AS/NZS 3112:2017

Australian/New Zealand Standard™

Approval and test specification—Plugs and socket-outlets

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Australian/New Zealand Standard™

Approval and test specification—Plugs and socket-outlets

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-004, Electrical Accessories to supersede AS/NZS 3112:2011.

Regulatory Authorities have accepted a transition period of 18 months for the requirements of particular clauses. In Clause 3.1.2, new requirements have been added. In Paragraphs J2.3, J4.3.1 and J4.8.2 through to J4.8.4.1 of Appendix J, new and pre-existing requirements are included. During the transition period the new requirements as detailed above may be applied in lieu of the pre-existing requirements. All other parts of this Standard take effect from the date of publication. The 'new requirement' date of application (DOA) and the 'pre-existing' date of withdrawal (DOW), where relevant, are indicated by the marginal bar against the part affected.

The objective of this Standard is to provide the Australian and New Zealand electrical industry, including manufacturers, test laboratories and regulators, with requirements and test methods for plugs and socket-outlets.

This Standard is one of a series of approval and test specifications to be read in conjunction with AS/NZS 3100, *Approval and test specification—General requirements for electrical equipment*. The purpose of this series is to outline conditions which need to be met to secure approval for the sale and use of electrical equipment. Only safety matters and related conditions are covered.

The essential safety requirements in AS/NZS 3820, *Essential safety requirements for electrical equipment*, which could be applicable to plugs and socket-outlets, are covered by this Standard, taken in conjunction with any other relevant requirements affecting safety.

Major changes in this edition are in the following:

(a) Clause 1.1 Scope. Updated and clarified.

(b) Clause 2.8.1 Ratings and dimensions.

(c) Clause 2.8.4 Dimensions of Figure 2.1.

(d) Clause 2.13.3 High voltage test.

(e) Clause 3.1.2 Construction of terminals.

(f) Clause 3.10 Floor socket-outlets.

(g) Clause 3.12 Shuttered socket-outlets.

(h) Clause 3.14.1 Tests for socket-outlets.

(i) Clause 3.14.3 High voltage test.

(j) Figure 2.1.

(k) Figure 2.11.

(l) Figure 3.10.

(m) Appendix J. Change the title and include integral or detachable plug portions of equipment for insertion into socket outlets requirements.

This Standard was revised to introduce the following technical and editorial changes:

(i) Update referenced documents.

(ii) Update and clarify the scope of the Standard.

(iii) Update diagrams for clarity.

(iv) Add new definition for insulation piercing terminal or connecting device.

(v) Add a new Appendix K, Non-detachable parts test (normative).

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this Standard.

The term ‘normative’ has been used in this Standard to define the application of the appendix to which it applies. A ‘normative’ Appendix is an integral part of a Standard.

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S E C T I O N 1 S C O P E A N D G E N E R A L

1.1 SCOPE

This Standard specifies essential safety requirements for plugs and socket-outlets, as defined in Clause 1.4, intended for use at a rated voltage not exceeding 500 V and a rated current not exceeding 32 A for household or similar purposes. Requirements for extra low voltage plugs and socket-outlets are set out in Appendix E.

Plug and socket configurations listed in IEC 60083 other than Australian and New Zealand are excluded from this Standard, with the exception of travel adaptors covered in AS/NZS 3122 Appendix A.

This Standard does not provide requirements on the following:

(a) Appliance couplers (see AS/NZS 60320.1).

(b) Installation couplers (see AS/NZS 3131 or AS/NZS 61535).

(c) Plugs, socket-outlets and couplers for general industrial applications (see AS/NZS 3123).

(d) Plugs and socket-outlets for stationary appliances (see AS/NZS 3131).

1.2 APPLICATION

1.2.1 General requirements of AS/NZS 3100

This Standard shall be read in conjunction with AS/NZS 3100. The relevant provisions of AS/NZS 3100 shall apply to the construction of a plug or socket-outlet and the insulation and safeguarding of parts that primarily carry current.

1.2.2 Specific requirements of this Standard

A plug or socket-outlet, including a special purpose plug or socket-outlet, shall be deemed to comply with this Standard only if it satisfies all the applicable requirements and passes the applicable tests specified in this Standard.

For special purpose plugs and socket-outlets small deviations from the dimensions as specified in Figure 2.1, which give the impression of a standardized plug and socket-outlet and lead to confusion with standardized plugs and socket-outlets, are not allowed.

For protective dummy plugs, refer to Appendix I.

For integral or detachable plug portions of equipment for insertion into socket-outlets, refer to Appendix J.

1.2.3 Transitional arrangements

New requirements have been added to Clause 3.1.2 and, in Paragraphs J2.3, J4.3.1, J4.8.2 through to J4.8.4.1 of Appendix J, new and pre-existing requirements are included which will run concurrently for a period of 18 months. Following this period, the pre-existing requirements are withdrawn. The pre-existing requirements are set in text boxes below the relevant new version of the Clauses. All affected text is indicated by bars in the margin. The pre-existing requirements remain unchanged from the previous edition of this Standard. Either set of requirements may be applied from the date of publication. From 24/02/2019 the new requirements only shall apply.

NOTE: See Preface for additional information.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard.

AS

1722	Pipe threads of Whitworth form
1722.2	Part 2: Fastening pipe threads
60068	Environmental testing
60068.2.30	Part 2.30: Tests—Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)
60068.2.32	Part 2.32: Tests—Test Ed: Free fall
60529	Degrees of protection provided by enclosures (IP Code)

AS/NZS

3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
3100	Approval and test specification—General requirements for electrical equipment
3105	Approval and test specification—Electrical portable outlet devices
3120	Approval and test specification—Cord extension sockets
3121	Approval and test specification—Insulating mouldings
3123	Approval and test specification—Plugs, socket-outlets and couplers for general industrial application
3131	Approval and test specification—Plugs and socket-outlets for stationary appliances
3133	Approval and test specification—Air-break switches
60320	Appliance couplers for household and similar general purposes
60320.1	Part 1: General requirements (IEC 60320-1, Ed. 2.1 (2007) MOD)
60320.2.2	Part 2.2: Interconnection couplers for household and similar equipment (IEC 60320-2-2, Ed. 2.0 (1998) MOD)
61535	Installation couplers intended for permanent connection in fixed installations (IEC 61535, Ed. 1.0 (2009) MOD)

AS/NZS IEC

60670	Boxes and enclosures for electrical accessories for household and similar fixed electrical installations
60670.23	Part 23: Particular requirements for floor boxes and enclosures
60998	Connecting devices for low-voltage circuits for household and similar purposes
60998.2.3	Part 2.3: Particular requirements for connecting devices as separate entities with insulation-piercing clamping units

IEC
60695 Fire hazard testing
60695-10-2 Part 10-2: Abnormal heat—Ball pressure test

61032 Protection of persons and equipment by enclosures—Probes for verification

1.4 DEFINITIONS

For the purpose of this Standard, the definitions in AS/NZS 3100 and those below apply.

1.4.1 Aperture panel

A separate part of the faceplate with pin aperture set(s).

NOTE: See Figure 3.8.

1.4.2 Aperture set

Active, neutral and earth pin apertures on a socket-outlet.

NOTE: This does not preclude configurations with auxiliary pins.

1.4.3 Equipment

Any accessory, appliance, apparatus, device, luminaire, fixture, material or the like used or intended for use as part of, or in connection with, an electrical installation.

1.4.4 Faceplate

Escutcheon plate, flushplate, gridplate or cover of a socket-outlet incorporating an aperture set.

1.4.5 Fully recessed socket-outlet

A socket-outlet provided with additional protection in accordance with Clause 3.6.4.

1.4.6 Insulated pin plug

A plug with all live pins having an insulated portion in accordance with this Standard.

NOTE: Both active and neutral pins are considered to be live.

1.4.7 Insulation piercing terminal or connecting device

A terminal or connecting device for the connection and possible disconnection of one conductor or the interconnection of two or more conductors, the connection being made by piercing, boring through, cutting through, removing, displacing or making ineffective in some other manner the insulation of the conductor(s) without previous stripping.

NOTE: The removal of the sheath of the cable, if necessary, is not considered as a previous stripping.

1.4.8 Non-rewireable plug

A plug constructed so that it forms an integral unit with its flexible cable or cord so that—

(a) the flexible cable or cord cannot be detached from the accessory without making it permanently useless; or

(b) the flexible cable or cord cannot be replaced by hand or by using a general-purpose tool.

1.4.9 Plug

An accessory having pins designed to engage with the contacts of a socket-outlet and incorporating means for the electrical connection and mechanical retention of flexible cables or cords.

1.4.10 Plug, IP-rated, with threaded retaining device

A plug complying with this Standard provided with an internal threaded retaining device complying with this Standard and suitable for joining with a socket-outlet, IP-rated, with threaded retaining device.

1.4.11 Rewireable plug

A plug constructed so that the flexible cable or cord can be replaced.

1.4.12 Socket-outlet

An accessory with socket contacts designed to engage with the pins of a plug and having terminals for the connection of cables or cords.

1.4.13 Socket-outlet, IP-rated, with threaded retaining device

A socket-outlet complying with this Standard provided with an external threaded retaining device complying with this Standard and suitable for joining with a plug, IP-rated, with threaded retaining device.

1.4.14 Special purpose plugs and socket-outlets

Special purpose plugs and socket-outlets are based on a standard plug and socket with variations and provide a technical advantage and do not adversely affect the safety of the standard plug and socket-outlet, especially with regards to interchangeability and non-interchangeability.

NOTE: Examples of a special purpose plug and socket-outlet are those with additional pins or with special shaped earth pins.

SECTION 2 PLUGS

2.1 TERMINALS AND INTERNAL CONNECTIONS

2.1.1 Materials

Terminals and internal connections, intended primarily for carrying current shall be of a corrosion-resisting metal with sufficient hardness and rigidity for the intended application.

2.1.2 Construction of terminals

The terminals shall be of suitable size and form to accommodate the conductors of a flexible cord of current-carrying capacity corresponding to the marked current rating of the plug.

Facilities shall be provided to prevent slipping or spreading of the conductors or conductor strands. Where the facilities are such that the conductor is to be located around the shank of the terminal screw and clamped under the screw head, the following requirements shall apply:

(a) When the terminal screw is screwed in to the limit of its thread, the clearance between the head of the screw and the washer or other means of retention of the conductor shall not exceed 0.4 mm.

(b) The terminal screw shall be of sufficient length to enable it to be backed off sufficiently from the washer or other means of retention of the conductor so that the conductor can be located around the shank without difficulty.

(c) Where the means of retention of the conductor is not continuous, e.g. prongs, there shall be at least three points of retention and the maximum angle between any two points shall not exceed 150°.

(d) Where the means of retention of the conductor is continuous, e.g. a portion of the insulating moulding, the angle subtended by the arc of the means of retention shall be not less than 180°.

2.2 PLUG PINS

2.2.1 Material for pins

Current-carrying parts of plug pins shall be of metal with, under the conditions occurring in the plug, sufficient mechanical strength, electrical conductivity and resistance to corrosion adequate for their intended use. Conformance is checked by inspection and, where in doubt, by chemical analysis.

Examples of suitable materials, when used within the permissible temperature range and under normal conditions of chemical pollution, are—

(a) copper;

(b) copper alloy containing at least 58% copper for parts made from cold rolled sheet or at least 50% copper for other parts; or

(c) stainless steel containing at least 13% chromium and not more than 0.09% carbon.

2.2.2 Assembly of pins

Where, during assembly, pins may become detached from the body of a plug yet remain attached to the conductors of a flexible cord, or have to be detached from the body to enable connection, it shall not be possible for a plug to be assembled with any pin located in a position other than that intended.

In a plug made of resilient insulating material, the pins and terminals shall be held securely in position.

NOTE: See Clause 2.8 for dimensions of flat pins.

2.2.3 Form of pin

The plug pins shall be adequately proportioned throughout, and the portion adjacent to the connection shall be designed to not introduce a stress concentration that may lead to a fracture of the pin, and shall be suitably shaped to prevent abrasion or cutting of conductor strands due to flexure in normal use.

The exposed ends of plug pins shall have a bevel or radius to facilitate entry into socket-outlets and to operate shutters.

Round pins shall have a semicircular end profile.

Flat pins with the following width and thickness profiles are deemed to comply:

(a) Flat pins with a radius on the end with side bevels, as shown in Figure 2.1(h), having the following profiles:

  (i) Width profile with an arc on the centre-line of the pin of—

    (A) 6 mm for all pins of 10 A plugs and live pins of 15 A plugs; or

    (B) 11 mm for earth pins of 15 A plugs and all pins of 20 A plugs.

  (ii) Thickness profile with each corner bevelled 0.3 mm to 0.4 mm along the sides, finishing along the pin at 0.8 mm to 1.0 mm.

(b) Flat pins square on the end with corner bevels and side bevels, as shown in Figure 2.1(i), having the following profiles:

  (i) Width profile that is square and with each corner bevelled 0.6 mm finishing along the pin at 0.8 mm to 1.0 mm.

  (ii) Thickness profile with each corner bevelled 0.3 mm to 0.4 mm along the sides, finishing along the pin at 0.8 mm to 1.0 mm.

(c) Flat pins square on the end with corner bevels and a radius on the sides, as shown in Figure 2.1(j), having the following profiles:

  (i) Width profile that is square and with each corner bevelled 0.6 mm finishing along the pin at 0.8 mm to 1.0 mm.

  (ii) Thickness profile with a radius of approximately half the material thickness along the sides, finishing along the pin at 0.8 mm to 1.0 mm.

The contact portion of the pins shall be smooth and free from openings or indentations; however, for flat-pin plugs, a longitudinal seam or opening in the contact portion of one face up to 0.3 mm width is deemed to comply. The thickness of any pin at the seam is measured using a 0.3 mm thick blade, as indicated in Figure 2.3 and shall not be less than 1.58 mm.

NOTE: This is to ensure satisfactory mating with edge-type socket contacts.

The exposed portion of earthing pins and pins other than insulated pins shall be free from any non-metallic coverings or coatings.

2.2.4 Insulation of plug pins

Live parts of insulated pin plugs shall not be exposed when the plug is partially or fully engaged with the associated socket.

Conformance is checked by measurement to Figure 2.4.

For the purpose of this Clause, lacquer, enamel or sprayed insulating coating is not considered to be insulation material.

All live pins on low voltage plugs except for those shown in Figure 2.1(a2), Figure 2.1(b) and Figure 2.1(g) shall be of the insulated pin type.

The colour green or a combination of green and yellow shall not be used for the insulation of insulated pins.

2.3 INSULATING MATERIALS

2.3.1 General

Except for ceramics, all insulating materials of a plug shall comply with Clause 2.13.11.

The moulding or encapsulating material shall be of even texture throughout and of suitable proportions to ensure adequate physical properties. It shall be free of voids, which may significantly lessen the mechanical strength or electrical properties of the plug.

2.3.2 Plug body

The insulating portion of a plug body shall consist of—

(a) insulating material with properties not inferior to those specified in AS/NZS 3121 for insulating mouldings having a temperature class of 80°C; or

(b) ceramic material of a type that, after 48 h immersion in water and after all visible drops of water have been removed from the surface using a clean dry cloth, shall not have increased in mass by more than 2%.

2.3.3 Plug cover

The insulating material of a plug cover shall have properties not inferior to those specified in AS/NZS 3121 for insulating mouldings with a temperature class of 60°C.

2.4 NON-REWIREABLE PLUGS

A non-rewireable plug shall comply with the following requirements:

(a) Each conductor shall be rigidly and effectively attached to the appropriate plug pin. Each plug pin, with the conductor attached to it, and the insulation of the conductor adjacent to the connection, shall be adequately supported and secured in position in the plug.

(b) The conductors shall be attached to the plug pins by clamping, crimping, welding or soldering. Soldered connections shall comply with AS/NZS 3100. Soldering shall be used only to supplement a clamped or crimped connection unless the design of the plug is such that the soldered connection will not be subjected to flexure or undue mechanical stress during normal use of the plug and cord set.

(c) The flexible cord, complete with any braid, cover or sheath, shall be taken into the body of the plug. The complete flexible cord shall be securely held in position in the plug by the moulding, encapsulation, cover or other suitable means that will effectively prevent any part of the flexible cord from moving out of the plug during normal use.

2.5 MEANS OF ENTRY AND CORD ANCHORAGE FOR FLEXIBLE CORD

2.5.1 General

Provision shall be made for entry of a flexible cord together with any protective covering, and for effective anchorage of the flexible cord or range of cords that the plug is intended to accommodate, so that any stress on the terminals will be substantially reduced. For rewireable plugs, the anchorage shall be effective for the range of flexible cords listed in Table 2.1, except where—

(a) there is a special aperture for the accommodation of only one type or size of flexible cord, a circular hole not being regarded as restricting the entry of cords having diameters smaller than that of the hole; or

(b) the cord or range of cords as specified by the manufacturer is marked as required by Clause 2.12.3(d).

The cord anchorage shall comply with Clause 2.13.4. In addition, except where the plug is specially designed to accept only parallel two-core unsheathed flexible cord, the following shall apply to rewireable resilient and thermoplastic plugs of the type referred to in Figure 2.1(a) and Figure 2.1(b).

Two means of cord grip shall be provided: one that anchors each insulated core by a pillar, post, grip, tortuous path or equally effective means; the second that grips or clamps the sheathing of the flexible cord. Both means may be incorporated in one device.

2.5.2 Side entry (of the flexible cord) plugs

In addition to complying with the general requirements of Clause 2.5.1, low voltage flat pin side entry plugs having ratings up to and including 15 A, shall comply with Figure 2.1(d1) or Figure 2.1(d2), as appropriate.

NOTE: Figure 2.1(d1) is primarily intended for general-purpose side-entry plugs, whereas Figure 2.1(d2) allows for side-entry plug in devices and special purpose side-entry plugs, the maximum size of which is not limited. Attention is also drawn to the requirements of Clause 3.6.2 and Notes 1 and 2 of Clause 3.6.3.

The angle of entry of the flexible cord for side entry plugs of the Figure 2.1(d2) type is not specified. However, for side entry plugs of this type, the edge of the flexible cord, including any protective covering or cord guard, closest to the plug face, shall be not less than 8.6 mm from the plug face.

TABLE 2.1

RANGE OF FLEXIBLE CORDS

Plug rating A	Flexible cord	
	Conductor size, mm^2	Type
≤7.5	0.5, 0.75	Appropriate to design of plug
>7.5 ≤10	0.75, 1.0	Light duty Ordinary duty Heavy duty
>10	Maximum size appropriate to design of plug and next smallest size	Ordinary duty or heavy duty as appropriate

2.6 CAPACITORS

Where a capacitor is incorporated in a plug for the suppression of radio or television interference, the capacitor shall comply with the capacitor requirements of AS/NZS 3100.

2.7 FINGER GRIP

A plug shall be provided with a functionally adequate finger grip to permit easy insertion into, or withdrawal from its corresponding sockets. Plugs complying with Figure 2.1(a1), Figure 2.1(c), Figure 2.1(d), Figure 2.1(f) or Figure 2.1(g) shall permit easy insertion, or withdrawal from, a fully recessed socket-outlet complying with Figure 3.5.

Conformance shall be checked by inspection.

2.8 RATINGS AND DIMENSIONS OF LOW VOLTAGE PLUGS

2.8.1 General

Plugs with ratings up to and including 20 A, shall conform to the appropriate dimensions shown in Figure 2.1.

NOTES:

1 In Figure 2.1(e1), the less than 21.9 mm and greater than 27 mm dimensions have been specified to give an exclusion zone to allow side-by-side use, without jamming, of plugs and equipment with integral plug portions in adjacent socket-outlets (refer to Figure 2.11 for examples).

2 In Figure 2.1(e), the 8.6 mm dimension on plugs or equipment with integral plug portions having an external enclosure projection greater than R21 mm is specified to ensure they fit in a recessed socket-outlet of Figure 3.5 or a cord extension socket of AS/NZS 3120.

In addition to the dimensions of Figure 2.1, the distance between a live pin of any plug and the edge of the moulding of the plug shall be not less than 9 mm. Where doubt exists regarding conformance with this requirement, the gauge of Figure A1 in Appendix A or Figure B1 in Appendix B, or Figure F1(a) or Figure F1(b) in Appendix F, as appropriate, shall be placed over the pins to ensure contact with the highest points associated with the plug face. Using a 1.5 mm feeler gauge of greater than 3 mm width and applied without undue force between the plug and the plug gauge, penetration to within 9 mm of the live pin shall not be possible.

No point on the front face of the plug shall protrude by more than 0.5 mm. The pin lengths shall be measured from a plane normal to the pins passing through the highest point on the front face of the plug, to the end of the pin.

NOTE: Examples of protrusions are moulding irregularities and markings.

Dimensional requirements of Figure 2.1(e2) do not apply to plugs with greater than three pins as they will not engage with a standard socket-outlets complying with Figure 2.1.

2.8.2 Integrally moulded plug and cord

A two-core flexible cord may be integrally moulded with a three-pin plug.

2.8.3 Two-pin flat-pin plugs with non-parallel pins

A low voltage, two-pin, flat-pin plug with pins arranged as in Figure 2.1(c) shall have a current rating not exceeding that of the cord to which it is connected. Such plugs shall be permitted only where the plug has a maximum rating of 10 A and is integrally moulded.

2.8.4 Conformance with dimensional requirements of Figure 2.1

Low voltage plugs shall be checked for conformance with the prescribed dimensions of Figure 2.1 by any suitable means, except that conformance with the nominal dimensions covering disposition of pins, i.e. spacing from centre and angular orientation shall be checked by a gauge complying with Appendix A, Appendix B or Appendix F, as appropriate.

In addition, low voltage flat pin, or combination of flat and round pin plugs having ratings up to 15 A of the Figure 2.1(a1), Figure 2.1(c), Figure 2.1(d), Figure 2.1(f) or Figure 2.1(g) type, shall comply with the dimensional requirements of Figure 2.1(e1 and e2).

20 A plugs of the Figure 2.1(a2) type shall comply with the dimensional requirements of Figure 2.1(e2).

Plugs with insulated pins, complying with this Standard, need not comply with dimension R20 ±1.0 mm of Figure 2.1(e2) provided there is at least 9mm from the edge of the live pins to the edge of the plug face Figure 2.1(e3).

2.8.5 Plugs, IP-rated, with threaded retaining device

Where an IP-rated plug has a threaded retaining device, the dimensions of the retaining device shall comply with Appendix H. The pitch circle diameter (PC) on the threaded retaining device shall be as shown in Figure H1(d).

2.9 INTERNAL CONNECTIONS

The design and construction of a plug provided with earthing connections shall be such that when the plug is correctly wired and completely assembled—

(a) a loose terminal screw or conductive material cannot bridge any live parts or earthing parts;

(b) the earthing parts are effectively isolated from contact with a live conductor that may become detached; and

(c) the live parts are effectively isolated from contact with any earthing conductor that may become detached.

Any connections for auxiliary devices, such as radio interference suppressors or visual indicators, shall comply with the above requirements.

2.10 ARRANGEMENT OF EARTHING CONNECTIONS

The earthing pin of any low voltage, three-pin plug shall be that pin which is radial to the circle embracing the pins [see Figure 2.1(a), Figure 2.1(f) and Figure 2.1(g)].

2.11 FUSES

Plugs shall not include a fuse.

2.12 MARKING

2.12.1 Required marking

The plug shall be marked with the following information in accordance with AS/NZS 3100:

(a) The name, trade name, or mark of the manufacturer or of the supplier.

(b) The current rating in amperes.

(c) The voltage.

(d) If not the only type of plug marketed by the manufacturer or supplier, the plug shall also be marked with a catalogue number, type number or name, or other marking that will distinguish it from any other plug marketed by that manufacturer or supplier.

Plugs of the same basic design incorporating identical components but with variations of pin arrangements, such as 10 A, 15 A or round earth pin, may have a common type marking.

(e) Any IP rating greater than IP20, if claimed.

NOTE: Manufacturers making a statement of conformance with this Australian/New Zealand Standard on a product, packaging or promotional material related to that product are advised to ensure that such conformance is capable of being verified.

2.12.2 Location of marking

The marking required by Clause 2.12.1 shall be located as follows:

(a) Items (a) and (d)—on any portion of the plug.

