equipment).

The slow deterioration of surge protection devices with time might result in an increase in leakage current. This can cause a permanent and continuously increasing temperature stress, which can cause the component to burn or burst, and thus SPDs/VDRs are regarded as potential safety hazards.

2. This annex does not cover comprehensive type testing which is specified in the MS IEC 61643 series.

### J.4.2 Requirements

The following types of SPD of the appropriate category shall be considered acceptable:

- a) metal oxide varistors conforming to MS IEC 61643-331;
- b) gas discharge tubes conforming to MS IEC 61643-321; and
- c) avalanche breakdown diodes conforming to MS IEC 61643-311.

VDRs conforming to IEC 61051-2 and having the following characteristics shall be considered acceptable:

- a) Preferred climatic categories:
  - i) Lower category temperature -10 °C
  - ii) Upper category temperature +85 °C
  - iii) Duration of damp heat, steady state test: 21 days
- b) Maximum continuous voltage:
  - i) The maximum continuous a.c. voltage shall be not less than 315 V.
- c) Pulse current (IEC 61051-2:1992+A1:2009, Table 1, Group 1)
  - i) Combination pulses of 6 kV/3 kA of alternating polarity are used, having a pulse shape of 1.2/50  $\mu$ s for voltage and 8/20  $\mu$ s for current.

In addition to the performance requirements of IEC 61051-2:1992+A1:2009, Table 1 Group 1, the clamping voltage after the test shall not have changed by more than 10 %, when measured with the manufacturer's specified current.

## **MS 589-2:2018**

### **J.4.3 Conformity**

Conformity to J.4.2 shall be checked by inspection of component conformity evidence.

### **J.4.4 Incorporation of VDRs in socket-outlets**

A circuit interrupting device having adequate breaking capacity shall be connected in series with the VDR to provide protection against:

- a) temporary overvoltages above the maximum continuous voltage;
- b) thermal overload due to leakage current within the VDR; and
- c) burning and bursting of the VDR in the event of a short-circuit fault.

The following methods of VDR incorporation are permitted.

- a) Between L and N

Where not protected by a BS 1362 fuse, a circuit interrupting device having adequate breaking capacity shall be incorporated within the product in series with the VDR.

- b) Between L and E

Where not protected by a BS 1362 fuse a VDR is permitted between line and protective earth provided it is located in series with a circuit interrupting device having adequate breaking capacity, and is connected in series with a spark gap/gas tube meeting the requirements for basic insulation.

### **J.4.5 Conformity**

Conformity to J.4.4 shall be checked by inspection.

## **J.5 Electronic switches**

### **J.5.1 General**

Electronic switches incorporated in socket-outlets shall conform to MS IEC 60669-2-1.

### **J.5.2 Conformity**

Conformity to J.5.1 shall be checked by inspection of conformity evidence or by test.

## Bibliography

- [1] MS 589-1:2018, *13 A plugs, socket-outlets, adaptors and connection units - Part 1: Specification for rewirable and non-rewirable 13 A fused plugs*
- [2] MS 589-3, *13 A plugs, socket-outlets, adaptors and connection units - Part 3: Specification for adaptors*
- [3] MS 589-4, *13 A plugs, socket-outlets, adaptors and connection units - Part 4: Specification for 13 A fused connection units switched and unswitched*
- [4] MS 2112-3, *Electric cable and wire - Polyvinyl chloride (PVC) insulated cables of rated voltages up to and including 450/750 V - Part 3: Non-sheathed cables for fixed wiring*
- [5] MS 2112-4, *Electric cable and wire - Polyvinyl chloride (PVC) insulated cables of rated voltages up to and including 450/750 V - Part 4: Sheathed cables for fixed wiring*
- [6] MS 2112-5, *Electric cable and wire - Polyvinyl chloride (PVC) insulated cables of rated voltages up to and including 450/750 V - Part 5: Flexible cables*
- [7] MS IEC 60529, *Degrees of protection provided by enclosures (IP code)*
- [8] MS IEC 60664-1:2014, *Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests*
- [9] MS IEC 60664-3, *Insulation coordination for equipment within low voltage systems - Part 3: Use of coating, potting or moulding for protection against pollution*
- [10] MS IEC 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*
- [11] MS IEC 60669-2-1, *Switches for household and similar fixed electrical installations - Part 2-1: Particular requirements - Electronic switches*
- [12] MS IEC 60950-1, *Information technology equipment - Safety - Part 1: General requirements*
- [13] MS IEC 61000-6-1, *Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments*
- [14] MS IEC 61000-6-3, *Electromagnetic compatibility (EMC) - Generic standards - Part 6-3: Emission standard for residential, commercial and light industrial environments*
- [15] MS IEC 61032, *Protection of persons and equipment by enclosures - Probes for verification*
- [16] MS IEC 61180-1, *Guide to high-voltage test techniques for low-voltage equipment - Part 1: Definitions, test and procedure requirements*