(b) Items (b), (c) and (e)—on the external body of the plug.

2.12.3 Additional requirements for rewireable plugs

A rewireable plug shall also be supplied with instructions detailing the following:

(a) A diagram illustrating the method of connection of the conductors and, in particular, the earthing conductor and the cord anchorage. This diagram shall show the earthing conductor printed in green and yellow. The live conductors shall not be coloured.

(b) A full-scale diagram showing the length of sleeving and insulation to be stripped back.

(c) A description of the method of connection of each conductor giving the permissible alternative colours for the active, neutral and earthing conductors, respectively.

(d) The size and types of flexible cords with which it is intended to be used.

NOTE: Plugs intended to be marketed in bulk, e.g. to equipment manufacturers, may be supplied with one set of instructions per package.

2.12.4 Earthing connections

Where a rewireable plug incorporates a pin intended to provide an earthing facility, the pin shall be distinguished by marking in accordance with the requirements for the marking of the earth connection in AS/NZS 3100 and located either on the pin or adjacent to the earthing terminal.

This marking shall be supplemented by the application of a conspicuous green colour on, or adjacent to, the earthing terminal, if the plug is of the rewireable type.

Where, during assembly, pins may become detached from the body of a plug yet remain attached to the conductors of a flexible cord, or are required to be detached from the body to enable connection, the above information shall be conspicuously marked on the earthing pin and on the body adjacent to the earthing pin position.

2.12.5 Live connections

2.12.5.1 *General*

The marking of live connections of rewireable plugs shall be as required by AS/NZS 3100, except that the active connection of plugs shall be indicated by the letter ‘L’, ‘A’ or ‘P’. ‘L’ is the preferred letter.

2.12.5.2 *Location of marking*

Where pins may become detached from the body or are required to be detached to enable connection to the terminals, the marking shall be inside the body of the plug adjacent to the terminals.

In other cases, the marking may be on the terminals.

2.12.6 Configuration of plugs

A plug conforming to Figure 2.1(a), Figure 2.1(c), Figure 2.1(f) or Figure 2.1(g) shall have its pins disposed so that, when the pins are correctly connected, the pin configuration, viewed as from the pins, shall be earth, neutral and active in a clockwise direction.

Where there is no earthing pin, the live pins shall conform to this configuration.

2.13 TESTS ON PLUGS

2.13.1 General

Plugs shall be subjected to the tests specified in Table 2.2, carried out in the stated order, and shall comply with the requirements specified for each test.

The general conditions described in Clause 8.1 General in AS/NZS 3100 shall be observed during the tests of this Standard.

TABLE 2.2

PLUGS—TESTS TO BE APPLIED AND ORDER OF APPLICATION

1	2	3	4
Test No.	**Description of test**	**Reference for test procedure and criteria***	**Sample identification**
	General and dimensions	2.1 to 2.12	A
1	Insulation resistance test	2.13.2	A
2	High voltage test	2.13.3	A
3	Flexible cord anchorage test for rewirable plugs	2.13.4	A
4	Test of external nut or lamping ring	2.13.5	A
5	Screw threads and fixings	AS/NZS 3100	A
6	Attachment of covers	2.13.6	A
7	Mechanical strength of pin tests	2.13.7	
7a	Tumbling barrel test	2.13.7.1	BCD
7b	Pin bending test	2.13.7.2	EFG
8	Temperature rise test	2.13.8	H
9	Securement of pins	2.13.9	
9a	Movement of pins	2.13.9.1	I
9b	Fixing of pins	2.13.9.2	J
10	Determination of IP rating	2.13.10	K
11	Determination of ignitability and combustion propagation	2.13.11	any or L†
12	Tests on non-rewireable plug and cord sets	2.13.12	
12a	Attachment of flexible cord	2.13.12.2	M
12b	Attachment of insulated cores	2.13.12.3	N
12c	Attachment of sheathing (sheathed cords)	2.13.12.4	O
12d	Attachment of insulation (unsheathed cords)	2.13.12.5	O
12e	Attachment of conductors	2.13.12.6	Qu‡
13	Tests for plugs with insulated pins	2.13.13	
13a	Pressure test at high temperature	2.13.13.2	Pin_a§
13b	Static damp heat test	2.13.13.3	R|
13c	Low temperature test	2.13.13.4	S|
13d	Impact test at low temperature	2.13.13.5	Pin_b§
13e	Abrasion test	2.13.13.6	RS|

Total number of samples required:

Tests 1 to 9	10 (A, B, C, D, E, F, G, H, I, J)
Test 10	1 (K)
Test 11	1 (L)
Test 12	4 (M, N, O and one unmoulded Q)
Test 13	2 (R, S) plus 2 (Pin_a and Pin_b) insulated pins

* Clause numbers refer to this Standard.

† Resistance to fire test may require a further sample in new and clean condition.

‡ Q_u is an unmoulded sample.

§ Pin_a and Pin_b are samples of separate insulated pins only.

| The manufacturer may indicate that R and S are the same sample.

2.13.2 Insulation resistance test

The insulation resistance of a plug shall be measured at a voltage of 500 V d.c. as follows:

(a) Between all poles of the plug, taken in pairs.

(b) Between live poles of the plug and any external metal, all live poles of the plug being connected together.

(c) Between live poles of the plug and the earthing terminal of exposed metal, the live poles being connected together.

(d) Between live poles and a flexible electrode applied to non-conducting parts normally handled in service, all live poles connected together.

(e) For insulated pin plugs, between live poles and a metal foil applied around the insulation on each live pin for a distance of approximately 4 mm from plug face, all live poles being connected together.

The measured insulation resistance shall be not less than 5 MΩ.

2.13.3 High voltage test

The plug shall withstand without failure an a.c. voltage of the value indicated in Table 2.3, applied between the parts set out in Items (a) and (c) of Clause 2.13.2 for 1 min in each case.

The plug shall further withstand, without failure, a voltage of 3000 V a.c. applied between the parts set out in Items (b) and (d) of Clause 2.13.2 for 1 min in each case.

The insulation of insulated pin plugs shall withstand a voltage of 1250 V a.c. for 1 min applied in accordance with Clause 2.13.2(e).

TABLE 2.3

TEST VOLTAGES FOR HIGH VOLTAGE TEST

Working voltage (r.m.s.) between parts (see Note)		Testing voltage
	≤32 V	500 V
>32 V	≤250 V	1 000 V
>250 V	≤650 V	1 000 V + (2 × working voltage) with a maximum of 2 000 V

NOTE: For example, a plug for connection to a system operating at 415 V between phases and 240 V to earth would require a test of 1000 + (2 × 415) V between live terminals but only 1 000 V between each live terminal and the earth terminal.

2.13.4 Flexible cord anchorage test for rewireable plugs

The cord anchorage test for rewireable plugs shall be carried out in accordance with the following test method.

The cord anchorage shall be tested with the conductors connected to the appropriate terminals.

A direct pull of the values specified in Column 4 of Table 2.4 shall be applied through the flexible cord in the direction in which it enters the plug.

Over a period of 10 s, the pull shall be increased uniformly to the appropriate value, maintained at that value for a further 10 s, and then released.

This test shall be performed three times.

The terminal screws of resilient and thermoplastic plugs shall be loosened as much as possible without removing the screws and a direct pull of the values specified in Column 5 of Table 2.4 shall be applied through the flexible cord. Over a period of 10 s, the pull shall be increased gradually to the appropriate value, maintained at that value for a further 10 s, then released. This test shall be performed three times.

The number of cores in the flexible cord shall be appropriate to the number of pins of the plug. Notwithstanding Column 3 of Table 2.4, if a plug has been designed to accommodate only a particular type of flexible cord in accordance with Clause 2.5, the plug shall be tested only with that cord; however, an entry hole of a size corresponding to the diameter of a particular type of circular flexible cord shall not be considered as restricting the use of the plug to that flexible cord.

The cord anchorage shall be considered inadequate if the flexible cord parts from the terminals, if the terminals break away or are impaired or, if during the test with the terminal screws loosened, the flexible cord moves longitudinally by 2 mm in the anchorage, either before the direct pull reaches the specified value or during the time that the pull is maintained.

TABLE 2.4

LOADS FOR CORD ANCHORAGE TEST

1	2	3	4	5
Plug rating	**Flexible cord**		**Test force N**	
A	**Size, mm²**	**Type**	**Conductors connected to terminals**	**Conductors connected; terminal screws loosened**
≤3	0.5	Appropriate to design of plug	70 ±0.7	50 ±0.5
>3 ≤7.5	0.75	Appropriate to design of plug	110 ±1	50 ±0.5
>7.5 ≤10	0.75	Light duty* or ordinary duty		
>10 ≤15	1.0	Ordinary duty*		
>15	Next smaller size than maximum intended to be accommodated	Ordinary duty* or heavy duty if appropriate	110 ±1	65 ±0.7

* PVC insulated and sheathed.

2.13.5 Test of external nut or clamping ring

Plugs that incorporate an external nut or clamping ring as a means of cord anchorage shall be subjected to the following test.

A plug shall be wired with a minimum sized cord, as specified by the manufacturer, and an axial force of 110 N shall be applied to the external nut or clamping ring for 60 s and the external nut or clamping ring shall not become detached.

2.13.6 Attachment of covers

A plug with a removable cover, which is not secured by screws and which, when removed, exposes live parts, shall, together with the test equipment, be heated to a temperature of 50 ±2°C for 1 h and shall be maintained at that temperature throughout the test. The test shall be conducted without a cord attached to the plug.

The base of the plug shall be securely held in position. A force which, over a period of 10 s, shall be increased steadily to 60 ±0.6 N and held at this value for a further 10 s, shall be applied evenly at the neck of the plug in a direction parallel to the pins. This procedure shall be conducted three times on the same plug, at intervals of 5 min, without disturbing the cover between tests.

During the test period, the cover shall not separate from the base to enable live parts to be accessible to the standard test finger.

2.13.7 Mechanical strength of pin tests

2.13.7.1 *Tumbling barrel test*

Three plugs, not subjected to any previous tests, shall be tested in a tumbling barrel as described in AS 60068.2.32. Rewireable plugs shall be fitted with a flexible cord as specified in Table 2.1, having the smallest cross-sectional area of the lightest type and a length of approximately 100 mm, measured from the outer end of the guard (if any) or the plug.

Terminal screws and assembly screws shall be tightened with a torque equal to two-thirds of the torque specified in the test for screw threads and fixings of AS/NZS 3100.

Non-rewireable plugs shall be tested with the flexible cord as delivered, the cord being cut so that a free length of approximately 100 mm projects from the outer end of the guard or the plug (if any).

The samples shall be dropped from a height of 500 mm onto a steel plate, 3 mm thick. After each 100 drops the pins shall be inspected and straightened to pass through the gauge of Figure A1 or Figure F1. The total number of falls shall be 1 000.

The barrel shall be turned at a rate of 5 r/min, to yield 10 falls per minute. Only one sample shall be tested at a time.

After the test, the sample shall show no damage within the parameters of this Standard. In particular the following shall apply:

(a) Live parts shall not have become exposed to the standard test finger.

(b) For earth pins, the resistance of the plug/socket-outlet circuit shall be such that conformance with Clause 3.14.7 is maintained.

(c) Any other function affecting safety shall not be impaired.

(d) No live part shall have become detached or loosened, to the extent that a hazardous situation is created (see Clause 2.9).

(e) The pins shall be inspected with normal, or corrected to normal, vision. Insulation may be removed if necessary. Pins shall not be broken or show cracking.

NOTES:

1 Special attention is paid to the connection of the flexible cord. Small pieces may be broken off without causing rejection, provided that the protection against electric shock is not affected.

2 Slight damage to the finish and small dents are neglected.

3 The specified free length of flexible cord of 100 mm may be reduced if the overall length of the plug and flexible cord approaches the width of the tumbling barrel test apparatus.

4 Tests to ascertain conformance with Items (a), (b) and (c) are conducted only in case of doubt.

5 Minor damage to plug pins is ignored.

2.13.7.2 *Pin bending test*

All flat pins of plugs rated up to and including 15 A shall be subjected to a pin bending test.

Three sample plugs not subjected to any previous tests shall be tested as follows:

(a) Pins of assembled plugs shall be tested by clamping the plug in a rigid holding block and applying a bending force, as shown in Figure 2.8, to the pin under test.

(b) The pins shall be straight at the beginning of the test. If there is any doubt about the straightness of the pin, it shall be checked by the appropriate plug gauge shown in Appendix A, Appendix B or Appendix F.

(c) The point of application of the force shall be 14 ±0.5 mm from the face of the plug.

(d) The direction of the force shall be along a line parallel to the face of the plug.

(e) Active and neutral pins shall be forced towards the centroid of the plug and then back to the starting point. On the first sample plug, any earth pin shall be forced but in one direction only and then forced back to the starting point. On the second sample plug, any earth pin shall be forced in the opposite direction to that used for testing the first sample plug. On the third sample plug, any earth pin shall be forced in the direction that gave the least favourable result during testing of the first two sample plugs.

NOTE: This is intended to simulate damage that may occur when a plug is walked on and bent pins are straightened.

(f) The distance moved from the point of application shall be 7.5 ±0.3 mm, and then the pin shall be forced back to the starting point. Any ‘spring-back’ is ignored.

NOTE: ‘Spring-back’ means that the pin is allowed to move back to a position less than the travel distance, when the force is removed.

(g) The travel from the starting point to the end point (7.5 mm) and back to the starting point is one cycle (i.e. one cycle is two separate movements).

(h) The speed of deflections shall be a maximum of 50 mm/s, without intentional delay between consecutive movements within each cycle.

(i) The interval between successive cycles shall be a minimum of 10 s.

(j) The duration of one cycle shall be a maximum of 60 s.

(k) The pins shall be tested for 20 complete cycles.

(l) After the tests the pins shall be inspected with normal or corrected to normal vision.

(m) The pin shall not be broken off.

NOTE: Cracking of the pin, less than full thickness, is not deemed to be broken off.

(n) If in doubt, pins shall be disassembled from the plug and any insulation removed.

NOTE: In some cases the break may be below the face of the plug or the insulation may hold the broken pieces together, retaining electrical contact.

2.13.8 Temperature rise test

Plugs shall be so constructed that they comply with the following temperature rise test:

(a) Non-rewireable plugs shall be tested as delivered with the minimum cross-sectional area of conductor size for each respective current rating.

(b) Rewireable plugs shall be fitted with polyvinyl chloride flexible cords with conductors having the minimum cross-sectional area specified in the manufacturer's instructions.

The terminal screws or nuts shall be tightened with a torque equal to two-thirds of that specified in Table 2.2 Test No. 5.

To ensure normal cooling of the terminals, the conductors connected to plugs shall have a length of at least 1 m.

The plug shall be tested in a draught-free environment at the centre of a plane wooden board, which shall be at least 6 + 2 mm thick, 500 mm wide and 500 mm long with the rear completely enclosed in a wooden mounting enclosure (wall box) of 90 mm × 60 mm × 40 mm. Apertures in the wooden board for the plug pins to pass through are specified in Table 3.1 (see Figure 2.9).

Plugs shall be tested as follows:

(i) The appropriate clamping units with the dimensions specified in Figure 2.10 are fitted on each live pin of the plug, together with the thermocouple. The screw is then placed approximately in the middle of the bare part of the pin and tightened with a torque of 0.8 Nm. The clamping unit is fitted with PVC-insulated conductors at least 1 m long, having nominal cross-sectional areas as shown in Table 3.3. Where the conductors pass through the wooden mounting enclosure (wall box) there shall be a complete airtight seal between the conductors and the enclosure.

(ii) An alternating current of 1.1 times the rated current of the plug is then passed through each live pin/clamping unit for 1 h.

(iii) For plugs with three poles or more, the current during the test shall be passed through the phase contacts, where applicable. In addition, separate tests shall be made passing the current through the neutral contact, if any, and the adjacent phase contact.

(iv) The temperature rise of the thermocouple shall not exceed 45 K.

2.13.9 Securement of pins

2.13.9.1 *Movement of pins*

Plugs shall be tested for pin movement by clamping the pin or pins not under test in a rigid holding block positioned 5 ±0.5 mm from the plug face and applying a force of 18 ±1 N to the pin under test. The design of the block shall be such that the pin under test shall not come into contact with the block during the test.

Except for non-rewireable plugs, the test shall be carried out without a cord attached to the plug, and with the terminal screws loosened sufficiently to allow a 1 mm^2 conductor to be connected.

The plug and test equipment shall be preconditioned at a temperature of 40 ±1°C for 1 h, without the test force applied. Throughout the test, all parts of the plug and test equipment shall be maintained at this temperature.

For all plugs, the point of application of the force shall be 14 ±0.5 mm from the face of the plug along the pins, and the direction of the force shall be—

(a) in both directions along the line perpendicular to the plane of the pin, and passing through the centre of the pin; and

(b) in that plane in both directions along a line at right angles to that specified in Item (a).

Over a period of 10 s, the force shall be gradually applied to each of the pins in the manner prescribed in Items (a) and (b), maintained at its maximum value for 10 s, and then released. The deflection of the pins shall be measured along the line of force relative to the face of the rigid holding block during the period when the force is applied. The maximum deflection shall not exceed 2.0 mm.

Following the test on all pins of a plug conforming to Figure 2.1, any distortion 5 min after the completion of the test on the last pin shall be such that it will not prevent the plug from being inserted in the appropriate standard gauges shown in Appendix A, Appendix B and Appendix F without the application of undue force.

For other types of plugs, any distortion after 5 min shall be such that will not prevent the plug being inserted into an appropriate socket-outlet without the application of undue force.

2.13.9.2 *Fixing of pins*

A separate sample of a plug shall be heated to a temperature of 50 ±2°C for 1 h and maintained at that temperature during the whole of these tests, including the 5 min period after removal of the test load.

The plug shall be held firmly in such a manner that there will be no undue squeezing or distortion of the body, and the means of holding shall not assist in maintaining the pins in their original position.

Each pin, in turn, shall have applied to it a force which, over a period of 10 s, shall be increased steadily to 60 ±0.6 N and held at this value for 10 min.

Two tests on each pin shall be conducted, one with the direction of force along the length of the pin towards the body of the plug, and the other with the direction of force along the length of the pin away from the body.

The attachment of pins shall be considered inadequate if any pin is displaced relative to the adjacent material of the body by more than 2.4 mm at any time during these tests, or if any pin fails to return to within 0.8 mm of its nominal length specified in Figure 2.1 within 5 min of the removal of the test force.

2.13.10 Determination of IP rating

The IP rating of a plug shall be determined with a socket-outlet nominated by the manufacturer and with any retaining device engaged. The assembly shall be tested to AS 60529.

Where a plug is to be tested to first characteristic numeral 5 of AS 60529 (dust test), testing shall be carried out under the conditions specified in AS 60529 for Category 2.

2.13.11 Determination of ignitability and combustion propagation

Plugs shall comply with the requirements for resistance to fire in accordance with AS/NZS 3100 for equipment not designated as ‘attended’ or ‘unattended’. The glow-wire test temperature ‘T’ shall be 750°C.

2.13.12 Tests on non-rewireable plug and flexible cord

2.13.12.1 *General*

Non-rewireable plugs and flexible cords shall pass the tests in Clauses 2.13.12.2 to 2.13.12.6, except that only the test of Clause 2.13.12.5 shall be applied to flexible cords with tinsel conductors. Each of the tests is to be conducted on a separate sample.

For the purpose of these tests, the ambient temperature shall be maintained at 20 ±2°C.

2.13.12.2 *Attachment of flexible cord*

The flexing test shall be conducted according to the following procedures:

(a) *Fixing the plug to the test apparatus* The plug shall be fixed by the pins in a rigid holding block to the oscillating member of the apparatus, as shown in Figure 2.2, so that when the member is in the middle of its travel, the axis of the flexible cord, where it enters the plug, is vertical and passes through the axis of oscillation. For the purpose of this test, any cord guard is considered to be part of the plug.

Plugs with flat cords shall be mounted so that the major axis of the section is parallel to the axis of oscillation.

The plug shall be positioned on the test apparatus so that when the member is oscillating, minimum lateral movement of the weight and cord occurs.

NOTES:

1 To obtain a mounting position with the minimum lateral movement of the weight and cord during a test, the apparatus should be constructed in such a manner that the different supports on the oscillatory member may be adjusted by a threaded spindle with a possible range of displacement of at least from 20 mm to 150 mm.

2 A device, e.g. a slot or a pin, should be used to check that the weight and cord assembly make minimum lateral movement.

(b) *Loading of flexible cord* The cord shall be loaded with a mass such that the force applied is—

(i) 20 ±0.2 N for accessories with cables or cords having a nominal cross-sectional area exceeding 0.75 mm^2; or

(ii) 10 ±0.1 N for accessories with flexible cords having a nominal cross-sectional area not exceeding 0.75 mm^2.

The weight shall be positioned not less than 300 mm from the point at which the flexible cord enters the plug (see Figure 2.2).

(c) *Test method* The oscillating member shall be moved through an angle of 90° (45° on either side of the vertical), the number of flexings being 10 000 and the rate of flexing 60 per minute.

NOTE: A flexing is a movement in one direction.

Samples with circular section cables or cords are turned through 90° in the oscillating member after 5 000 flexings. Samples with flat cords are bent only in a direction perpendicular to the plane containing the axis of the cores.

(d) *Conformance during the flexing test* During the test, no strands shall pierce the insulation so that they become accessible.

(e) *Conformance after the test* The criteria for conformance are the following:

(i) The sample shall not show damage.

(ii) The protective sleeve, if any, shall not have separated from the body.

(iii) The insulation of the flexible cord shall not have been damaged.

(iv) Not more than 10% of the number of strands of each conductor shall have broken.

2.13.12.3 *Attachment of insulated cores*

The plug shall be rigidly held by the pins. A direct pull in the direction in which the flexible cord emerges from the plug shall be applied through the insulated cores clamped together at a point approximately 600 mm from the point of entry to the plug, with the sheathing (if any) being removed back to the plug. Over a period of 10 s, the pull shall be increased uniformly to 110 ±1 N, maintained at the maximum value for a further 10 s, and then released.

The attachment of the insulated cores shall be considered inadequate if any core detaches from the plug, or if all conductor strands detach from a pin at any time during the test.

2.13.12.4 *Attachment of sheathing (sheathed cords)*

The plug shall be rigidly held by the pins. A direct pull in the direction in which the flexible cord emerges from the plug shall be applied through the sheathing only at a point approximately 600 mm from the point of entry to the plug, with the insulated cores and bedding being severed at a point approximately 25 mm from the plug. An axial slit shall be made in the sheathing for this purpose. Over a period of 10 s, the pull shall be increased uniformly to 130 ±1.3 N, maintained at that value for a further 10 s, and then released.

The attachment for sheathing shall be considered inadequate if the insulated cores are exposed at the point of entry to the plug or the cord guard (if permanently attached to the plug), either before the direct pull reaches the required value or during the time that the pull is maintained.

For plugs attached to a light-duty PVC or ordinary-duty elastomeric flexible cord, the attachment shall be considered adequate if the insulated cores are not exposed at the point of entry when the sheathing breaks, if this occurs before the maximum force of 130 N is reached.

2.13.12.5 *Attachment of insulation (unsheathed cords)*

The plug shall be rigidly held by the pins. A direct pull in the direction in which the flexible cord emerges from the plug shall be applied to the cord at a point approximately 600 mm from the point of entry to the plug, with the insulation of each core being slit parallel to the conductor for a short distance at a point approximately 25 mm from the point of entry to the plug. All strands of the conductor and the separator (if any) shall be severed at the slit portion. Over a period of 10 s, the pull shall be increased uniformly to 65 ±0.7 N, maintained at the maximum value for a period of 10 min, and then released.

The attachment of insulation shall be considered inadequate if the insulation detaches from the plug, or if the conductors are exposed at, or near, to the entry of the body, at any time during the test.

2.13.12.6 *Attachment of conductors*

The plug shall be cut open and the pins, together with a suitable length of the insulated cores, removed from the plug. Alternatively, the manufacturer may submit unmoulded samples for this test. Approximately 25 mm of the insulation adjacent to the plug pin shall be stripped from the cores. Each plug pin, in turn, shall be held rigidly and a direct pull applied to the conductor at a point approximately 600 mm from the pin in the direction in which the conductor is attached to the pin.

Over a period of 10 s, the pull shall be increased gradually to 85 ±0.9 N, maintained at that value for a period of 1 min, and then released.

The attachment of conductors shall be considered inadequate if all conductor strands detach from the pin during any test.

2.13.13 Tests on the insulation material of insulated pin plugs

2.13.13.1 *General*

The material of the pin insulation shall be resistant to the stresses to which it may be subjected at the high temperature likely to occur in conditions approaching the bad connection conditions and at low temperatures in particular conditions of service. Conformance is checked by the tests of Clauses 2.13.13.2 to 2.13.13.6.

2.13.13.2 *Pressure test at high temperature*

One insulated pin only shall be subjected to the following test by means of the apparatus shown in Figure 2.5. This apparatus shall have a blade with a round shape, diameter of 6 mm and a thickness of 0.7 mm.

The sample shall be placed in position as shown in the Figure 2.5 and a force of 2.5 N shall be applied through the blade to the sample.

The apparatus, with the sample in position, shall be maintained for 2 h in a heating cabinet at a temperature of 160 ±5°C. The sample shall then be removed from the apparatus and, within 10 s, cooled by immersion in cold water.

The thickness of the insulation shall be measured immediately at the point of impression.

The thickness of the insulation remaining at the point of impression shall be measured and shall not have been reduced by more than 50%.

Visual inspection shall be made and no cracks on the insulation material shall be visible with normal, or corrected to normal, vision without additional magnification, and the dimension of the insulating material shall not have changed below the minimum size shown in Figure 2.4.

2.13.13.3 *Static damp heat test*

An insulated pin plug shall be subjected to two damp heat cycles in accordance with AS 60068.2.30, Db (12 + 12 h cycle), 95% relative humidity, lower temperature 25 ±3°C and upper temperature 40°C.

After this treatment and after recovery to room temperature, the sample shall be subjected to—

(a) the insulation resistance test in accordance with Clause 2.13.2(e);

(b) high voltage test in accordance with Clause 2.13.3; and

(c) abrasion test in accordance with Clause 2.13.13.6.

NOTE: At the manufacturer's option, the same sample may be used for this test and the low temperature test (see Clause 2.13.13.4) and a single abrasion test may be done.

2.13.13.4 *Low temperature test*

An insulated pin plug shall be maintained at −15 ±2°C for at least 24 h and returned to room temperature.

The sample shall be subjected to—

(a) the insulation resistance test in accordance with Clause 2.13.2(e);

(b) high voltage test in accordance with Clause 2.13.3; and

(c) abrasion test in accordance with Clause 2.13.13.6.

NOTE: At the manufacturer's option, the same sample may be used for this test and the static damp heat test (see Clause 2.13.13.3) and a single abrasion test may be done.

2.13.13.5 *Impact test at low temperature*

One insulated pin only shall be subjected to an impact test by means of the apparatus shown in Figure 2.6. The mass of the falling weight shall be 100 ±1 g.

The apparatus, on a sponge rubber pad 40 mm thick, together with the sample, shall be maintained at −15 ±2°C for at least 24 h.

At the end of this period, the sample shall be placed in position, as shown in Figure 2.6, and the falling weight shall be allowed to fall from a height of 100 mm. Four impacts shall be applied successively to the same sample, rotating it through 90° between impacts.

After the test the sample shall be allowed to return to room temperature and then examined. No cracks of the insulating material shall be visible with normal, or corrected to normal, vision without additional magnification.

NOTE: The cooling period of 24 h includes the time necessary to cool down the apparatus.

2.13.13.6 *Abrasion test*

An insulated pin of an insulated pin plug shall be subjected to the following test by means of an apparatus as shown in Figure 2.7.

The test apparatus comprises a horizontally disposed beam, which shall be pivoted about its centre point. A short length of steel wire, 1 mm in diameter and bent into a U-shape, the base of the U being straight, shall be rigidly attached, at both ends, to one end of the beam, so that the straight part projects below the beam and shall be parallel to the axis of the beam pivot.

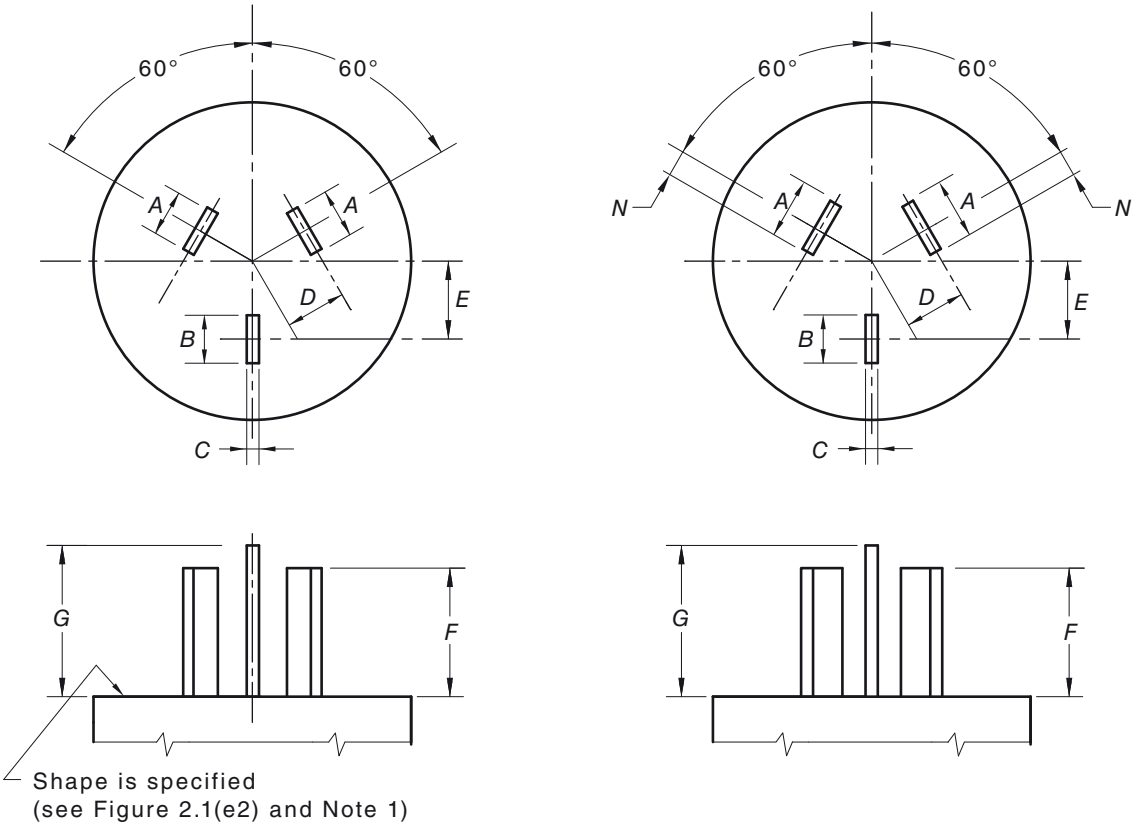
The plug shall be held in a suitable clamp in such a position that the straight part of the steel wire rests on the major axis face of the plug pin, at right angles to it. The pin shall slope downwards at an angle of 10° to the horizontal.

The beam shall be loaded so that the wire exerts a force of 4 N on the pin.

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

The number of movements shall be 20 000 (10 000 in each direction) and the rate of operation shall be 30 movements per minute.

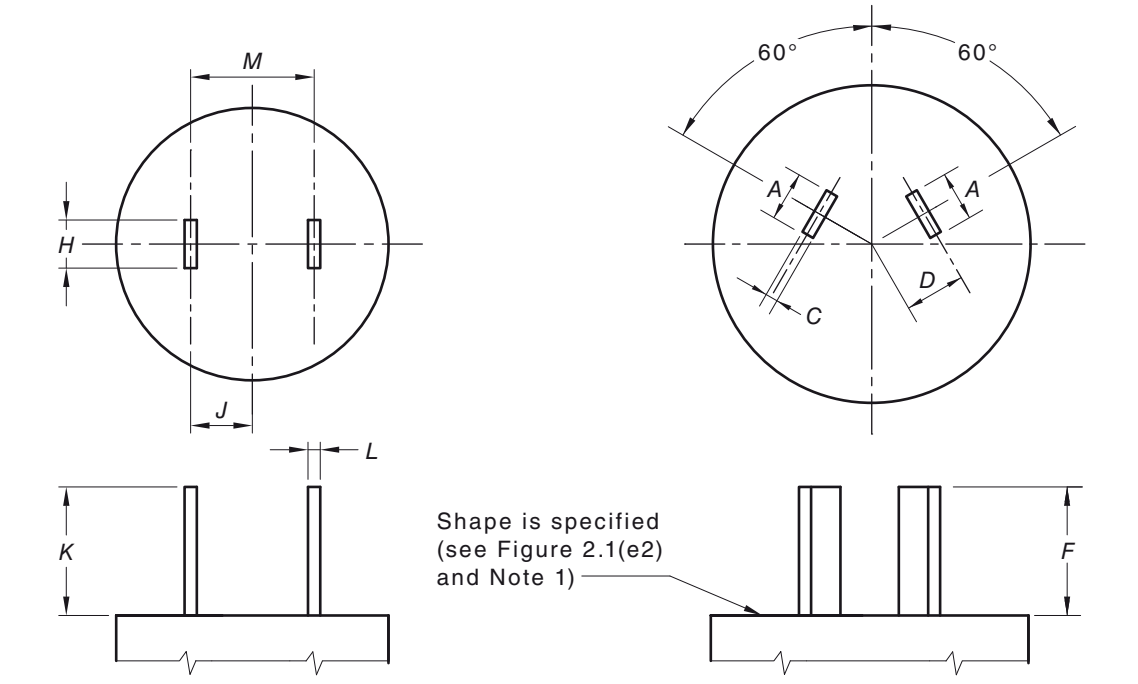
After the test, the pins shall show no damage which may affect safety or impair the further use of the plug, in particular, the insulating sleeve shall not have punctured or rucked up.



(a1) 10 A or 15 A, 250 V max.

(a2) 20 A, 250 V max.

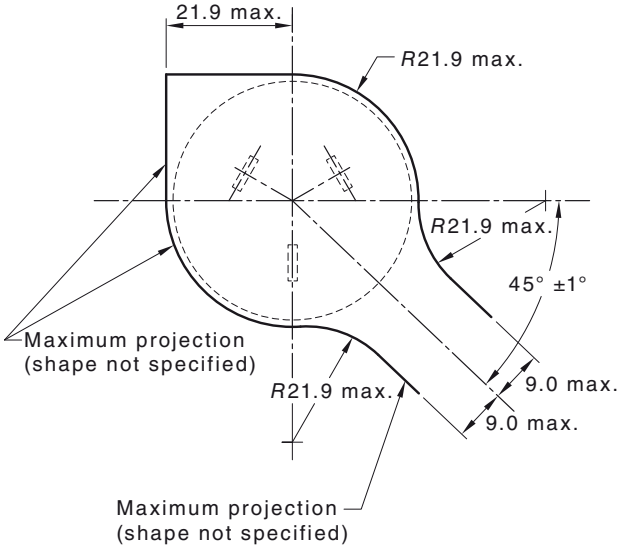
(a) Three-pin plugs (10 A, 15 A or 20 A, 250 max.)



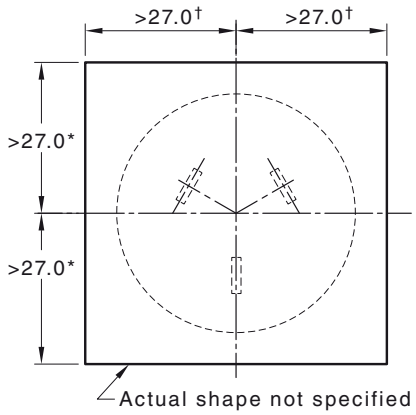
(b) Two-pin plugs (10 A, 125 V max.)

(c) Two-pin plugs (up to 10 A, 250 V max.)

FIGURE 2.1 (in part) DIMENSIONS OF PLUGS



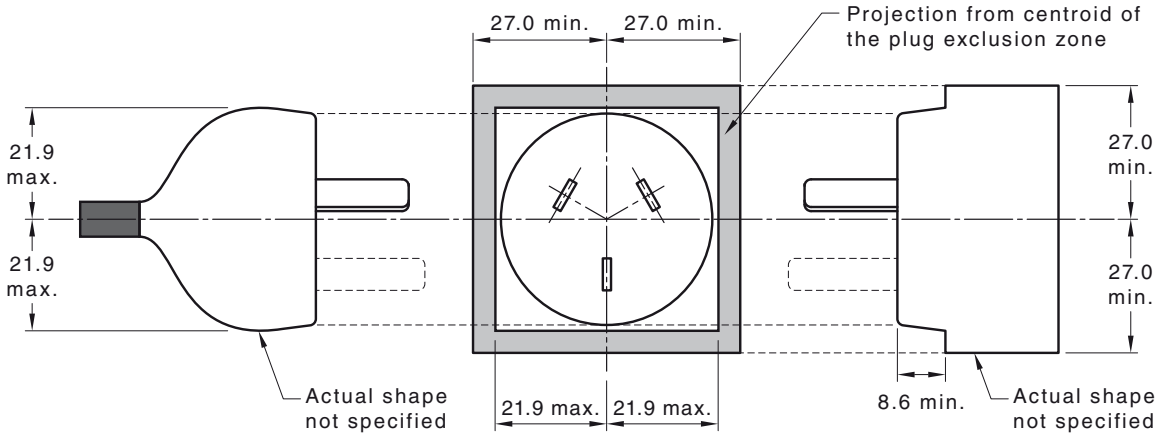
(d1) Side-entry plugs with a maximum projection of 21.9 mm (see Clause 2.5.2)



*This dimension may be reduced to ≤21.9mm provided that the angle of entry of the flexible cord is such that two side entry plugs of this type can be satisfactorily accommodated in both a vertical and horizontal double socket-outlet arrangement.

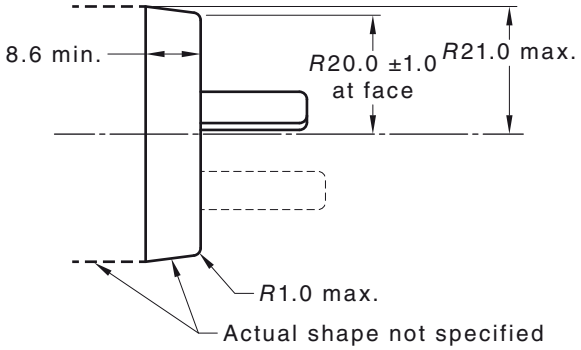
(d2) Side-entry plugs with a maximum projection greater than 27.0 mm (see Clause 2.5.2)

(d) Configuration of side-entry plugs (up to 15 A, 250 V max.) (view from rear of plug)

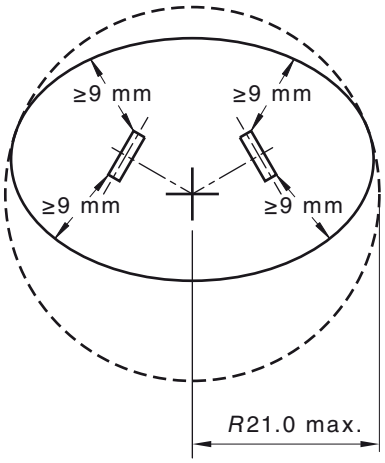


(e1) Shape of projection from faceplate centroid

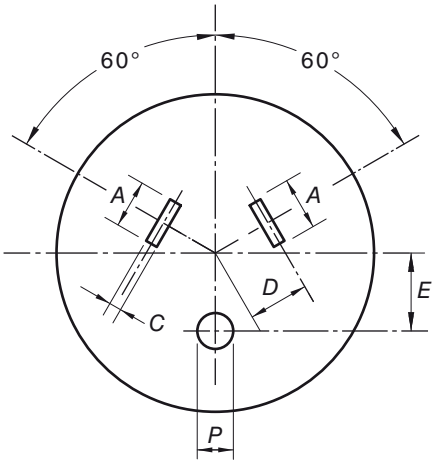
FIGURE 2.1 (in part) DIMENSIONS OF PLUGS

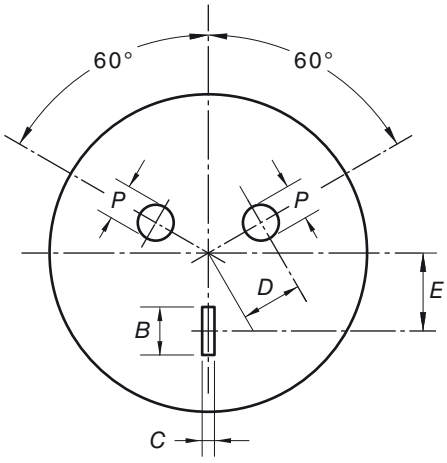


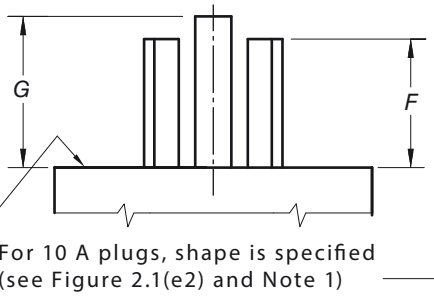
(e2) Shape of plugs having ratings up to 20 A, 250 Vmax. and of the (a1), (a2), (c), (d), (f) or (g) type.



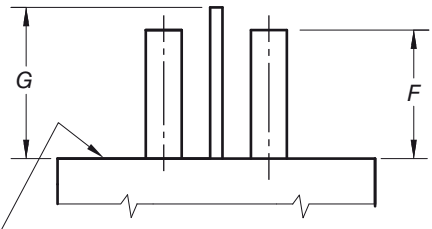
(e3) Acceptable shape of plugs with insulated pins (see Note 1)





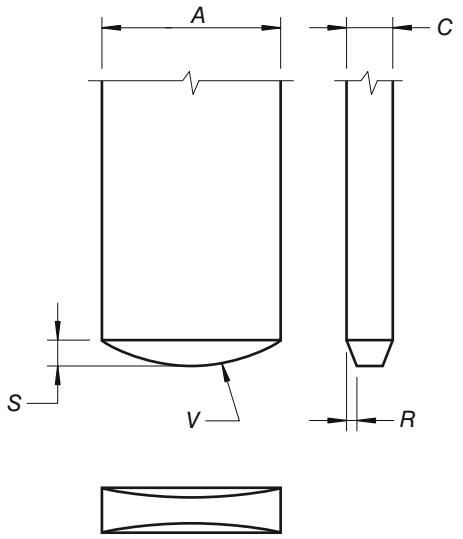


(f) Three-pin plugs (10 A, 250 V a.c. max.) (round earth pin)

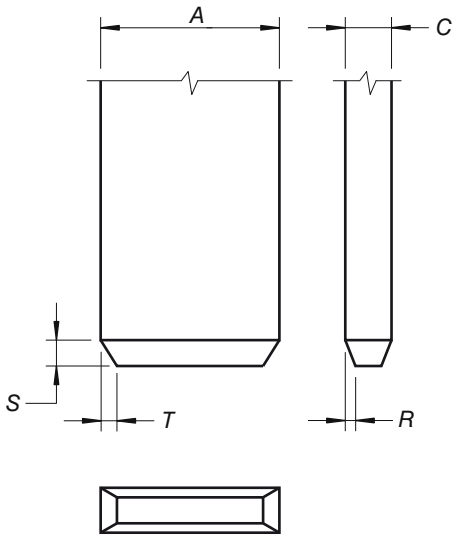


(g) Three-pin plugs (10 A, 125 V max.) (round live pins)

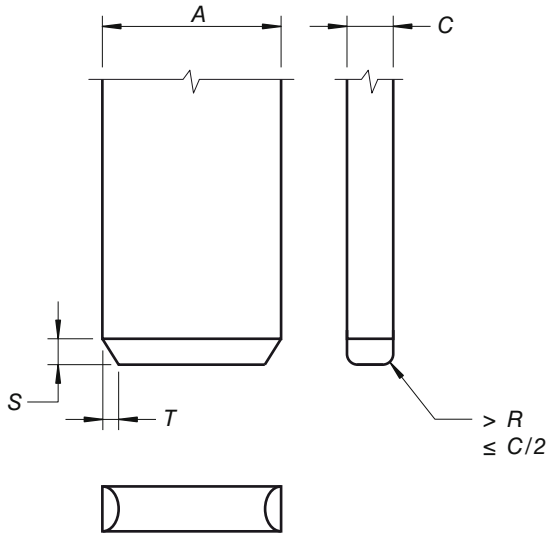
FIGURE 2.1 (in part) DIMENSIONS OF PLUGS



(h) Flat-pin with radius
on the end with side bevels



(i) Flat-pin square on the end
with corner bevels and side bevels



(j) The flat-pin square on the end
with corner bevels and radius on the sides

FIGURE 2.1 (in part) DIMENSIONS OF PLUGS

millimetres

Dimension	≤10 A	15 A	20 A	Tolerance
A	6.35	6.35	9.08§	±0.15
B	6.35	9.08	9.08	±0.15
*C**	1.63	1.63	1.63	+0.15, −0.05
D	7.92	7.92	7.92§	†
E	10.31	10.31	10.31	†
F	17.06	17.06	17.06	±0.4
G	19.94	19.94	19.94	±0.8
N	—	—	3.18	†
P	4.75	—	—	±0.05
R	0.35	0.35	0.35	±0.05
S	0.90	0.90	0.90	±0.10
T	≥0.60	≥0.60	≥0.60	—
V	6	6/11‡	11	†

millimetres

Dimension	≤10 A	Tolerance
H	6.35	±0.15
*L**	1.63	±0.15
J	6.35	†
K	17.06	±0.4
M	12.70	†

* Dimensions *C* and *L* apply to all pins.

† Dimensions without tolerances are nominal. Samples are to be checked with the gauge specified in Appendix A, Appendix B or Appendix F, as appropriate.

‡ All live pins rated 15 A = 6 mm.

Earth pins of 15 A plug = 11 mm.

§ Spacing from centre and angular orientation of pin does not relate to the centroid of the pin.

NOTES TO FIGURE 2.1:

1 Plugs with insulated pins, complying with this Standard, need not comply with dimension R20±1.0 mm of Figure 2.1(e2) and provided there is at least 9 mm from the edge of the live pins to the edge of the plug face, then other plug shapes are acceptable [e.g. oval 2-pin, triangular 3-pin, see Figure 2.1(e3)]. Other dimensions of Figure 2.1(e) are still applicable to ensure correct insertion into a recessed socket-outlet of Figure 3.5.