**Bibliography (continued)**

- [17] MS IEC 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*
- [18] MS IEC 61643-311, *Components for low voltage surge protective devices - Part 311: Performance requirements and test circuits for gas discharge tubes (GDT)*
- [19] MS IEC 61643-321, *Components for low voltage surge protective devices - Part 321: Specification for avalanche breakdown diode (ABD)*
- [20] MS IEC 61643-331, *Components for low voltage surge protective devices - Part 331: Specification for metal oxide varistors (MOV)*
- [21] IEC 60112:2003+A1:2009, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*
- [22] IEC 60695-10-2, *Fire hazard testing - Part 10-2: Abnormal heat - Ball pressure test method*
- [23] IEC 60695-2-11, *Fire hazard testing - Part 2-11: Glowing/hot wire based test methods - Glow-wire flammability test method for end-products (GWEPT)*
- [24] IEC 61140, *Protection against electric shock - Common aspects for installation and equipment*
- [25] IEC 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*
- [26] IEC 62368-1, *Audio/video, information and communication technology equipment - Part 1: Safety requirements*
- [27] IEC 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)*
- [28] IEC 61051-2:1992+A1:2009, *Harmonized system of quality assessment for electric components - Varistors for use in electronic equipment - Sectional specification for surge suppression varistors*
- [29] IEC 60038, *IEC standard voltages*
- [30] IEC 60417-DB, *Graphical symbols for use on equipment*
- [31] BS 219:1977, *Specification for soft solders*
- [32] BS 638-4, *Arc welding power sources, equipment and accessories - Part 4: Specification for welding cables*



### Bibliography (concluded)

- [33] BS 1362:1973, *Specification for general purpose fuse links for domestic and similar purposes (primarily for use in plugs)*
- [34] BS 2572:1990, *Specification for phenolic laminated sheet and epoxy cotton fabric laminated sheet*
- [35] BS 4662:2006+A1:2009, *Boxes for flush mounting of electrical accessories - Requirements; test methods and dimensions*
- [36] 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*
- [37] BS 6006, *Electric cables - Flexible cables rated up to 300/500 V, for use with appliances and equipment intended for domestic, office and similar environments*
- [38] BS 6007, *Electric cables - Single core unsheathed heat resisting cables for voltages up to and including 450/750 V, for internal wiring*
- [39] BS 7211, *Electric cables - Thermosetting insulated and thermoplastic sheathed cables for voltages up to and including 450/750 V for electric power and lighting and having low emission of smoke and corrosive gases when affected by fire*
- [40] BS 7919, *Electric cables - Flexible cables rated up to 450/750V, for use with appliances and equipment intended for industrial and similar environments*
- [41] BS EN 50075:1991, *Specification for flat non-wirable two-pole plugs; 2.5 A 250 V, with cord, for the connection of class II-equipment for household and similar purposes*
- [42] BS EN 50525-1:2011, *Electric cables Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U) Part 1: General requirements*
- [43] BS EN 50525-2-11:2011, *Electric cables Low voltage energy cables of rated voltages up to and including 450/750V (U0/U) Part 2-11: Cables for general applications - Flexible cables with thermoplastic PVC insulation*
- [44] BS EN 50525-2-12:2011, *Electric cables Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U) Part 2-12: Cables for general applications Cables with thermoplastic PVC insulation for extensible leads*
- [45] BS EN 50525-2-21:2011, *Electric cables Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U) Part 2-21: Cables for general applications Flexible cables with cross linked elastomeric insulation*
- [46] BS EN 50525-2-71:2001, *Electric cables Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U) Part 2-71: Cables for general applications Flat tinsel cables (cords) with thermoplastic PVC insulation*
- [47] 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)*
- [48] BS EN 60893-3-4:2004+A1:2012, *Insulating materials - Industrial rigid laminated sheets based on thermosetting resins for electrical purposes - Part 3-4: Specifications for individual materials - Requirements for rigid laminated sheets based on phenolic resins*

## Acknowledgements

### Members of Technical Committee on LVAC Transformers, Switchgears and Electrical Accessories

Mr Dahari Mat Siran (Chairman)	Association of Suppliers Against Fake Electrical Equipment
Ms Zulaikah Zulkifely (Secretary)	SIRIM Berhad
Ir Chong Chew Fan	Association of Consulting Engineers Malaysia
Ir Nizar Othman/Ir Hamzah Ismail	Jabatan Kerja Raya Malaysia
Mr Abdul Aziz Abdul Razak/	SIRIM QAS International Sdn Bhd
Mr Mohamad Asnan Ahmad	
Ms Iffah Hamidah Mubuk/	Suruhanjaya Tenaga
Ms Nurshella Idris	
Engr Leong Kam Seng/	The Electrical and Electronics Association of Malaysia
Mr Khoo Lin Siang	
Ir Hairil Azli Abdul Satar/	TNB Distribution Sdn Bhd
Mr Mohd Khairul Ikram Ghazali	
Prof Dr Saad Mekhilef/	Universiti Malaya
Dr Hazlee Azil Illias	

### Members of Working Group on Plugs, Socket-outlets and Switches

Mr Mohammad Ismail (Chairman)	SIRIM QAS International Sdn Bhd (Testing Services Department)
Ms Zulaikah Zulkifely (Secretary)	SIRIM Berhad
Mr Curtis Lim	Eaton Industries Sdn Bhd
Mr Muhammad Izzuddin Abd Latif	Hager Engineering (M) Sdn Bhd
Ir Surian Rasol/	Independent
Mr Tan Boon Chong	
Ms Noorfaezah Hamdi	Jabatan Kerja Raya Malaysia
Mr Surani Burham	MK Electric (M) Sdn Bhd
Mr Roy Chan	Schneider Electric (M) Sdn Bhd
Mr Azizul Abd Rahman	SIRIM QAS International Sdn Bhd (Product Certification and Inspection Department)
Ms Nurul Akmal Mohamed Izhar/	SIRIM QAS International Sdn Bhd (Testing Services Department)
Mr Khairul Azmi Mohd Hassan	Suruhanjaya Tenaga
Ir Fairus Abd Manaf	Time Era Sdn Bhd
Mr Khoo Lin Siang	United MS Electrical Mfg (M) Sdn Bhd
Mr Chi Chee Pyng	

<http://www.china-gauges.com/>

© Copyright 2018

All rights reserved. No part of this publication may be reproduced or utilised in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the Department of Standards Malaysia.