2 The pin ends are shown as squared off for illustrative purposes only.

3 Attention is drawn to the requirements of Clause 3.6.2 and Notes 1 and 2 of Clause 3.6.3.

FIGURE 2.1 (in part) DIMENSIONS OF PLUGS

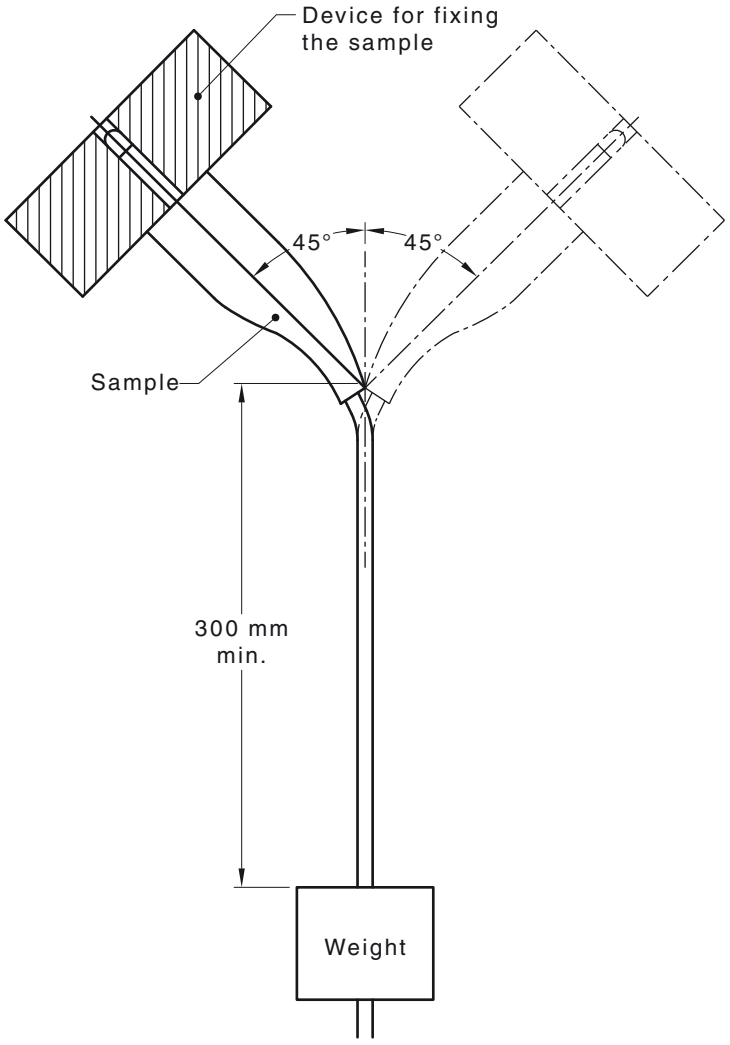
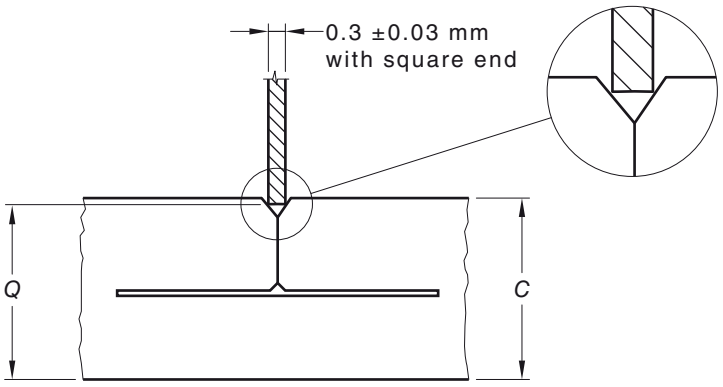


FIGURE 2.2 APPARATUS FOR FLEXING TEST



LEGEND:
For *C* refer to the table and the Notes to Figure 2.1.
Q = 1.58 mm min.

FIGURE 2.3 SECTIONED VIEW OF FOLDED PIN FORM

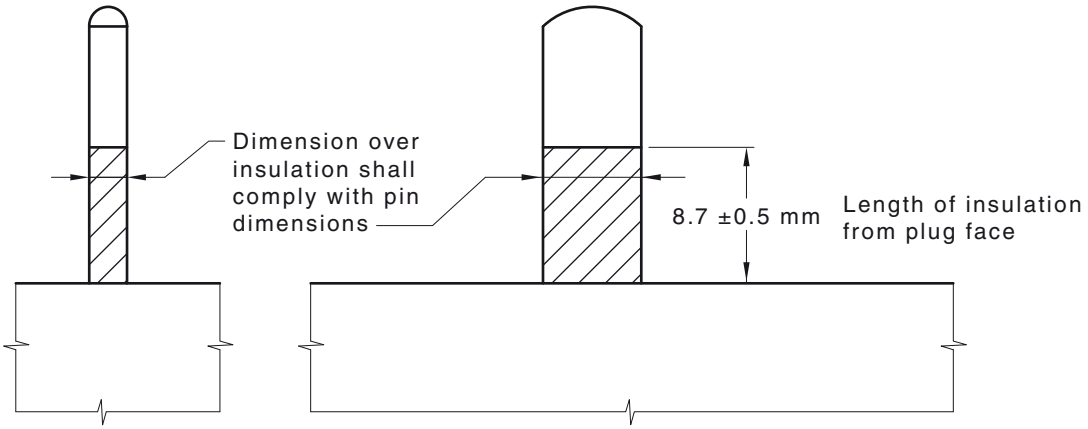


FIGURE 2.4 DIMENSIONS OF INSULATION ON INSULATED LIVE PINS

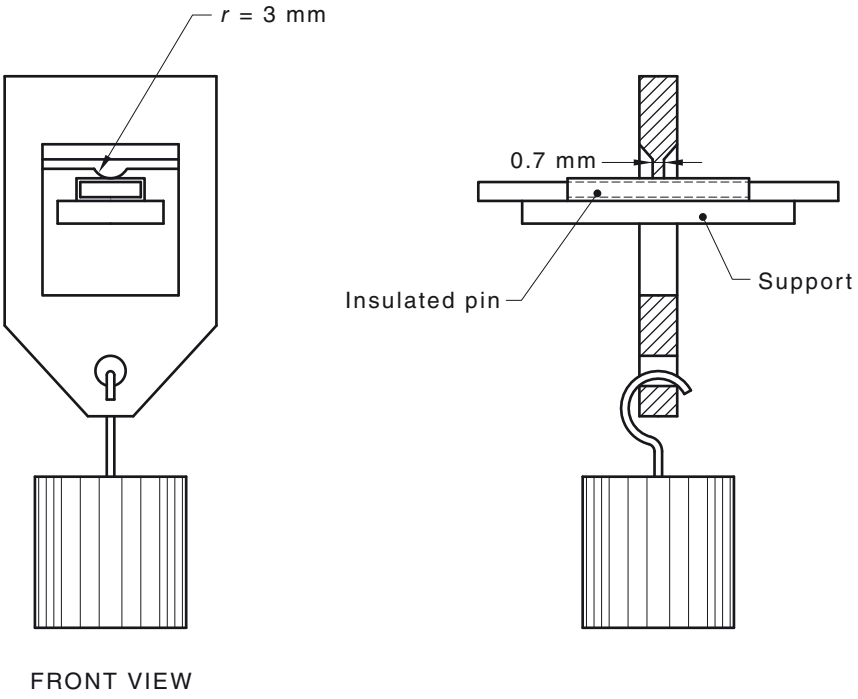
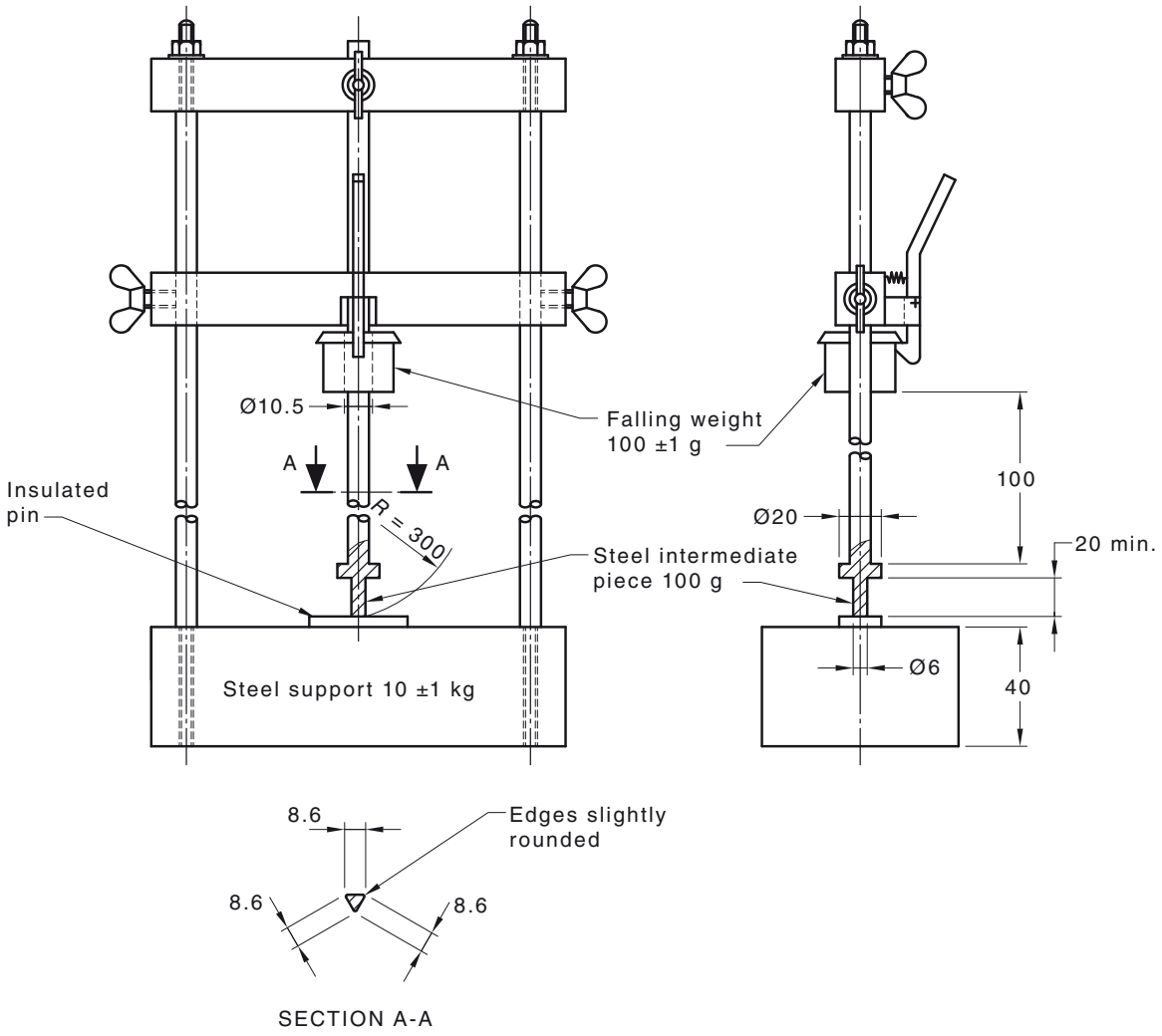
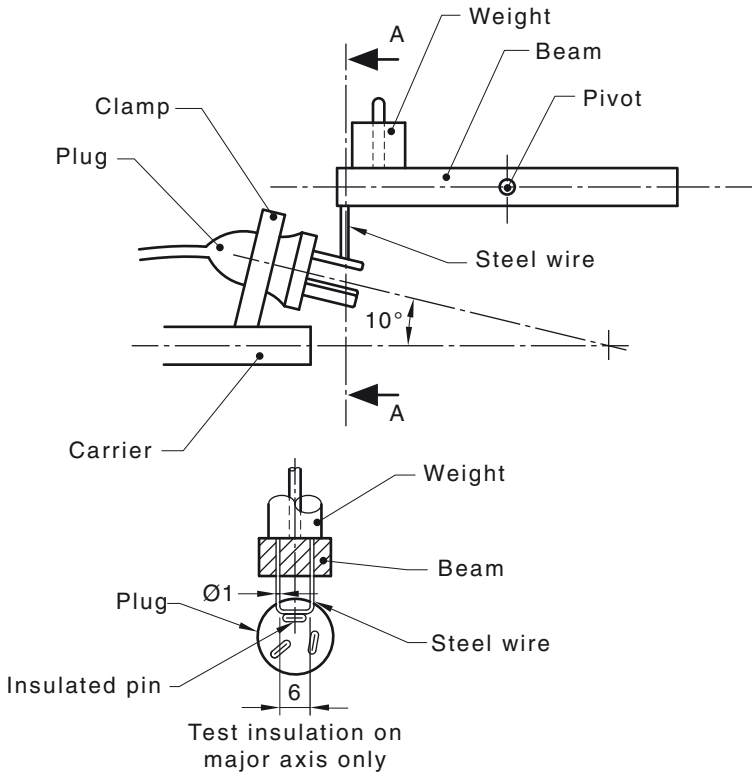


FIGURE 2.5 PRESSURE TEST APPARATUS FOR INSULATION
ON INSULATED PLUG PINS AT HIGH TEMPERATURE



DIMENSIONS IN MILLIMETRES

FIGURE 2.6 IMPACT TEST APPARATUS FOR INSULATION ON INSULATED PLUG PINS AT LOW TEMPERATURE



Enlarged part of section A-A showing steel wire

FIGURE 2.7 ABRASION TEST APPARATUS FOR INSULATION ON INSULATED PIN PLUGS

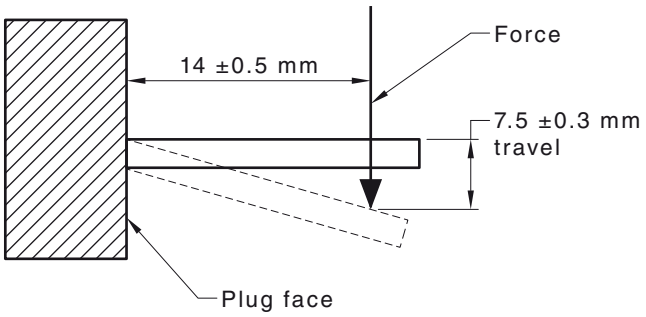
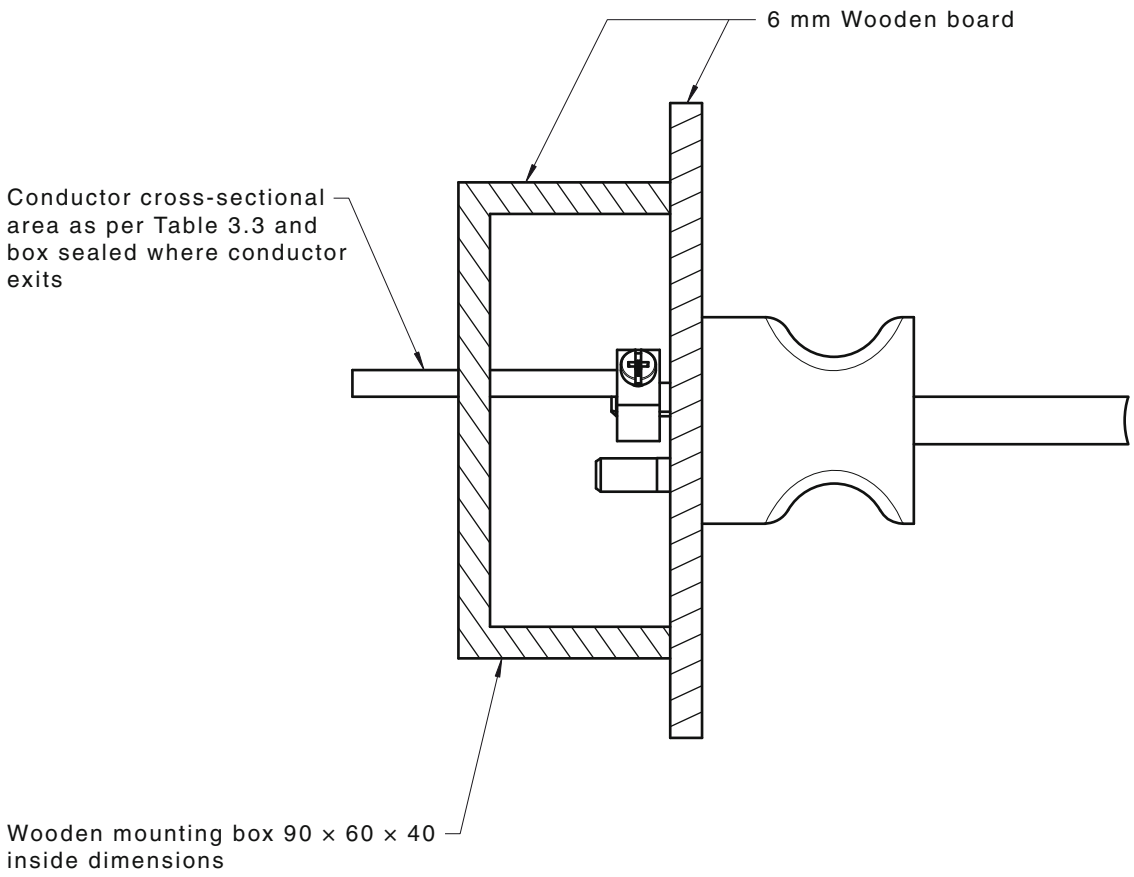
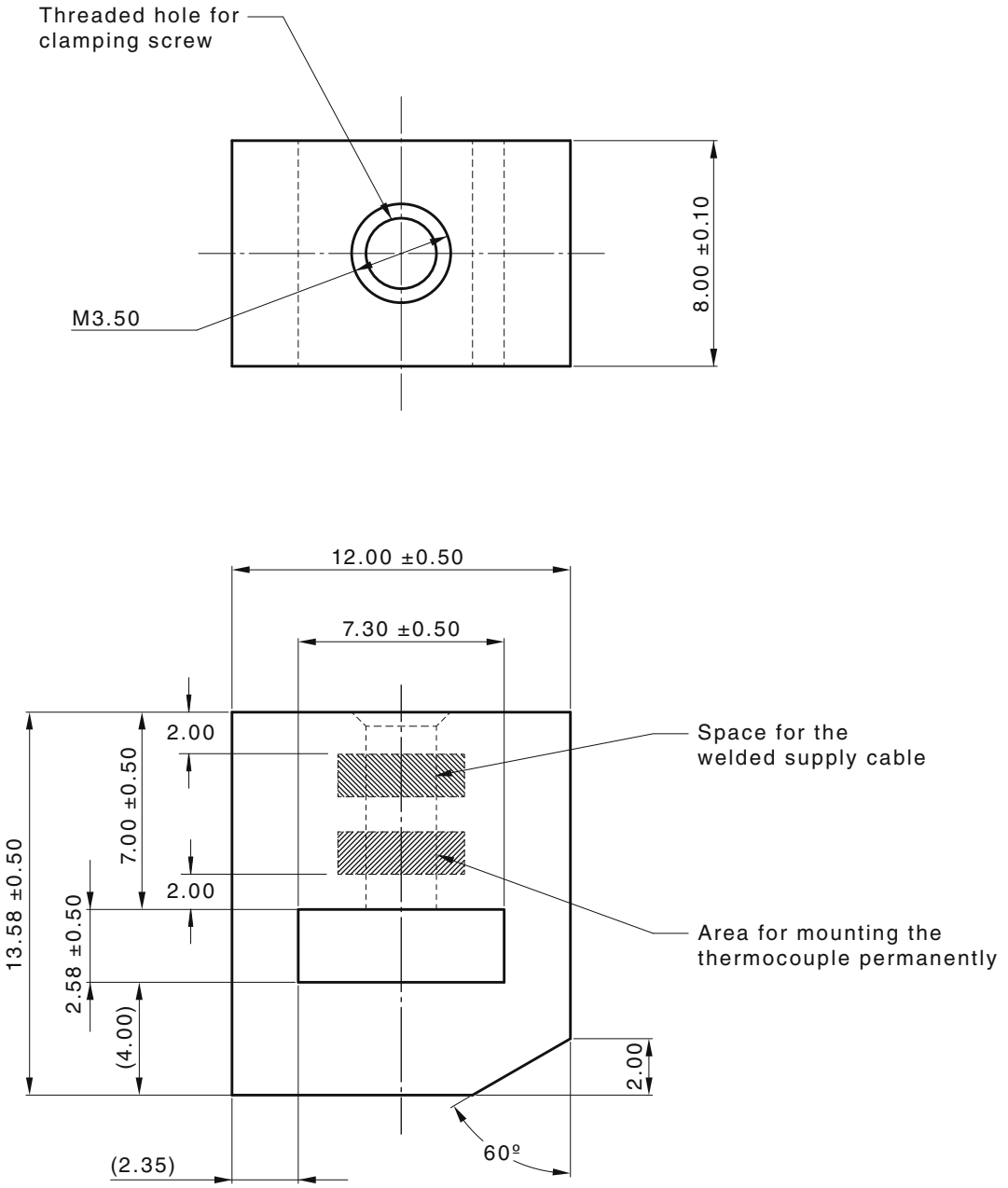


FIGURE 2.8 APPLICATION OF FORCE FOR PIN BENDING TEST



DIMENSIONS IN MILLIMETRES

FIGURE 2.9 MOUNTING OF PLUG FOR TEMPERATURE RISE TEST

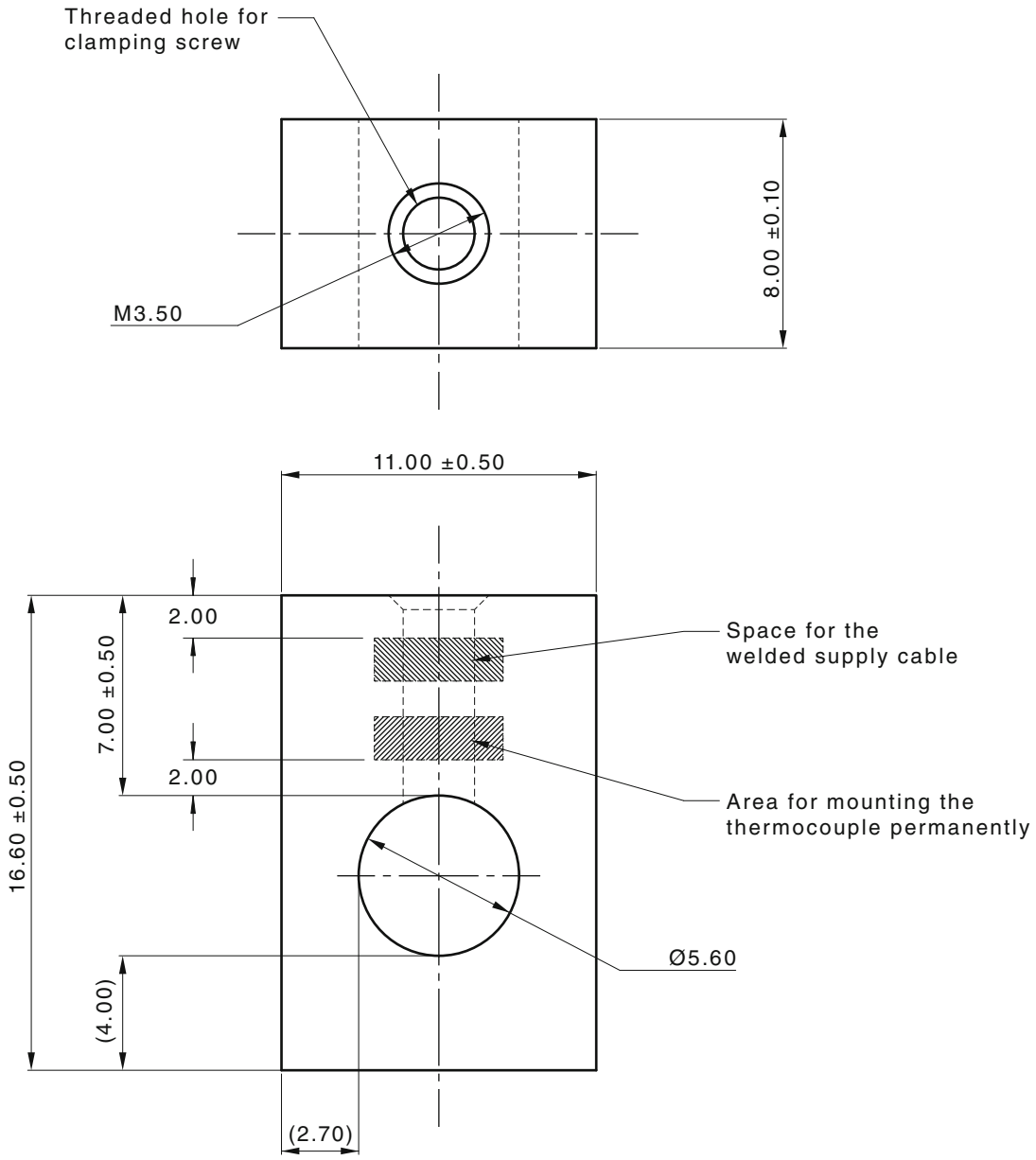


Material of clamping unit and clamping screw: brass with at least 52% copper
Length of clamping screw: 12 mm max.

(a) 10 A and 15 A flat pin

DIMENSIONS IN MILLIMETRES

FIGURE 2.10 (in part) PIN CLAMPING UNIT FOR THE TEMPERATURE RISE TEST

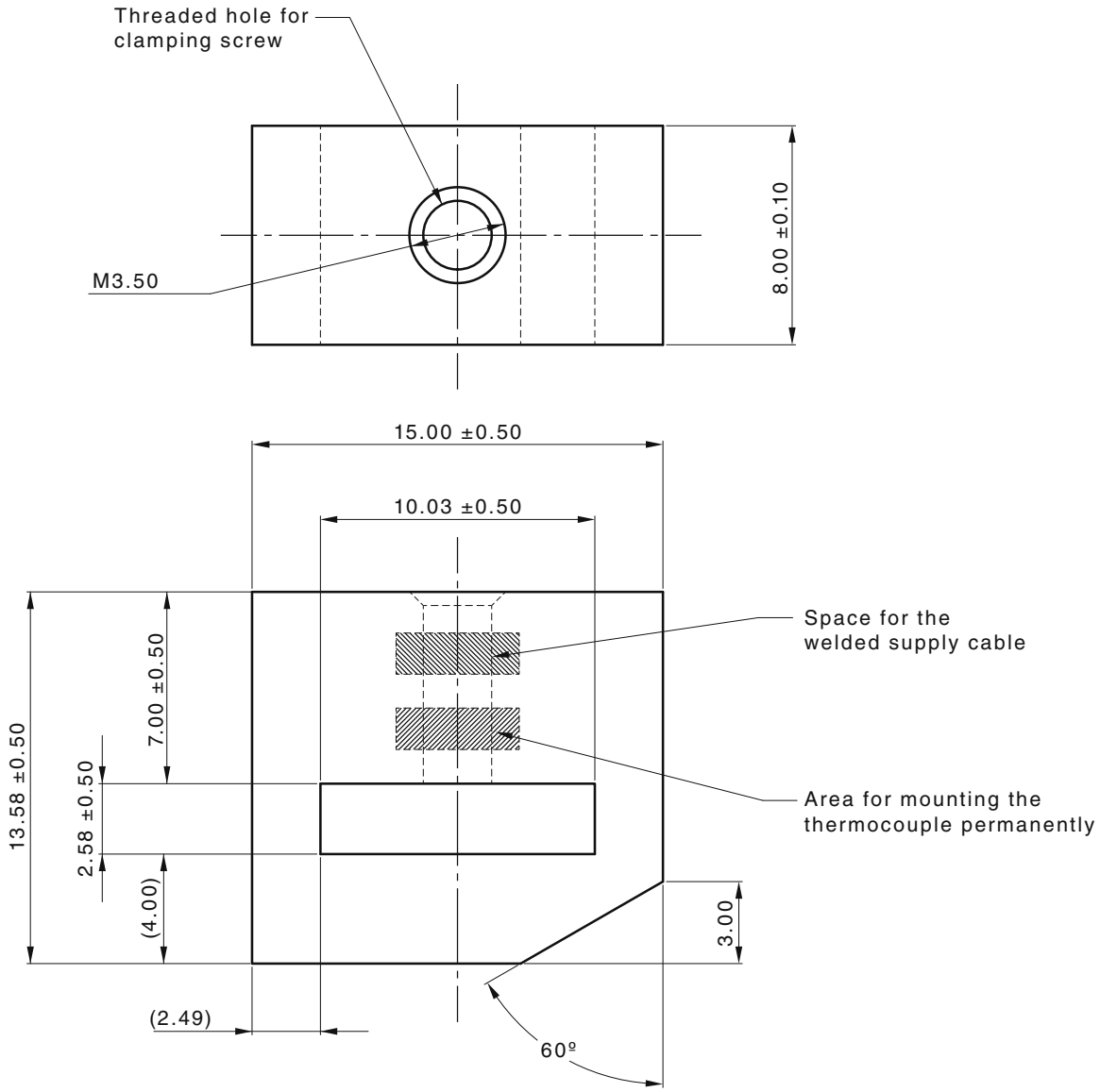


Material of clamping unit and clamping screw: brass with at least 52% copper
Length of clamping screw: 12 mm max.

(b) 10 A round pin

DIMENSIONS IN MILLIMETRES

FIGURE 2.10 (in part) PIN CLAMPING UNIT FOR THE TEMPERATURE RISE TEST

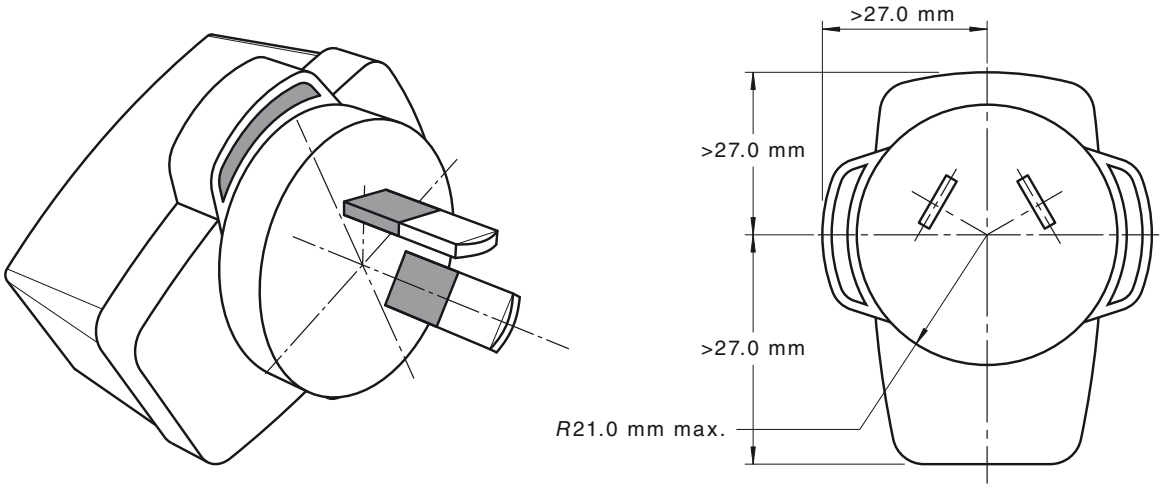


Material of clamping unit and clamping screw: brass with at least 52% copper
Length of clamping screw: 12 mm max.

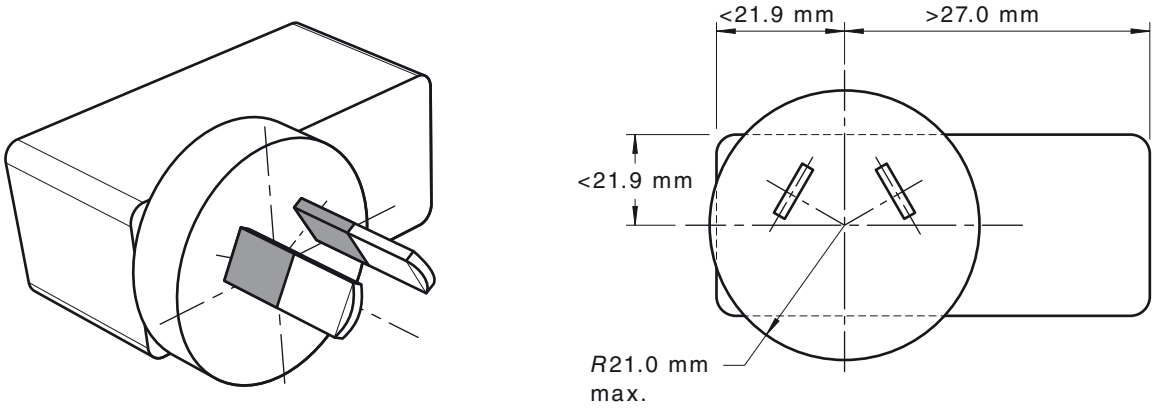
(c) 20 A flat pin

DIMENSIONS IN MILLIMETRES

FIGURE 2.10 (in part) PIN CLAMPING UNIT FOR THE TEMPERATURE RISE TEST

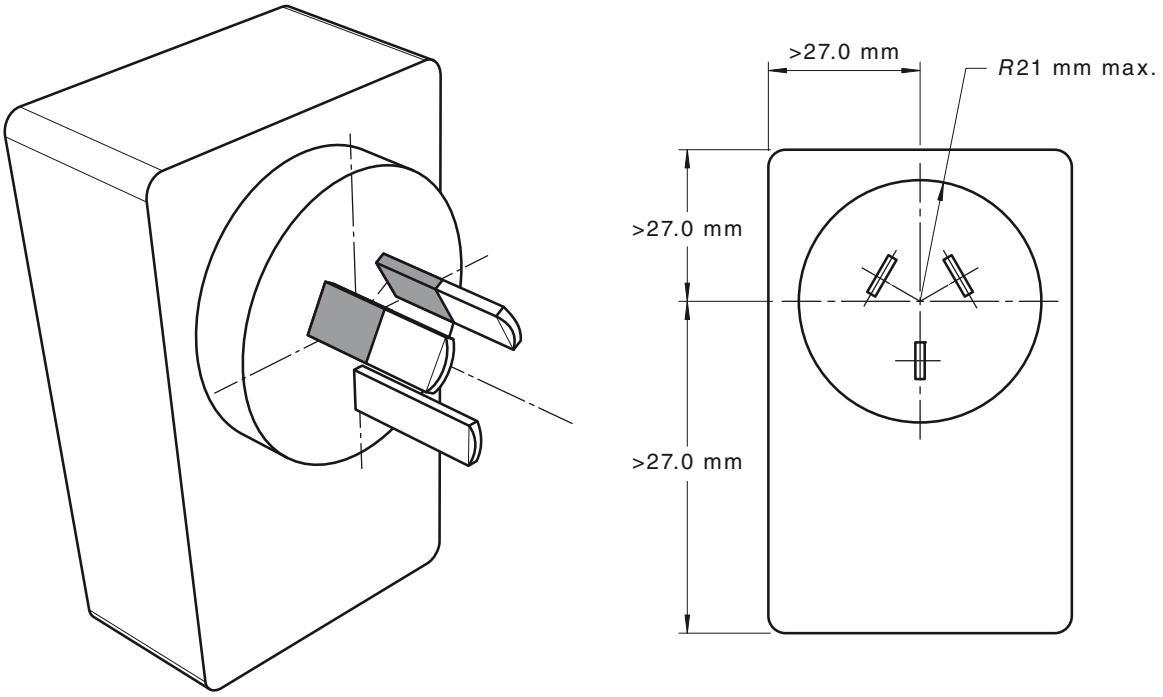


(a)

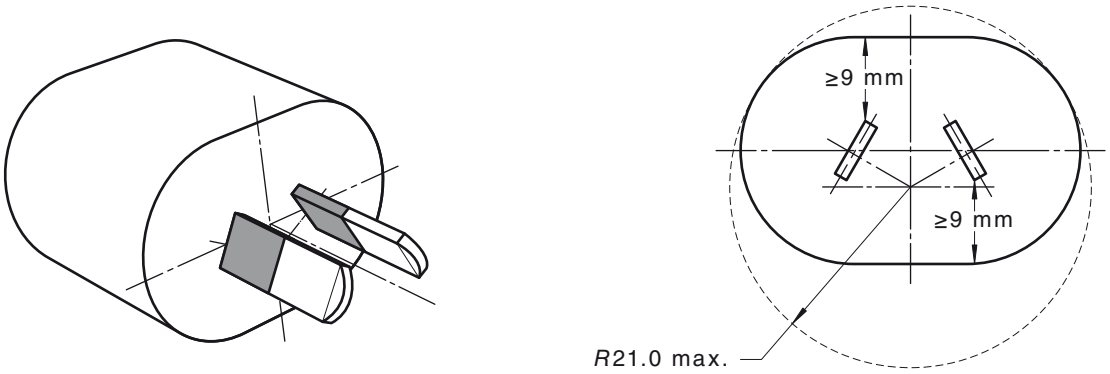


(b)

FIGURE 2.11 (in part) EXAMPLES OF VARIOUS EQUIPMENT WITH THE LESS THAN 21.9 mm AND GREATER THAN 27 mm DIMENSIONS



(c)



(d)

FIGURE 2.11 (in part) EXAMPLES OF VARIOUS EQUIPMENT WITH THE LESS THAN 21.9 mm AND GREATER THAN 27 mm DIMENSIONS

SECTION 3 SOCKET-OUTLETS

3.1 TERMINALS AND INTERNAL CONNECTIONS

3.1.1 Material

Terminals and internal connections intended primarily for carrying current shall be of a suitable corrosion resisting metal with sufficient hardness and rigidity for the intended application.

3.1.2 Construction of terminals

The terminals of socket-outlets shall be recessed into the body of the socket-outlet to prevent accidental contact with bare earthing conductors or with other exposed metal.

Except in socket-outlets rated at 15 A or more, the live terminals of a socket-outlet shall be of suitable size and form to accommodate at least two conductors (for looping in) of a size corresponding to the rating of the socket-outlet.

For all socket-outlets, earthing terminals shall be of suitable size and form to accommodate at least two earthing conductors of a size relative to the rating of the socket-outlets.

NOTE: Attention is drawn to AS/NZS 3000 regarding the minimum size of conductors permitted for wiring general purpose outlets.

New DOA 24/02/ 2019

Insulation piercing terminals or connecting devices shall conform to the relevant requirements of AS/NZS IEC 60998.2.3.

Any insulating cover retaining insulating piercing terminals or connecting devices shall be fixed in a reliable manner and withstand the mechanical stress occurring during normal use.

Conformance with the above paragraph is confirmed by Appendix K.

3.2 PROHIBITED ARRANGEMENTS

A low voltage fixed socket-outlet, or its faceplate, shall not incorporate a connecting device for telecommunications wiring, television or radio aerial wiring or other similar wiring systems.

This does not preclude the use of integral SELV outputs compliant with the relevant safety standard when assembled in the socket-outlet and AS/NZS 3100 Clause 4.1.2, Segregation of internal wiring.

3.3 SOCKET-OUTLET CONTACTS

3.3.1 Material

Contacts shall be of a corrosion resisting metal with sufficient rigidity and durability for the intended application.

3.3.2 Construction

Contacts shall be such that they make and maintain, under normal service conditions, satisfactory electrical and mechanical contact with the pins of the appropriate type of plug. For socket-outlets intended to accommodate plugs with flat pins, contact shall be made with both sides of each pin, except that it shall be permissible to use spring-assisted single-sided contacts. These contacts shall not rely exclusively on the resilience of the contact material and shall have an opposite face of material other than thermoplastic or resilient insulating material.

The alignment and contact making properties of contacts shall be independent of terminal screws.

The effectiveness of the contacts shall be independent of pressure from any thermoplastic or resilient moulding.

A visual inspection is conducted to determine the existence of interference between the metal contacts and the thermoplastic or resilient moulding to provide supplementary contact pressure to the metal contacts. The contacts independence shall be established in accordance with the requirements of Clause 3.14.8.1.

3.3.3 Entry or withdrawal of plug pins into a socket-outlet

Within the socket-outlet, there shall be provision for effective guidance of the corresponding plug pins to ensure direct entry and withdrawal without critical distortion of the socket-outlet contacts.

Conformance is checked by visual inspection and, if necessary, by a manual or electrical test.

3.3.4 Depth of contact

3.3.4.1 *Depth of contact for socket apertures for flat pins*

For socket-outlets with apertures intended to accommodate plugs having flat pins, the following tests shall be performed.

When the test gauge of Figure 3.1(a) or Figure 3.1(b), as appropriate, is inserted into the socket-outlet live contact apertures in any possible manner, without undue force, contact with live parts shall not be possible.

When the metal test gauge of Figure 3.1(d) or Figure 3.1(e), as appropriate, is inserted, perpendicular to the socket-outlet face, into each and every aperture for flat pins, contact shall be made before the gauge is fully inserted.

In addition, the three-pin plug of Figure C1 of Appendix C or of Figure G1 of Appendix G, as appropriate, shall be capable of being fully inserted into a socket-outlet.

3.3.4.2 *Depth of contact for socket apertures for round pins*

For socket-outlets with apertures intended to accommodate plugs and having round pins conforming to the dimensional requirements of Figure 2.1, the following tests shall be performed.

When the test gauge of Figure 3.1(c) is inserted into the socket-outlet live contact apertures in any possible manner, without undue force, contact with live parts shall not be possible.

When the metal test gauge of Figure 3.1(f) is inserted, perpendicular to the socket-outlet face, into each and every round contact aperture, contact shall be made before the gauge is fully inserted.

In addition, one of the three-pin test plugs shown in Figure G1 of Appendix G shall be capable of being fully inserted into a socket-outlet.

3.4 SOCKET-OUTLET CONSTRUCTION

3.4.1 Insulating materials

The insulating portions of socket-outlets shall consist of either—

(a) a material having properties not inferior to those of Class 100 mouldings complying with AS/NZS 3121; or

(b) ceramic material of a type that, after immersion in water for 48 h and after all visible drops of water have been removed from the surface using a clean dry cloth, it shall not have increased in mass by more than 2%.

All insulating materials, except ceramics, shall further comply with the requirements of Clause 3.14.11. Thermoplastic escutcheon plates and faceplates associated with socket outlets, which in normal service have any part positioned within 50 mm of live parts, shall be regarded as insulating materials for the purpose of this Clause. However, this requirement is not applicable to decorative covers not required for the safe operation or installation of socket-outlets.

3.4.2 Faceplates

Faceplates of socket outlets (see Figure 3.8), with or without aperture panels, shall be assembled such that they function reliably and withstand the mechanical stress occurring during normal use. Faceplates without aperture panels that are assembled without the use of screws or rivets shall not be able to be inadvertently removed from socket outlets.

Aperture panels shall not be able to be inadvertently removed from socket outlets. The aperture panels shall be fixed in a reliable manner and withstand the mechanical stress occurring during normal use.

Aperture panels shall provide insulation from live socket-outlet contacts. The panels may provide support for shutters.

Aperture panels shall not be able to be removed—

(a) without the use of a tool;

(b) inadvertently with a plug inserted; and

(c) through the action of inserting and withdrawing the plug into the socket face apertures.

Aperture panels fixed with moulded clips or interfaces shall not be held in position by the mounting screws holding the socket outlet assembly to the mounting surface.

Conformance is checked by inspection, and where required, the test of Clause 3.14.12.

3.5 COMPONENTS

3.5.1 Capacitors

Where a capacitor is incorporated in a socket-outlet for the suppression of radio or television interference, the capacitor shall comply with AS/NZS 3100.

3.5.2 Fuses

A fuse intended to provide over-current protection shall not be incorporated in a socket outlet.

3.6 DIMENSIONS

3.6.1 Pin entry apertures for plugs

Pin entry apertures in socket-outlets shall not exceed the dimensions specified in Table 3.1. These dimensions shall be checked by measurement.

The distance from the edge of the live pin aperture—

(a) to the extremity of the socket-outlet face or faceplate profile, in Figure 3.2, shall be not less than 11.7 mm, except for 20 A rated socket-outlets, which shall be not less than 10.7 mm; or

NOTE: Within the 10.7 mm and 11.7 mm distance, any radius or shaping of the edges of the faceplate or socket-outlet face needs to be contained within a radius of 2 mm.

(b) to the extremity of the socket-outlet shall not be less than 13.7 mm, and the shaping of the socket-outlet face profile of Figure 3.3, within the 13.7 mm distance specified, shall not be greater than 3 mm below the plane of the surface surrounding the pin apertures; and

(c) to the nearest point of any metal faceplate shall be not less than 3 mm.

NOTE: Items (a) and (b) need not apply to fully recessed socket-outlets.

TABLE 3.1

MAXIMUM DIMENSIONS OF PIN ENTRY APERTURES

1	2	3	4	5	6
Socket-outlet rating A	Dimensions, mm				
	Flat live pin aperture		Flat earthing pin aperture		Round pin aperture
	Major axis	Minor axis	Major axis	Minor axis	
10	7.3	2.3	7.0	2.1	5.25
15	7.3	2.3	9.7	2.1	—
20	10.1	2.3	9.7	2.1	—

NOTE: Consideration has been given to the inclusion of a minimum dimension for the length of guide path for pin entry apertures, but this has not proved possible because of the limitations imposed by various designs of socket-outlets. However, it is recommended that manufacturers should design the pin entry apertures to provide the maximum possible length of guide path in order to assist in the prevention of contact distortion due to angular entry of plug pins.

3.6.2 Spacing of socket-outlets

Where there is more than one socket-outlet, the centre-to-centre distance between adjacent socket-outlets shall be greater than 44 mm.

3.6.3 Socket-outlet faceplate

No part of the device, including any switch in any position, shall project more than 8.6 mm from the surface of the socket-outlet face within the shaded area of Figure 3.4. This requirement applies to all socket-outlets except those with special design features, such as providing protection from dust, weather or mechanical damage.

There shall be no projections or protrusions greater than 0.5 mm in the area defined by R21.6 in Figure 3.4.

In case of doubt, to verify projections on the socket face do not interfere when a plug or plug in device is inserted, insert the gauge of Appendix D modified as follows: the dimension of the diameter 38 mm is changed to 43.2 mm. This diameter becomes a raised boss of 8.6 mm to stimulate a plug/plug in device. When inserted the modified gauge shall not interfere with any part of the device or switch.

NOTES:

1 This requirement allows for full insertion of a plug or plug-in device of the size indicated in Figure 2.1 and also prevents inadvertent or partial operation of any switch during insertion.

2 This requirement does not necessarily permit manual operation of any switch with the plug or plug-in device inserted.

3 Examples of projections and protrusions are moulding irregularities and marking.

3.6.4 Fully recessed socket-outlets

Where the face of a 10 A, 15 A or 20 A socket-outlet for use with plugs complying with Figure 2.1(e) is fully recessed, the socket-outlet shall comply with Figure 3.5. Removable portions and breaks in the sidewall of the recess are not permitted. The socket-outlet face and recess sidewall shall form part of the fixed portion of the socket-outlet.

NOTE: This Clause only applies to socket-outlets that are claimed to be fully recessed socket-outlets.

3.6.5 Socket, IP-rated, with threaded retaining device

Where an IP-rated socket-outlet has an external thread, the dimensions of the thread shall comply with Figure H1(b) of Appendix H. The pitch circular dimension (PC) on the socket shall be as shown in Figure H1(b) of Appendix H.

3.7 ARRANGEMENT OF EARTHING CONNECTIONS

Where socket-outlets are provided with earthing connections, the design and construction shall be such that during normal insertion of the appropriate plug (see Clause 3.8.1), the earthing connection is made before the connection of the live pins and, during normal withdrawal, the earthing connection is broken after disconnection of the live pins.

The earthing pin aperture and contact of any low voltage socket-outlet, which is intended to accommodate a three-pin, flat pin plug, shall be that aperture and contact that is radial to the circle embracing the pins [see Figure 2.1(a)].

3.8 PREVENTION OF CONTACT WITH LIVE PINS

NOTE: Fully recessed socket-outlets that comply with Clause 3.6.4 are deemed to comply with Clauses 3.8.1 and 3.8.2.

3.8.1 During normal insertion

At any stage during normal insertion of a non-insulated pin plug into a socket-outlet, with the faces of the plug and socket-outlet in parallel planes, it shall not be possible to touch, with the standard test finger (see AS/NZS 3100), a pin that may become alive.

Socket-outlets, for use with two-pin flat-in plugs of the type shown in Figure 2.1(b), shall be checked for conformance with this requirement by means of an appropriate test plug having the minimum diameter of face and maximum length of live pins shown in Figure 2(b).

Socket-outlets for use with three-pin flat pin plugs of the type shown in Figure 2.1(a) and Figure 2.1(d), and two-pin flat pin plugs of the type shown in Figure 2.1(c) and Figure 2.1(d), shall be checked for conformance with this requirement by means of an appropriate test plug having the dimensions shown in Figure C1 of Appendix C.

Socket-outlets for use with three-pin plugs of the type having two flat live pins and one round earth pin, or two round live pins and one flat earth pin, as shown in Figure 2.1(f) and Figure 2.1(g), shall be checked for conformance with this requirement by means of the appropriate test plug having the dimensions shown in Figure G1(a) or Figure G1(b) of Appendix G, respectively.

For socket-outlets with covers that are intended to be removed for interchangeability, this test shall be conducted with and without the cover in position.

3.8.2 During other than normal insertion

The design and construction of a socket-outlet shall be such that it is not possible for any pin of a plug with which the socket-outlet may appropriately be used to touch a live contact except during normal insertion, i.e. with each pin entering or adjacent to the aperture for the appropriate contact.

Socket-outlets for use with two-pin flat pin plugs of the type shown in Figure 2.1(b) shall be checked for conformance with this requirement by means of an appropriate test plug having the minimum diameter of face and maximum length of live pins shown in Figure 2.1(b).

Socket-outlets for use with three-pin flat pin plugs of the type shown in Figure 2.1(a) and Figure 2.1(d), and two-pin flat pin plugs of the type shown in Figure 2.1(c) and Figure 2.1(d), shall be checked for conformance with this requirement by means of an appropriate test plug having the dimensions shown in Appendix D.

NOTE: This provision is intended to prevent the insertion of one pin of a plug while the other pin or pins are overhanging the socket-outlet, and to prevent the insertion of an earthing pin in a live contact.

For socket-outlets with covers that are intended to be removed for interchangeability, this test shall be conducted with and without the cover in position.

3.8.3 Alignment of faceplates

The socket-outlet shall incorporate positive means to preclude incorrect assembly and to ensure that the plug pin apertures in the socket-outlet faceplate will always be aligned with the appropriate contacts of the socket-outlet.

3.9 SOCKET-OUTLETS FOR BENCH INSTALLATION

3.9.1 General

Socket-outlets intended for permanent installation in, on or under a benchtop, shall be arranged so that dust and water will be prevented from accumulating in the socket-outlet.

Conformance shall be checked by inspection.

3.9.2 Socket-outlets with a supply flexible cord

Socket-outlets with a supply flexible cord, intended for permanent installation in a benchtop, shall comply with the relevant requirements of AS/NZS 3105 notwithstanding the scope.

NOTE: An example of this installation is the surface of a kitchen bench.

3.10 FLOOR SOCKET-OUTLETS

3.10.1 Socket-outlet assemblies mounted in a floor

Socket-outlet assemblies intended to be mounted in a floor shall be fitted with a strong hinged or sliding cover of a material that is capable of withstanding rough usage and covering the opening in the floor.

The socket-outlet assembly shall be arranged so that dust and water will be prevented from accumulating in the socket-outlet.

Conformance shall be checked by inspection.

3.10.2 Integral floor socket-outlets

An integral floor socket-outlet contains all the respective components in one assembly, such as the base assembly, the socket-outlet faceplate and the cover.

The cover shall automatically close over the socket-outlet when the plug is withdrawn or alternatively if the cover is not automatically closing the socket-outlet shall have shuttered outlets.

Conformance shall be checked by inspection.

3.10.3 Floor box or enclosure containing socket-outlet assemblies

Socket-outlet assemblies complying with the requirements of this Standard, installed in a floor box or enclosure complying with AS/NZS IEC 60670.23 do not require enhanced protection.

3.11 SWITCHED SOCKET-OUTLETS

3.11.1 Socket-outlets switched by insertion of plug pins

Socket-outlets switched by insertion of plug pins shall be arranged and constructed so that—

(a) the insertion of a plug into a socket-outlet shall cause the circuit to be made automatically (by means of a spring control or switch in the active conductor) after the engagement of the pins of the plug with the contacts of the socket-outlet;

(b) the removal of a plug from a socket-outlet shall cause the circuit to be broken automatically (by means of a spring control or switch in the active conductor) prior to disengagement of the pins of the plug with the contacts of the socket-outlet;

(c) any arc formed during the process of making or breaking the contacts shall be confined in such a way as to eliminate the risk of fire or shock; and

(d) the contacts shall not be subject to damage from repeated use.

In addition to complying with this Standard, the switching function of socket-outlets switched by insertion of plug pins and intended for use with a plug complying with Figure 2.1(a) and Figure 2.1(c) shall comply with the requirements of Clause 3.11.2 except that the ‘ON’ position need not be indicated. Where two or more functions affect each other (such as the contact, switch and terminals of a socket-outlet arrangement switched by insertion of plug pins), the temperature rise applicable to each part shall not be exceeded.

NOTE: Should wearing of the pins of the test plug occur during this test, another test plug(s) may be used.

3.11.2 Socket-outlet switches

Any switch intended for the control of a low voltage socket-outlet to be used with a plug complying with Figure 2.1(a) and Figure 2.1(c) shall comply with Clause 3.14.9 switch tests.

All switches provided shall be Category 2 switches and the visual indication of the switch shall be as per marking requirements of Clause 3.13.1(g).

3.12 SHUTTERED SOCKET-OUTLETS

If a socket-outlet contains shutters, the shutters shall be activated either by—

(a) the neutral pin alone; or

(b) the neutral and active pins operating together; or

(c) the neutral and earth pins.

The shutter shall not be activated by the active pin alone.

Conformance is checked by inspection and manual test, if necessary.

3.13 MARKING

3.13.1 Required marking

Every socket-outlet shall be marked with the following information, in accordance with AS/NZS 3100:

(a) The name, trade name or mark of the manufacturer or supplier.

(b) The current rating in amperes.

(c) The voltage.

(d) If limited by any component to use on alternating current or direct current, the socket-outlet shall be marked ‘a.c.’ or ‘d.c.’ respectively.

(e) If not the only type of socket-outlet marketed by the manufacturer or supplier, the socket-outlet shall also be marked with a catalogue number, type number or name, or other marking that shall distinguish it from any other type of socket-outlet marketed by the manufacturer or supplier.

NOTE: Sockets of the same basic design incorporating identical components but with variations of socket arrangements, such as 10 A, 15 A or round earth pin, may have a common type marking.

(f) Designation of degree of protection (if greater than IP2X).

(g) Switches controlling low voltage socket outlets

For any switch intended for the control of a low voltage socket outlet, not switched by insertion of plug pins, their ‘ON’ position shall be indicated in accordance with the requirements of AS/NZS 3100 for the visual indication of the positions of switches.

NOTE: The use of Red or Orange to indicate ‘ON’ position are the preferred colours.

3.13.2 Location of marking

The marking required by Items (a) to (f) of Clause 3.13.1 shall be located as follows:

(a) Item (d)—on any visible position of the socket-outlet or its cover.

(b) Item (a)—on any visible position of the socket-outlet or its cover, when installed.

Where the cover can be removed without the use of a tool, Item (a) shall be visible when installed and the cover is removed.

(c) Items (b), (c) and (f)—so that it is visible when the accessory is fixed in position and all covers are in place except that for socket-outlets intended to accommodate plugs with the dimensions specified in Figure 2.1, such markings may be inside the cover if the cover can be detached and replaced without removal of the socket-outlet when it is mounted in position. If insulating caps, plugs or the like are field fitted over screw heads for socket-outlets to pass any tests, such information shall be stated in manufacturer’s instructions.

If an insulating shroud is required to pass the ‘Insulation resistance test No. 1’ or ‘High voltage test’ of Table 3.2, such information shall be stated in manufacturer’s instructions.

(d) Item (e)—on the socket-outlet or on a securely attached label, or on the container in which the socket-outlet is marketed.

3.13.3 Earthing connections

Where a socket-outlet incorporates a contact intended to provide an earthing facility, its terminal shall be distinguished by marking, in accordance with the requirements of AS/NZS 3100, for the marking of earth connections located either on, or adjacent to, the earthing terminal.

3.13.4 Live connections

The live connections of socket-outlets designed to accept plugs that conform to Figure 2.1(a), Figure 2.1(c) and Figure 2.1(d) shall be marked either on or adjacent to the terminals, and shall comply with the requirements of AS/NZS 3100 for the marking of live supply connections, except that the active terminal of socket-outlets intended for use with flat-pin plugs shall be indicated by the letter 'A', 'L' or 'P'. 'L' is the preferred letter.

The marking shall correspond to the socket-outlet contacts being in the order of earth, active and neutral in a clockwise direction when viewed from the front of the socket-outlet.

3.13.5 Instructions

Instructions shall be provided to ensure that field-installed insulation is fitted correctly where this insulation is required for the socket to comply with the requirements for IP protection insulation resistance and high voltage tests.

3.14 TESTS FOR SOCKET-OUTLETS

3.14.1 General

Socket-outlets shall be subjected to the tests specified in Table 3.2, carried out in the stated order, and shall comply with the requirements specified for each test. Where required by these tests, the socket-outlet shall be tested in conjunction with an appropriate plug that complies with this Standard.

The general conditions described in Clause 8.1, AS/NZS 3100 shall be observed during the tests of this Standard.

Socket-outlets shall be mounted as in normal service and as follows:

(a) Flush and semi-flush socket-outlets that may be used in walls with thermal insulation shall be mounted on a vertical wooden surface, not more than 6 mm thick, with the portion designed to fit into the recess completely enclosed in absorbent cotton wool, loosely packed and held in position by an appropriate metallic (wall box) enclosure.

(b) Other socket-outlets shall be mounted in the minimum size enclosure or wall box.

NOTE: An appropriate metallic enclosure for socket-outlets on mounting plates of approximately H 114 mm × W 72 mm with 84 mm centres is one of H 90 mm × W 60 mm × D 40 mm (approximating dimensions of commonly available units).

(c) If field-installed insulation as per Clause 3.13.5 can be removed without the use of a tool, then this field-installed insulation shall be removed for all tests. Verification of insulation able to be removed without the aid of a tool shall be in accordance with the non-detachable parts test as specified in Appendix K.

(d) For socket outlets with removable covers, having demonstrated the removable cover does not provide an insulation function by complying with tests 4, 5 and 14 with the removable cover removed, the removable cover may remain fitted for the dimensional measurements.

TABLE 3.2

SOCKET-OUTLETS—TESTS TO BE APPLIED AND ORDER OF APPLICATION

1	2	3	4
Test No.	**Description of test**	**Reference for test procedure and criteria***	**Sample identification**
1	Installation verification	3.14.1(c)	A
2	General and dimension tests	3.1 to 3.13	A
3	Contact independence tests	3.14.8.1	A§
4	Insulation resistance test No. 1	3.14.2	A
5	High voltage test	3.14.3	A
6	Screw threads and fixings	AS/NZS 3100	A
7	Current breaking test	3.14.4	A, B†
8	Temperature rise test	3.14.5	A
9	Insulation resistance test No. 2	3.14.6	A
10	Test of earthing connection	3.14.7	B†
11	Test of lateral strain	3.14.8.2	C, D, E, F, G, H|
12	Withdrawal force test	3.14.8.3	C, D, E, F, G, H|
13	Switch test	3.14.9	DI
14	Determination of IP rating	3.14.10	D
15	Determination of ignitability and combustion propagation	3.14.11	Any or L‡
16	Inadvertent removal test	3.14.12	I, J, K
		Total number of samples required:	10/11†/12‡

* Clause numbers refer to this Standard.

† Two samples are required if both a.c. and d.c. ratings are required.

‡ Ignitability and combustion propagation testing may require a further sample in new and clean conditions.

§ The submitter may provide additional un-assembled contacts for the purpose of this test where required.

| Shutters, if any, shall be rendered inoperative so as not to affect the test.

3.14.2 Insulation resistance test No. 1

For the purpose of this test the socket-outlet shall be mounted to a metal plate and in appropriate metallic enclosure, using the fixing holes provided, by means of metal fixing screws corresponding in respect of their diameter and size and type of head, with the screws that would normally be used for fixing the socket-outlet.

NOTES:

1 The metal plate is to be approximately 1 mm thick and be larger than the projected area of the socket and have a cut-out as recommended by the manufacturer.

2 An appropriate metallic enclosure is described in Clause 3.14.1.

3 The most unfavourable position may be, for example, a switch closest to the enclosure on a multi-switch assembly.

4 One pole of any pilot light should be disconnected.

The socket-outlet shall be positioned in the most unfavourable position to take into account any variation in spacings due to wall thickness and any movement of the socket-outlet within its mountings.

For socket-outlets with covers that are intended to be removed (with or without the use of a tool) for interchangeability, or decoration or for ‘painting or decorating’, this test shall be conducted with and without the cover in position.

The insulation resistance of a socket-outlet shall be measured at a voltage of 500 V d.c. with the socket-outlet fitted with an appropriate plug, as follows:

(a) Between live terminals of the socket-outlet with the plug open-circuited.

(b) Between live terminals of the socket-outlet and any metal part that would be exposed when the socket-outlet is mounted in position, with the live terminals of the plug being connected together. This test shall be made with all exposed metal parts bonded together.

(c) Between live terminals of the socket-outlet and the metal plate, appropriate metallic enclosure and metal fixing screws, the live terminals of the plug being connected together.

(d) Between live terminals of the socket-outlet and the earthing terminal (if any), with the live terminals of the plug being connected together.

(e) Between live terminals of the socket-outlet and a flexible electrode applied to non-conducting parts normally accessible in service, including insulated heads of screws.

The insulation resistance measured shall be not less than 5 MΩ.

3.14.3 High voltage test

The socket-outlet shall withstand, without failure, an a.c. voltage applied between the parts set out in Items (a), (b) and (d) of Clause 3.14.2 for 1 min in each case as follows:

Item (a)—1000 V a.c.

Item (b)—1250 V a.c.

Item (d)—1000 V a.c.

NOTE: For rated voltage ≤32°V and voltage ≥250°V refer to AS/NZS 3100 for applicable high voltage test voltages.

The socket-outlet shall further withstand, without failure, a voltage of 3000 V a.c. applied between the parts set out in Items (c) and (e) of Clause 3.14.2 for 1 min in each case.

The socket-outlet shall be fitted with an appropriate plug during the test.

3.14.4 Current breaking test

With the exception of interlocked socket-outlets and socket-outlets switched by insertion of plug pins complying with Clause 3.11, socket-outlets shall be subjected to the test set out in this Clause.

Socket-outlets shall be tested using a test plug with brass pins having dimensions complying with this Standard.

The plug shall be inserted into, and withdrawn from, the socket-outlet 50 times (100 strokes) at a rate of 150 mm/s and 30 strokes per minute.

NOTE: A stroke is an insertion or a withdrawal of the plug.

The test voltage shall be 1.06 times the rated voltage and the test current shall be 1.25 times the rated current.

The test current shall be a.c. with a power factor of approximately 0.75 lagging, or d.c., as appropriate. Where a socket-outlet is intended for both a.c. and d.c. operation, a separate sample shall be tested on each source of supply.

No current shall be passed through the earthing circuit, if any such circuit exists.

The socket-outlet and plug shall be mounted so that the withdrawal movement is in an approximately horizontal direction, and the earthing pin, if any, is at the lowest point.

An appropriate type of plug, complying with this Standard and having a rating corresponding to that of the socket-outlet, shall be used for this test.

During the test, no sustained arcing shall occur.

After the test, the samples shall show no damage impairing their further use and the entry holes for the pins shall show no damage that may impair the safety of the socket-outlets.

3.14.5 Test of temperature rise

Socket-outlets shall be tested using a test plug with brass pins having the specified dimensions of Figure 2.1. The plug shall be inserted into the socket-outlet and 1.1 times rated current shall be passed until a constant temperature has been attained. The temperature shall be determined by means that have a negligible effect on the temperature being determined. For multi-outlet socket-outlet units, the test shall be conducted on one outlet of each type, the outlet(s) not under test being maintained in a no-load condition.

For the purpose of this test, the connecting cables shall be unsheathed Type V75 cables, the size of which shall be determined from Table 3.3. Plugs shall have at least 1 m of cable and socket-outlets shall have at least 2.5 m of cable. The cables shall be stripped to the minimum length required to effect the intended connection of the socket-outlet. The socket-outlet shall be mounted in an appropriate metal wall box installed in a draught-free position, and the cables supplying the socket-outlet shall be enclosed for a distance of 1 m in conduit terminated at the wall box. The terminal screws or nuts shall be tightened with a torque equal to two-thirds of that specified in the test for screw threads and fixings in AS/NZS 3100.

NOTE: An appropriate metal wall box is described in Clause 3.14.1.

The temperature rise of any terminal or contact shall not exceed 45 K.

For the purpose of this test, the ambient temperature shall be maintained at 20 ±5°C.

TABLE 3.3

SIZE OF CABLES FOR TEST OF TEMPERATURE RISE

Rated current of accessory A	Nominal cross-section area, mm^2	
	Flexible conductors for portable accessories	Rigid conductors (solid or stranded) for fixed accessories
≤10	1	1.5
>10 ≤16	1.5	2.5
>16 ≤20	2.5	2.5
>20 ≤25	4	4
>25 ≤32	6	6

3.14.6 Insulation resistance test No. 2

The insulation resistance test specified in Clause 3.14.2 shall be repeated. The insulation resistance measured shall be not less than 5 MΩ.

3.14.7 Test of earthing connection

The resistance between the earthing terminal of any socket-outlet provided with an earthing contact and the earthing terminal of the plug used for testing shall be of a low resistance. The earthing connections shall be tested in accordance with AS/NZS 3100.

3.14.8 Strength of contact tests

3.14.8.1 *Contact independence tests*

If interference exists, or if uncertain of the existence of interference between the contact and the thermoplastic or resilient moulding, the withdrawal force test is conducted on each socket contact where the assembly is modified by removing the suspected interfering material from around the contact, or an independent contact is removed from the assembly.

The withdrawal force of each socket contact shall be measured by a test pin gauge of Figure 3.10.

The withdrawal force shall be not less than 1.5 N for ratings up to and including 10 A, 2 N for ratings above 10 A up to and including 15 A and 3 N for ratings above 15 A.

NOTE: The submitter may provide additional un-assembled contacts for the purpose of this test where required.

In socket-outlets designed for use with plugs complying with Figure 2.1, the contacts shall be self-adjusting in pitch and contact making.

3.14.8.2 *Test of lateral strain*

Socket-outlets rated up to and including 10 A, and intended to be used with plugs of the Figure 2.1(a1) type or Figure 2.1(c) type, shall withstand the lateral strain imposed by equipment likely to be introduced into them.

Socket-outlets for use with plugs of the Figure 2.1(a1) type shall be tested by the application of the gauge shown in Figure 3.6 and Figure 3.7, and socket-outlets for use only with plugs of the Figure 2.1(c) type shall be tested by the application of the gauge shown in Figure 3.7 as follows:

(a) *Application of test gauges* The gauge shown in Figure 3.6 shall be applied to three socket-outlets not subjected to any previous test of this Standard. The gauge shown in Figure 3.7 shall be applied to three socket-outlets not subjected to any previous test of this Standard.

(b) *Test procedure* Each specimen shall be mounted on a vertical surface with the plane through the socket contacts horizontal. The gauge shall be then fully engaged and a weight hung on it such that the force exerted is 5 N.

The gauge shall be removed after 1 min and the socket-outlet shall be turned through 90° on the mounting surface. The test shall be made once in each of the following positions: 0°, 90°, 180° and 270°.

During the test, the gauge shall not come out.

After the tests, the socket-outlets shall show no damage within the meaning of this Standard and, in particular, socket-outlets intended for use with plugs of the type shown in Figure 2.1(a1) shall comply with the requirements of Clause 3.14.8.3.

In addition the withdrawal force of each socket contact that has been subjected to the above tests shall be measured by a test pin gauge of Figure 3.10. The withdrawal force shall be not less than 1.5 N.

Shutters, if any, shall be rendered inoperative so as not to affect the test.

3.14.8.3 *Withdrawal force test*

This test is applicable only to socket-outlets rated at up to and including 10 A, and intended for use with plugs of the type shown in Figure 2.1(a1). The test shall be applied to all the socket-outlets subjected to the test of Clause 3.14.8.2.

Plugs rated at 10 A complying with Figure 2.1(a1) which have not been subjected to any previous tests shall be used. A separate plug shall be used for testing each socket-outlet.

Manually insert the plug fully into and withdraw it from the socket-outlet 10 times.

Manually align the plug in the socket-outlet to minimize the effects of misalignment between mating components and any other friction-increasing factors, to attain the best practical position for minimum resistance to withdrawal.

NOTE: When testing in other than the horizontal plane, the mass of the plug and socket-outlet is to be considered in all measurements.

The plug is then fully reinserted and a withdrawal force gradually applied by any suitable means until the plug is fully withdrawn. The withdrawal force, during three subsequent and consecutive disengagements, shall be measured.

The withdrawal forces measured shall be between 20 N and 50 N.

3.14.9 Switch test

Where a switch is combined with a socket-outlet, separate samples shall be used for testing the switch in accordance with AS/NZS 3133. For the purpose of this test, the terminals of the switch-socket-outlet combination (as used in service) shall be used for the connection of cables and the connecting cables shall be in accordance with this Standard and the ambient temperature shall be maintained at 20 ±5°C.

The fluorescent load requirements are not applicable to an integral switch. A switch that can be removed shall comply with all the relevant requirements of AS/NZS 3133.

In addition, the switch shall pass the test for motor control switches of AS/NZS 3133, using the following test currents:

(a) For 10 A socket-outlets.....40 A.

(b) For 15 A socket-outlets.....50 A.

(c) For 20 A socket-outlets.....63 A.

3.14.10 Determination of IP rating

3.14.10.1 *General*

Socket-outlets shall have a minimum degree of protection IP2X when installed in accordance with manufacturer's instructions and Clause 3.14.1, to the extent that this degree of protection shall cover access to live parts and contact with screws for mounting brackets or wall boxes.

The requirements of AS 60529 shall be applied for the specific degree of protection, and the jointed test finger of AS 60529 shall not contact screws at 84 mm mounting centres for mounting brackets or wall boxes.

Socket-outlets constructed with mounting centres for metal mounting brackets or wall boxes other than 84 mm mounting centres in accordance with manufacturer's instructions shall be tested with the associated bracket/wall box.

NOTES:

1 Degree of protection IP2X does not preclude higher degrees of protection.

2 The extent of the degree of protection IP2X is intended to cover a situation where a socket-outlet may be mounted to a bracket or enclosure that is not 'earthed'.

3.14.10.2 *Tests*

For the purposes of testing, socket-outlets shall be mounted on a smooth wooden vertical surface and, for other than surface socket-outlets the rear of the mounting surface shall be sealed.

Socket-outlets shall be tested in the most unfavourable position of normal use, in accordance with the mounting instruction, both with and without an integrally moulded plug inserted.

Any hinged flap or cover relied upon for IP classification shall comply with Clauses 3.14.10.3 to 3.14.10.5, as relevant, prior to assessment of the requirements of AS 60529 specific to the classified degree of protection.

For socket-outlets with covers that are intended to be removed (with or without the use of a tool) for interchangeability, or decoration or for 'painting or decorating', this test shall be conducted with and without the cover in position.

Where a socket-outlet is to be tested for first characteristic numeral 5, testing shall be carried out under the conditions stated for Category 2 in AS 60529.

Socket-outlets are conditioned at 25 ±10°C for 24 h before the tests.

Immediately after the appropriate test the socket-outlet shall withstand the test of Clause 3.14.3.

3.14.10.3 *Requirements for hinged flaps or covers*

If a hinged flap or cover is required to maintain an IP rating it shall have a means to—

(a) close and hold the hinged flap or cover without manual assistance, or

(b) close and a latch the flap or cover to prevent opening without manual operation of the latch mechanism.

3.14.10.4 *Tests for hinged flaps or covers*

Conformance to Clause 3.14.10.3 is checked by the following:

(a) Initial verification of the strength of the latch.

A test force of 50 N is applied to the latched cover at a point near the latch.

The flap or cover shall not unlatch.

(b) Closing by the spring alone and endurance of the latch.

The flap or cover is opened at an angle of 45 ±5° from the closed position and released allowing the spring alone to close flap or cover (and latch if fitted). This operation is repeated 100 times. The flap or cover shall completely close (or latch if fitted) each time.

3.14.10.5 *Hinged flaps or cover closing means material verification*

If the closing means of the hinged flap or cover is a metallic spring, it shall be of non-corrosive metal and shall be verified by metallurgical test or supplier declaration.

3.14.11 Determination of ignitability and combustion propagation

Socket-outlets shall comply with the requirements for resistance to fire in accordance with AS/NZS 3100 for equipment not designated as 'attended' or unattended' as follows:

(a) The glow-wire test temperature 'T' for 'retaining parts' of fixed socket-outlets shall be—

(i) 850°C; or

(ii) 750°C, but there shall be no flaming for greater than 5 s.

(b) The glow-wire test temperature 'T' for 'retaining parts' of other socket-outlets shall be 650°C.

(c) The glow-wire test temperature for 'relevant parts' of fixed socket-outlets shall be 750°C.

(d) The glow-wire test temperature for 'relevant parts' of other socket-outlets shall be 650°C.

3.14.12 Inadvertent removal test

3.14.12.1 *General*

The aperture set(s) subject to the plugging endurance test below shall be used for subsequent tests of Clause 3.14.12.

3.14.12.2 *Plugging endurance test*

Socket-outlets shall be tested using a test plug with brass pins having dimensions complying with this Standard.

The socket-outlet and plug shall be mounted so that the withdrawal movement is in an approximately horizontal direction.

An appropriate type of plug, complying with this Standard and having a rating corresponding to that of the socket-outlet, shall be used for this test.

The test shall be carried out at room temperature.

The plug shall be inserted into, and withdrawn from, the socket-outlet 500 times (1000 strokes) at a rate of 150 mm/s and 30 strokes per minute.

NOTE: A stroke is an insertion or a withdrawal of the plug.

Aperture panels incorporating more than one aperture set shall be subject to the test on each aperture set.

3.14.12.3 *Preconditioning for push and pull tests*

The socket outlet shall be preconditioned at a temperature of 40 ±1°C for 1 h, without the test force applied. Throughout the tests, all parts of the socket outlet shall be maintained at this temperature.

3.14.12.4 *Push test*

A push force of 50 N by test probe 11 of IEC 61032 shall be applied without jerks for 10 s in the most unfavourable direction to the aperture set(s).

3.14.12.5 *Pull test*

The following forces shall be applied at the centroid of each aperture set(s) without jerks for 10 s in a perpendicular direction. The pull force is applied by the following suitable means such that the test results are not affected:

(a) A pull force of 50 N shall be applied if the shape of the aperture set(s) is such that the fingertips cannot easily slip off.

(b) A pull force of 30 N shall be applied if the projection of the aperture set(s) that is gripped is less than 10 mm in the direction of removal.

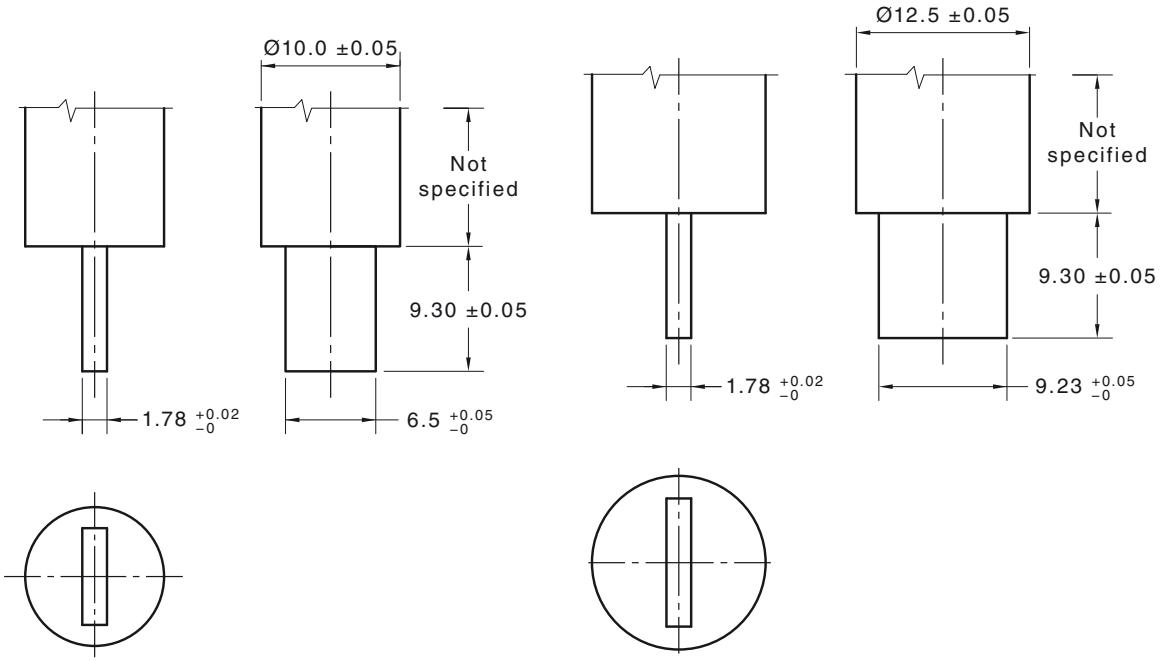
The pull test shall be repeated at 45° to the perpendicular in the following directions 0°, 90°, 180°, 270° consecutively without any adjustment of the aperture panel.

NOTE: See Figure 3.9.

3.14.12.6 *Conformance*

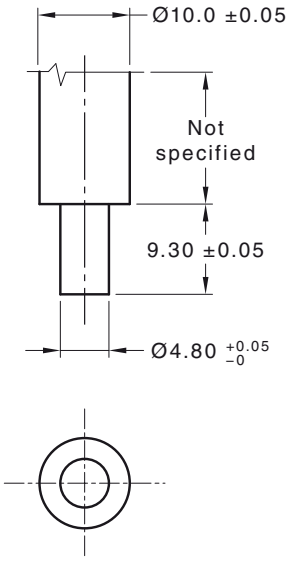
Following testing, the socket outlet shall not allow live parts to become exposed to the standard test finger (see AS/NZS 3100).

The part incorporating the aperture set(s) shall not become detached.



(a) Depth of non-contact for 10 A and 15 A socket-outlets

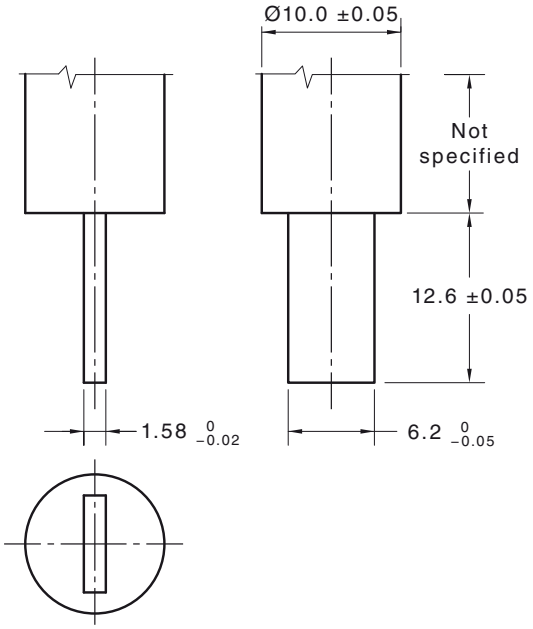
(b) Depth of non-contact for 20 A socket-outlets



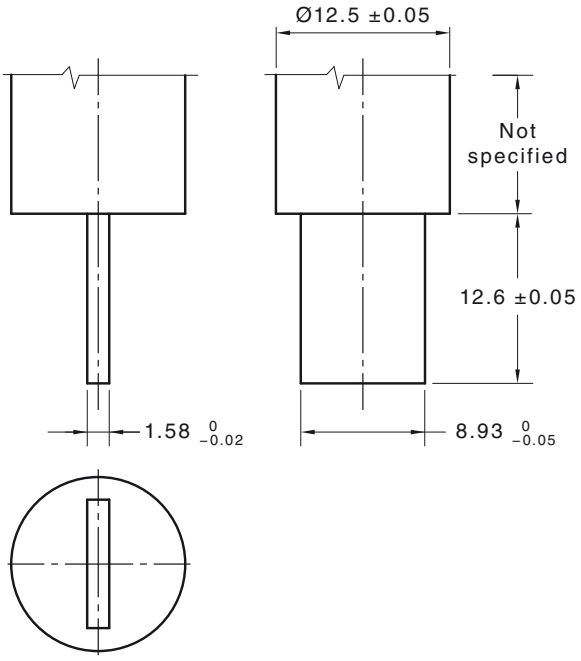
(c) Depth of non-contact for round socket-outlets

DIMENSIONS IN MILLIMETRES

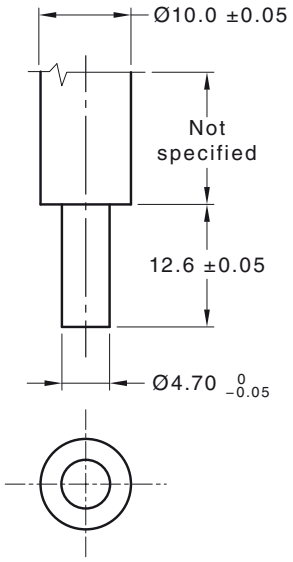
FIGURE 3.1 (in part) GAUGES FOR DEPTH OF CONTACT TESTS



(d) Depth of contact for 10 A and 15 A socket-outlets



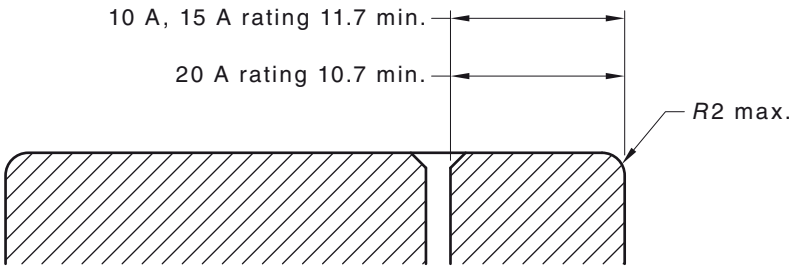
(e) Depth of contact for 20 A socket-outlets



(f) Depth of contact for round socket-outlets

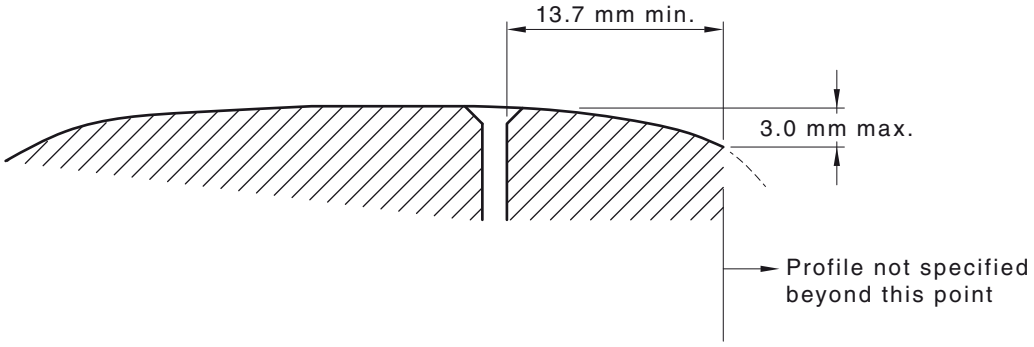
DIMENSIONS IN MILLIMETRES

FIGURE 3.1 (in part) GAUGES FOR DEPTH OF CONTACT TESTS



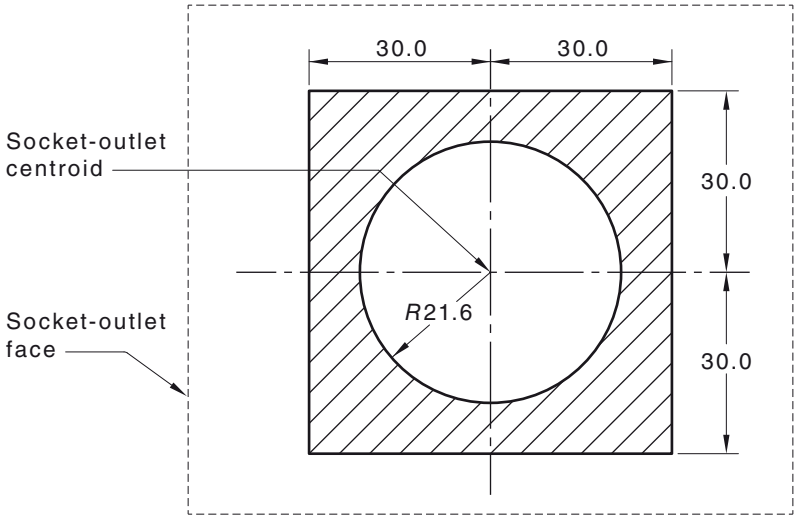
DIMENSIONS IN MILLIMETRES

FIGURE 3.2 SOCKET-OUTLET FACE PROFILE IN ACCORDANCE WITH CLAUSE 3.6.1(a)



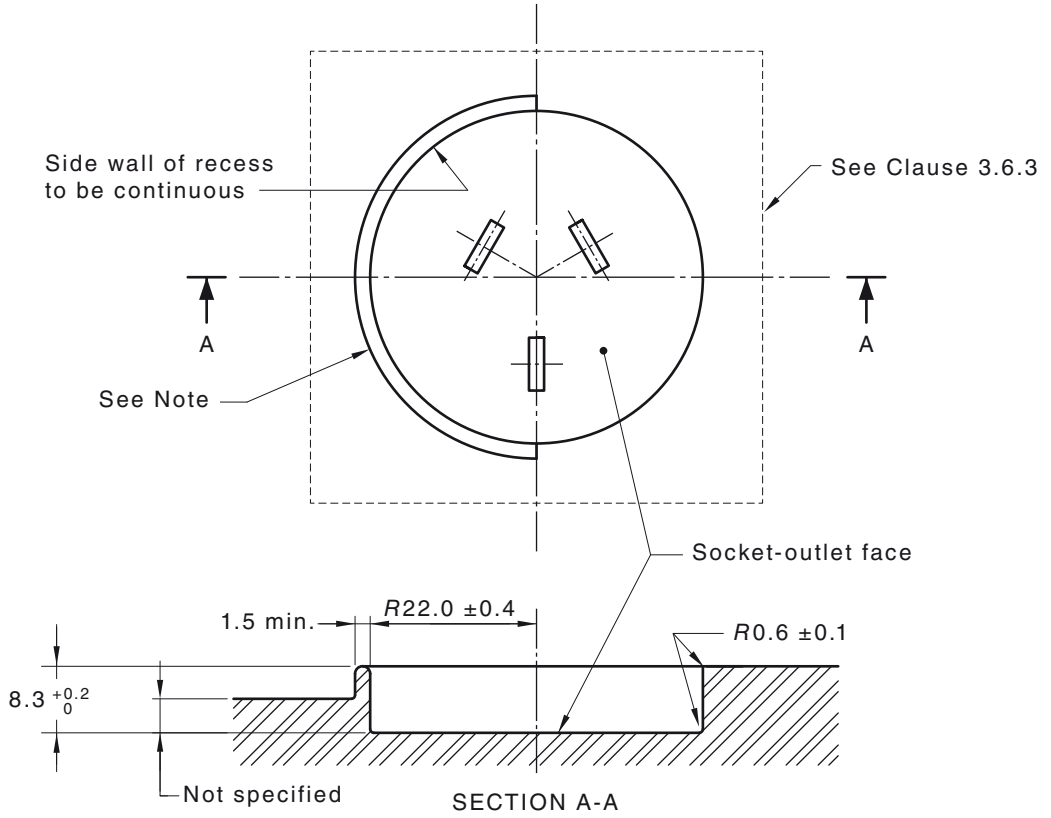
DIMENSIONS IN MILLIMETRES

FIGURE 3.3 SOCKET-OUTLET FACE PROFILE IN ACCORDANCE WITH CLAUSE 3.6.1(b)



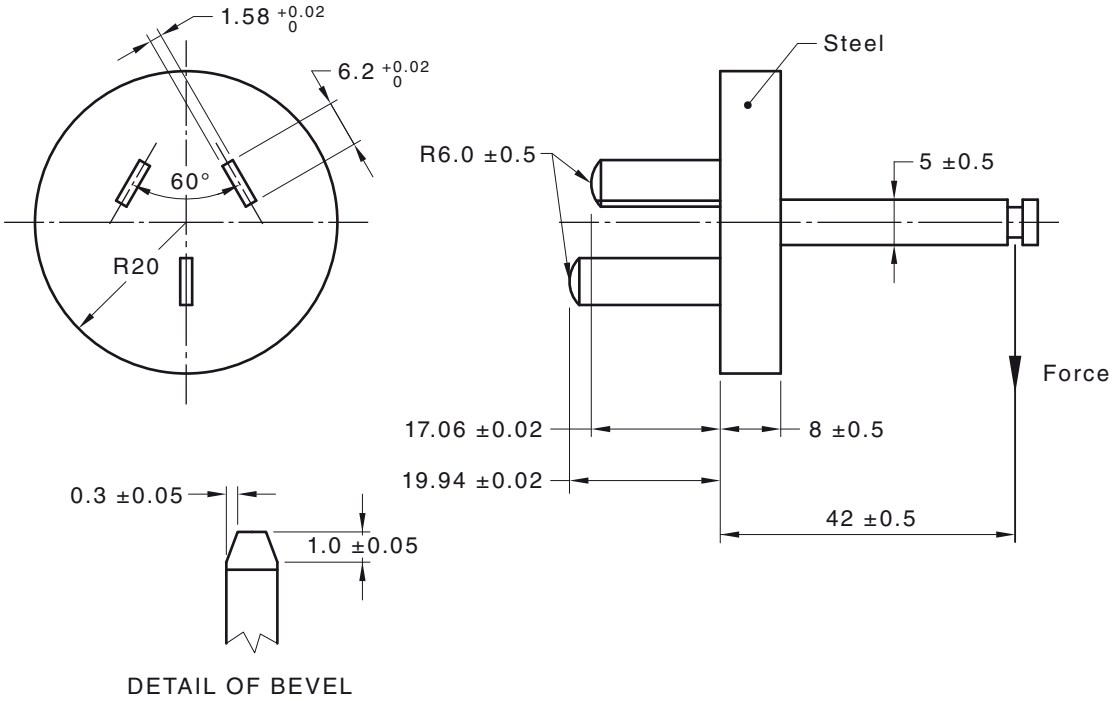
DIMENSIONS IN MILLIMETRES

FIGURE 3.4 AREA OF LIMITED PROJECTION



DIMENSIONS IN MILLIMETRES

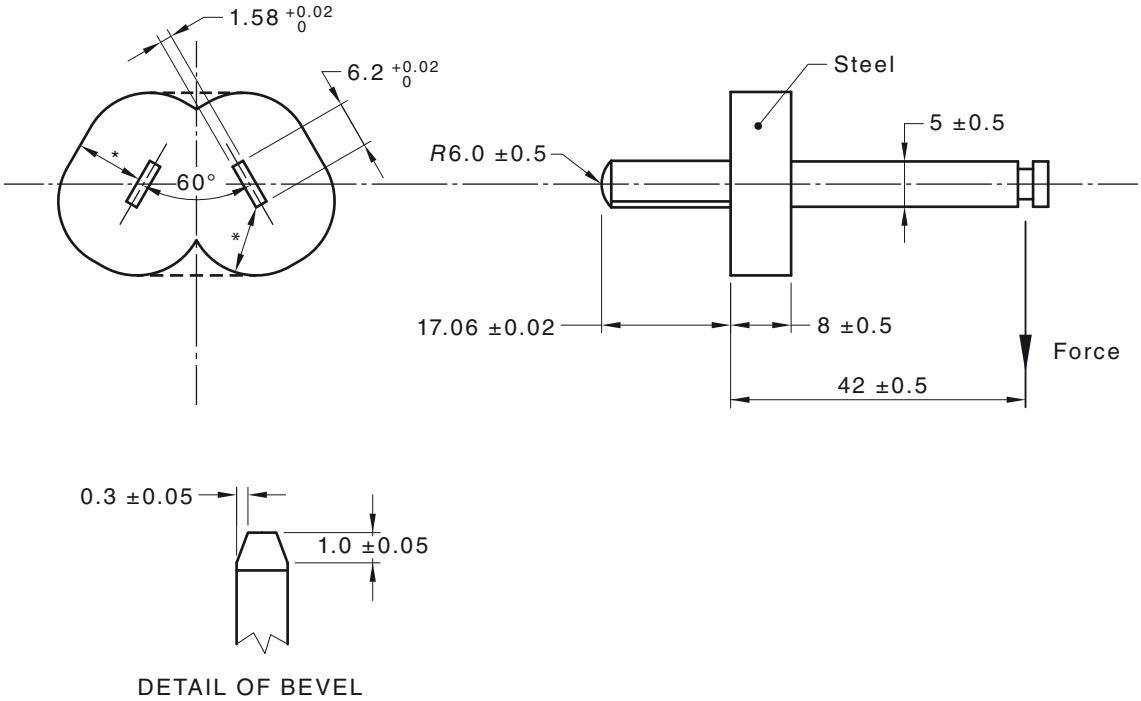
FIGURE 3.5 FULLY RECESSED SOCKET-OUTLET



NOTE: The width and thickness is identical for all pins.

DIMENSIONS IN MILLIMETRES

FIGURE 3.6 DEVICE FOR CHECKING THE RESISTANCE TO LATERAL STRAIN (THREE-PIN GAUGE)



DETAIL OF BEVEL

NOTE: Dimension is 9 mm from live parts in accordance with Clause 2.8.

DIMENSIONS IN MILLIMETRES

FIGURE 3.7 DEVICE FOR CHECKING THE RESISTANCE TO LATERAL STRAIN (TWO-PIN GAUGE)

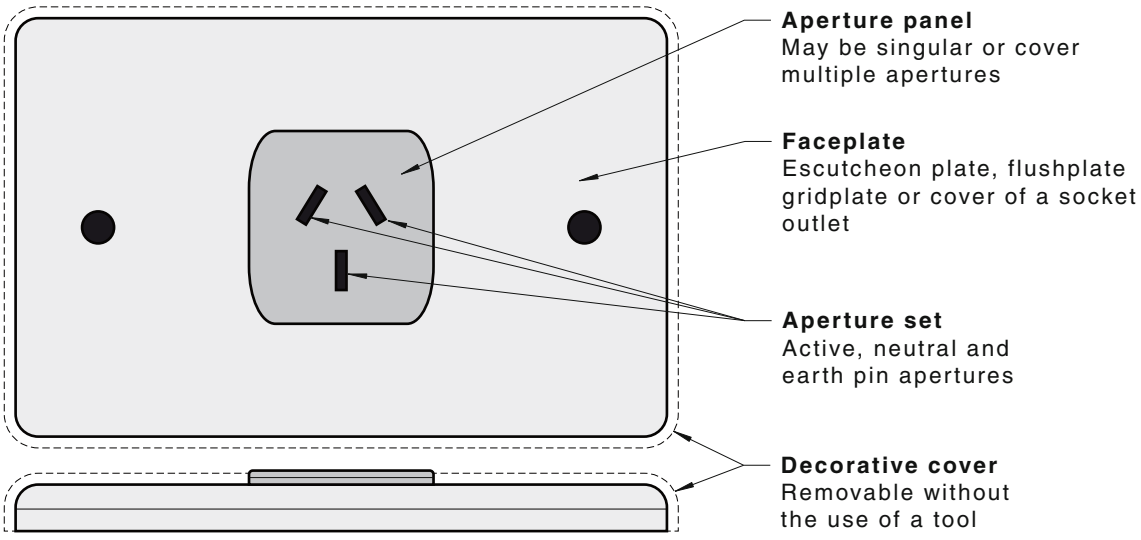


FIGURE 3.8 APERTURE PANEL—TYPICAL EXAMPLE DECORATIVE REMOVABLE COVER

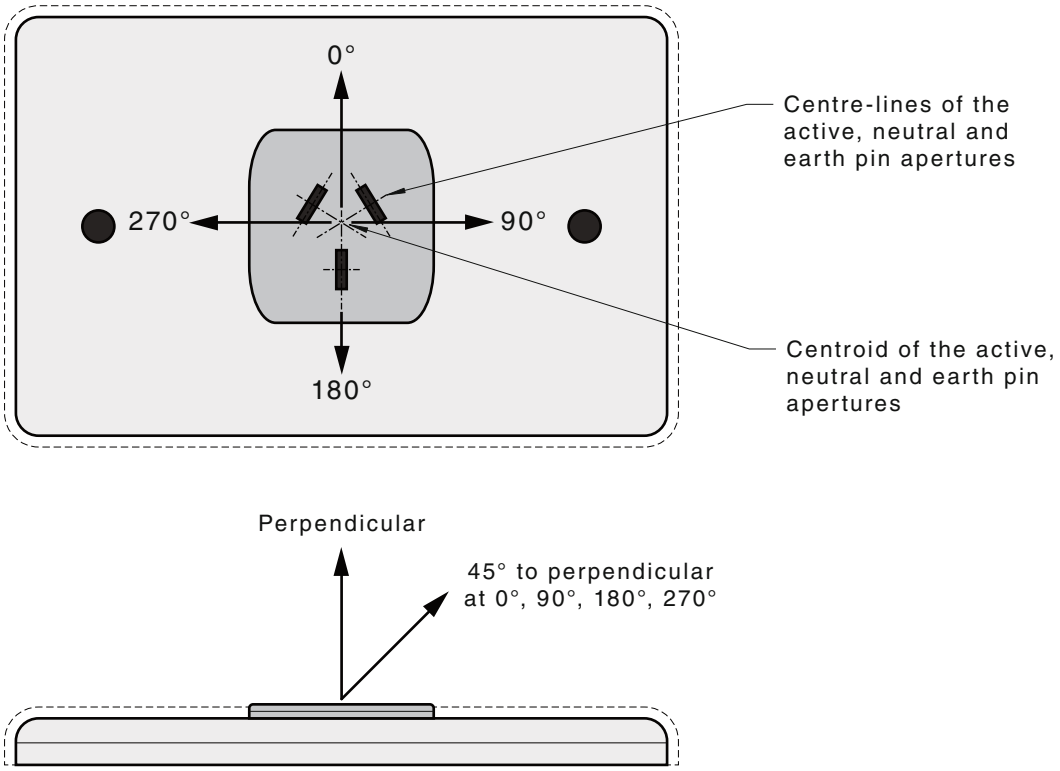
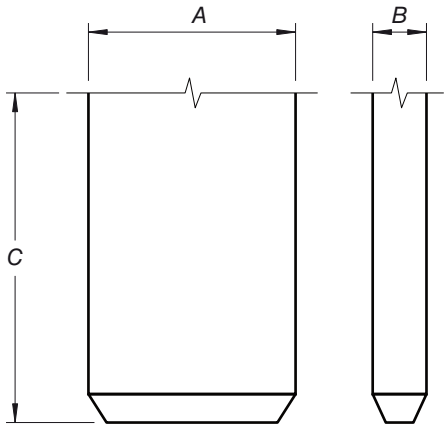


FIGURE 3.9 APERTURE PANEL PULL TEST—TYPICAL EXAMPLE DECORATIVE REMOVABLE COVER



NOTES:

1 Material: Hardened steel.

2 Surface roughness: <0.8 μm over its active length.

millimetres

Dimension	≤10 A	15 A	20 A	Tolerance
A	6.20	6.20	8.93	+0.02 / –0
B	1.58	1.58	1.58	+0.02 / –0
*C**	40	40	40	—

* The length of the pin is not a critical dimension.

FIGURE 3.10 CONTACT INDEPENDENCE TEST PIN

APPENDIX A

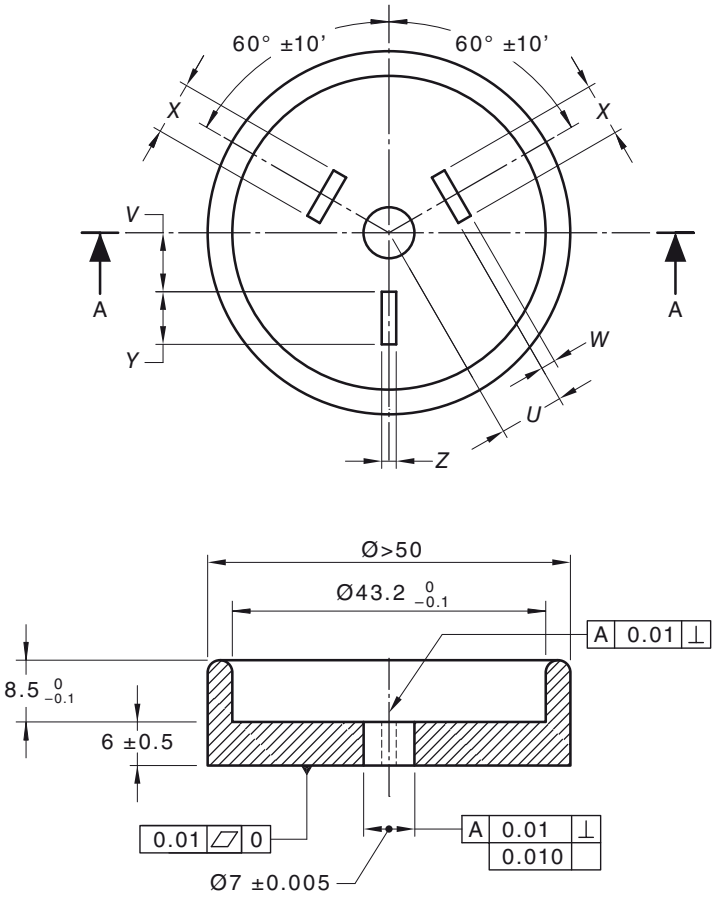
GAUGE FOR THREE-PIN FLAT-PIN PLUGS

(Normative)

The disposition of pins in flat-pin plugs of the types shown in Figure 2.1(a) and Figure 2.1(c) shall be checked by means of the appropriate gauge complying with Figure A1.

The plug pins shall pass easily through the gauge at all depths of insertion.

NOTE: Gauge not drawn to scale.



SECTION A-A

Dimension	10 A	15 A	20 A	Tolerance
U	6.83	6.83	6.05†	±0.03
V	6.96	5.59	7.16	±0.03
*W**	2.18	2.18	2.18	±0.03
X	7.09	7.09	9.80†	±0.03
Y	6.71	9.42	9.42	±0.03
Z	1.93	1.93	1.93	±0.03

* Applies to both live pins.

† Spacing from centre and angular orientation of pin does not relate to the centroid of the pin.

DIMENSIONS IN MILLIMETRES

FIGURE A1 GAUGE FOR THREE-PIN 250 V MAX. FLAT-PIN PLUGS

APPENDIX B

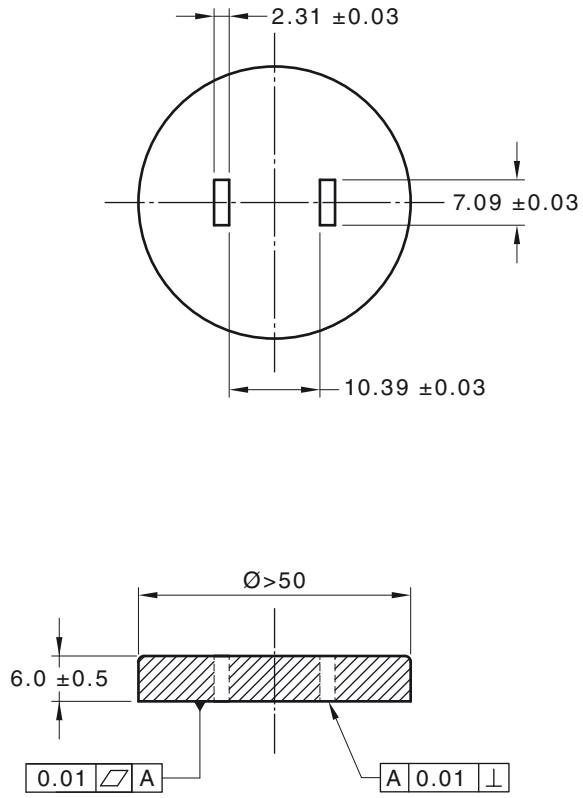
GAUGE FOR TWO-PIN FLAT-PIN PLUGS WITH PARALLEL PINS

(Normative)

The spacing of pins of two-pin flat-pin plugs of the type shown in Figure 2.1(b) shall be checked by means of a gauge complying with Figure B1.

The plug pins shall pass easily through the gauge at all depths of insertion.

NOTE: Gauge not drawn to scale.



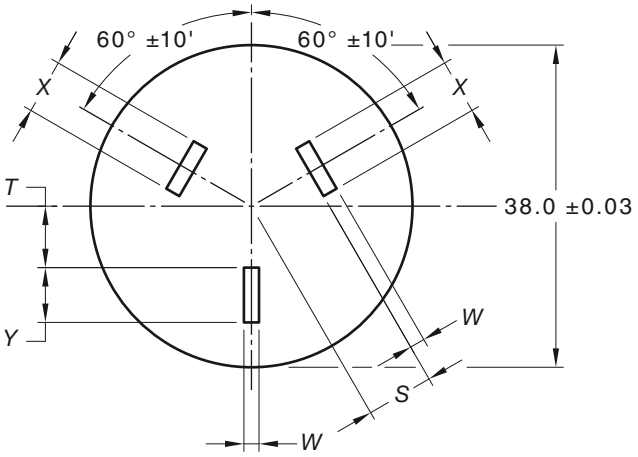
DIMENSIONS IN MILLIMETRES

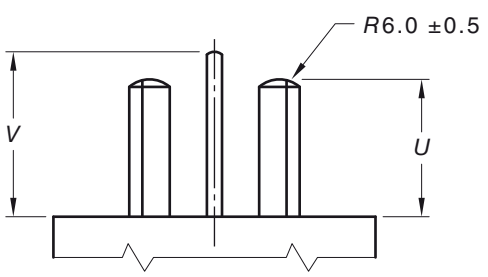
FIGURE B1 GAUGE FOR TWO-PIN FLAT-PIN 125 V MAX. PLUGS (WITH PARALLEL PINS)

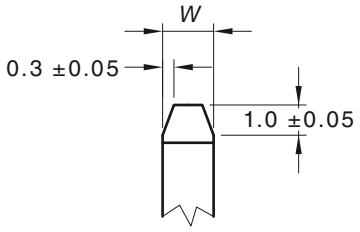
APPENDIX C

THREE-PIN TEST PLUG WITH FLAT PINS FOR FULL INSERTION TEST AND THE FINGER TEST DURING NORMAL INSERTION TEST

(Normative)







DETAIL OF BEVEL

Dimension	10 A	15 A	20 A	Tolerance
S	7.05	7.05	6.26†	±0.03
T	7.07	5.72	7.29	±0.03
U	17.46	17.46	17.46	±0.03
V	20.64	20.64	20.64	±0.03
*W**	1.75	1.75	1.75	±0.03
X	6.50	6.50	9.19†	±0.03
Y	6.50	9.19	9.19	±0.03

* Applies to all pins.

† Spacing from centre and angular orientation of pin does not relate to the centroid of the pin.

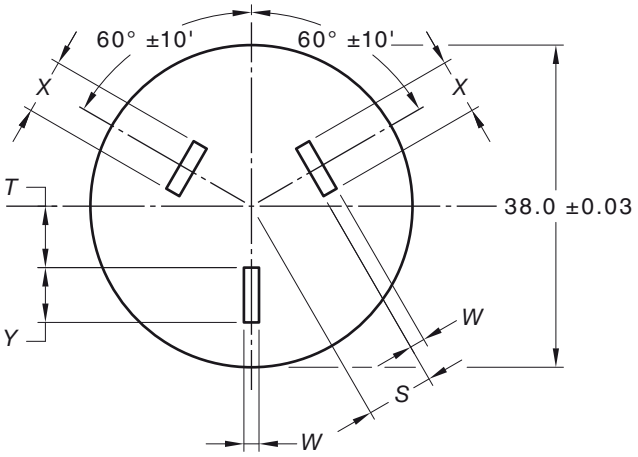
DIMENSIONS IN MILLIMETRES

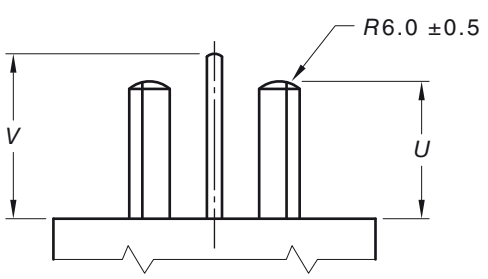
FIGURE C1 THREE-PIN TEST PLUG FOR CHECKING THREE-PIN FLAT PIN 250 V MAX. SOCKET-OUTLETS AGAINST THE STANDARD TEST FINGER IN ACCORDANCE WITH CLAUSES 3.3.4 AND 3.8.1

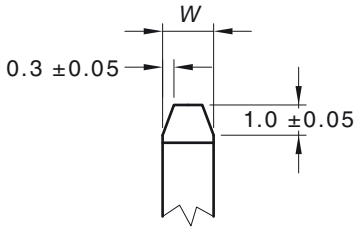
APPENDIX D

THREE-PIN TEST PLUG WITH FLAT PINS FOR ABNORMAL INSERTION TEST

(Normative)







DETAIL OF BEVEL

Dimension	10 A	15 A	20 A	Tolerance
S	7.11	7.11	6.32†	±0.03
T	7.14	5.78	7.35	±0.03
U	17.07	17.07	17.07	±0.03
V	19.84	19.84	19.84	±0.03
*W**	1.63	1.63	1.63	±0.03
X	6.35	6.35	9.07†	±0.03
Y	6.35	9.07	9.07	±0.03

* Applies to all pins.

† Spacing from centre and angular orientation of pin does not relate to the centroid of the pin.

APPENDIX E

PLUGS AND SOCKET-OUTLETS FOR USE IN EXTRA-LOW VOLTAGE CIRCUITS

(Normative)

E1 GENERAL

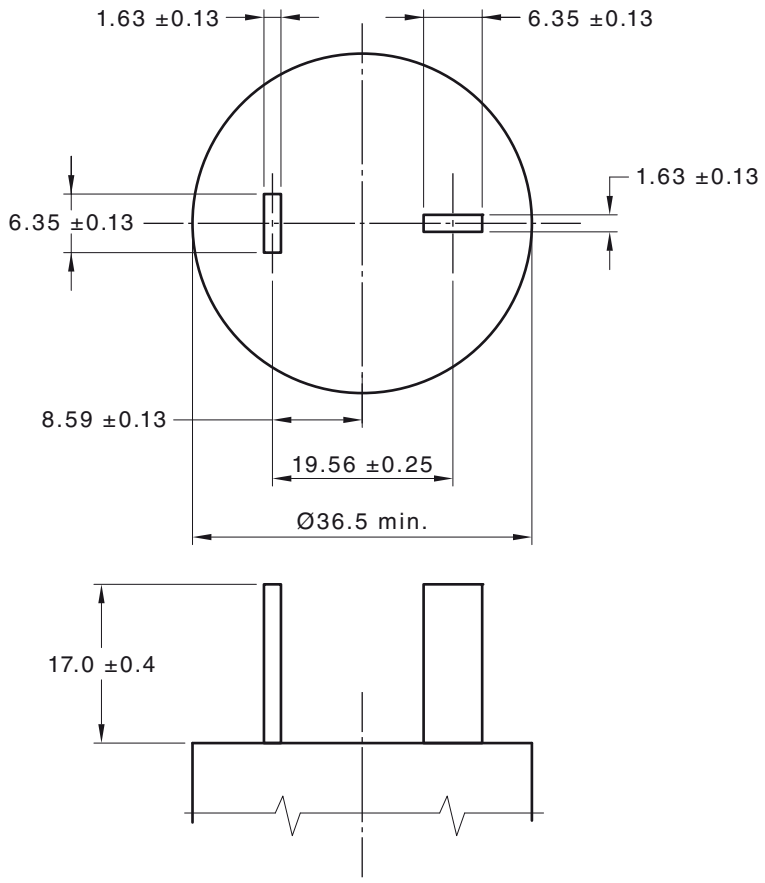
Plugs and socket-outlets used in extra-low voltage circuits shall be in accordance with the requirements of this Standard except for the requirements of Clauses 2.9, 2.10, 2.13.3, 3.7, 3.8.1 and 3.8.2.

NOTE: Where the ELV supply is referenced to earth, the radial pin should be the earth pin.

E2 DIMENSIONS AND RATING OF FLAT-PIN PLUGS

Flat-pin plugs for use in extra-low voltage circuits and with ratings not exceeding 15 A shall conform to the dimensions shown in Figure E1. The thickness of all pins shall be 1.63 ±0.13 mm and all pins shall be of the same nominal width.

Plugs shall be checked for conformance with dimensions by measurement.



NOTE: The pin ends are shown as squared off for illustrative purposes and may be bevelled, or otherwise shaped, to facilitate entry into socket-outlets.

DIMENSIONS IN MILLIMETRES

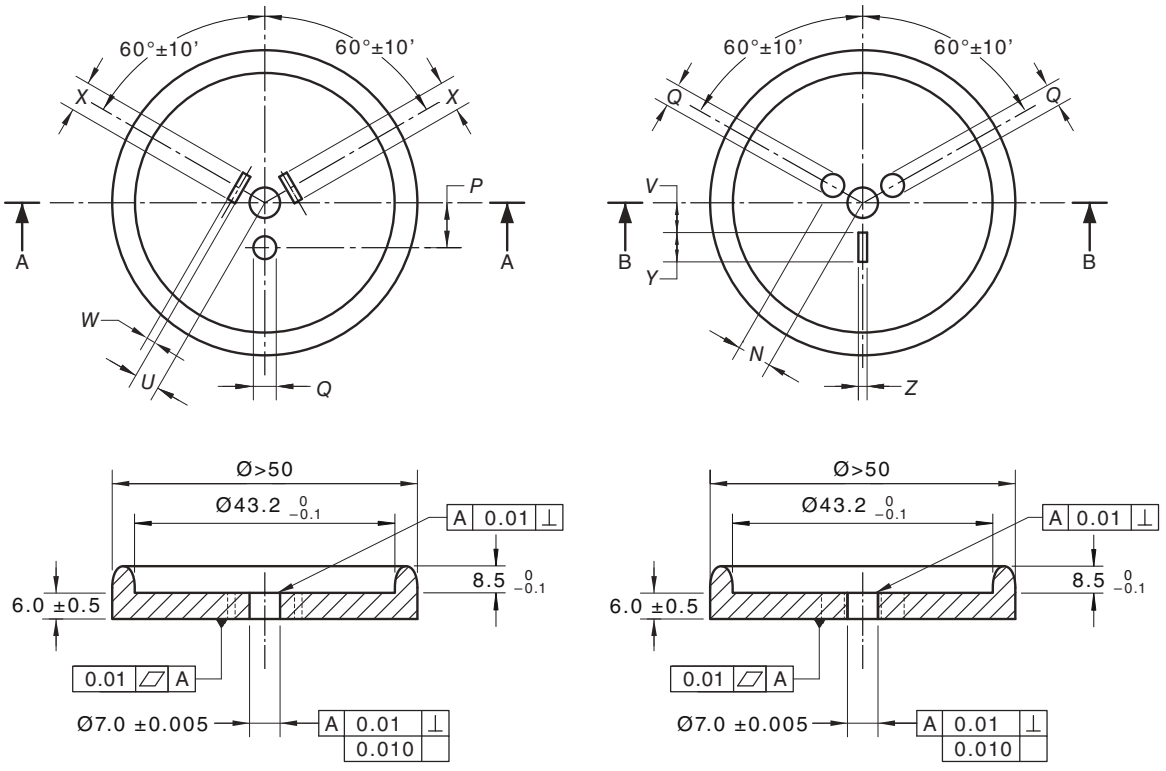
FIGURE E1 DIMENSIONS OF EXTRA-LOW VOLTAGE FLAT-PIN PLUGS

APPENDIX F

GAUGE FOR FLAT AND ROUND PIN PLUGS

(Normative)

The disposition of pins of three-pin plugs of the type shown in Figure 2.1(f) and Figure 2.1(g) shall be checked by means of the appropriate gauge complying with Figures F1(a) and Figure F1(b). The plug pins shall pass easily through the gauge at all depths of insertion.



Dimension	Size	Tolerance
N	7.92	Nominal
P	10.31	Nominal
Q	5.25	±0.03
U	6.83	±0.03
V	6.96	±0.03
*W**	2.18	±0.03
X	7.09	±0.03
Y	6.71	±0.03
Z	1.93	±0.03

* Applies to all pins.

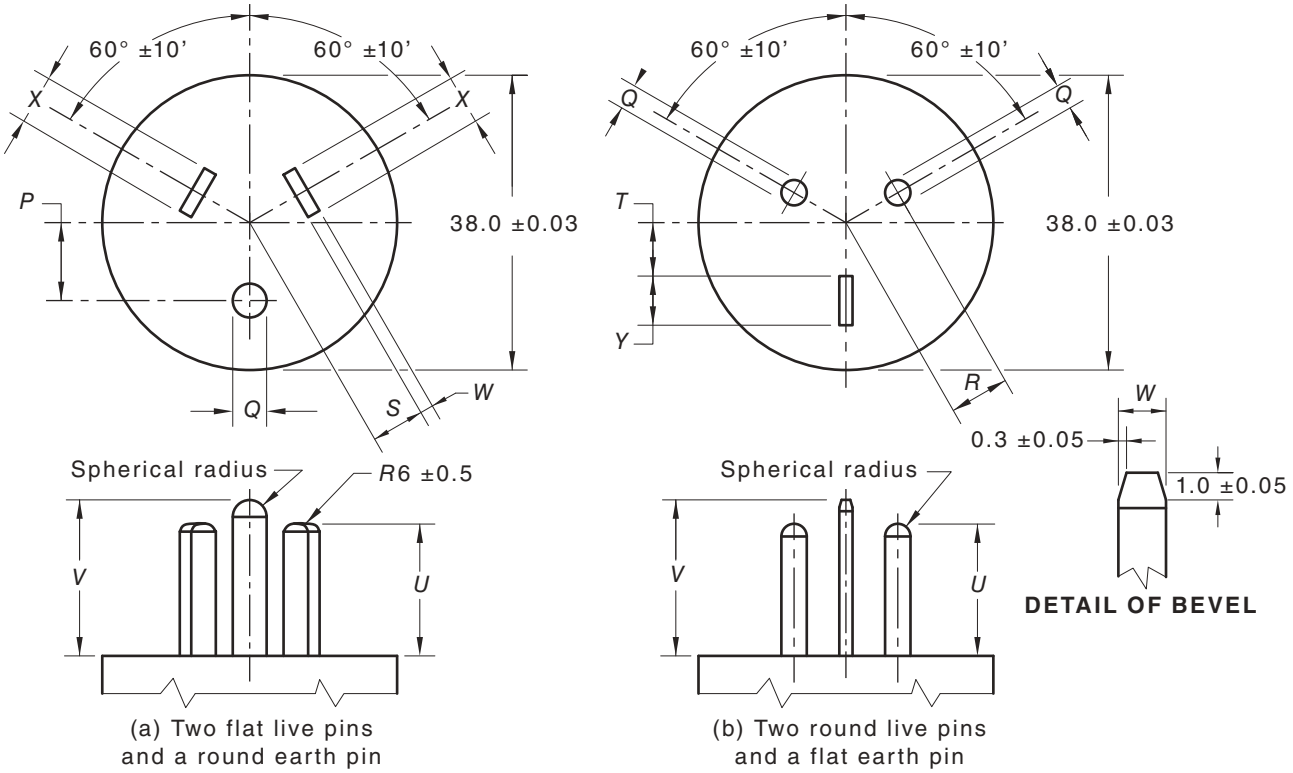
DIMENSIONS IN MILLIMETRES

FIGURE F1 GAUGE FOR FLAT AND ROUND PIN PLUGS

APPENDIX G

THREE-PIN TEST PLUG WITH FLAT AND ROUND PINS FOR THE FULL-INSERTION TEST AND THE FINGER TEST DURING NORMAL INSERTION TEST

(Normative)



(a) Two flat live pins and a round earth pin

(b) Two round live pins and a flat earth pin

Dimension	10 A and below	Tolerance
P	10.31	Nominal†
Q	4.80	±0.01
R	7.92	Nominal†
S	7.05	±0.03
T	7.07	±0.03
U	17.46	±0.03
V	20.64	±0.03
*W**	1.75	±0.03
X	6.50	±0.03
Y	6.50	±0.03

* Applies to both live pins.

† Dimensions without tolerances are nominal and are to be checked in samples by application of the gauge specified in Appendix F, as appropriate.

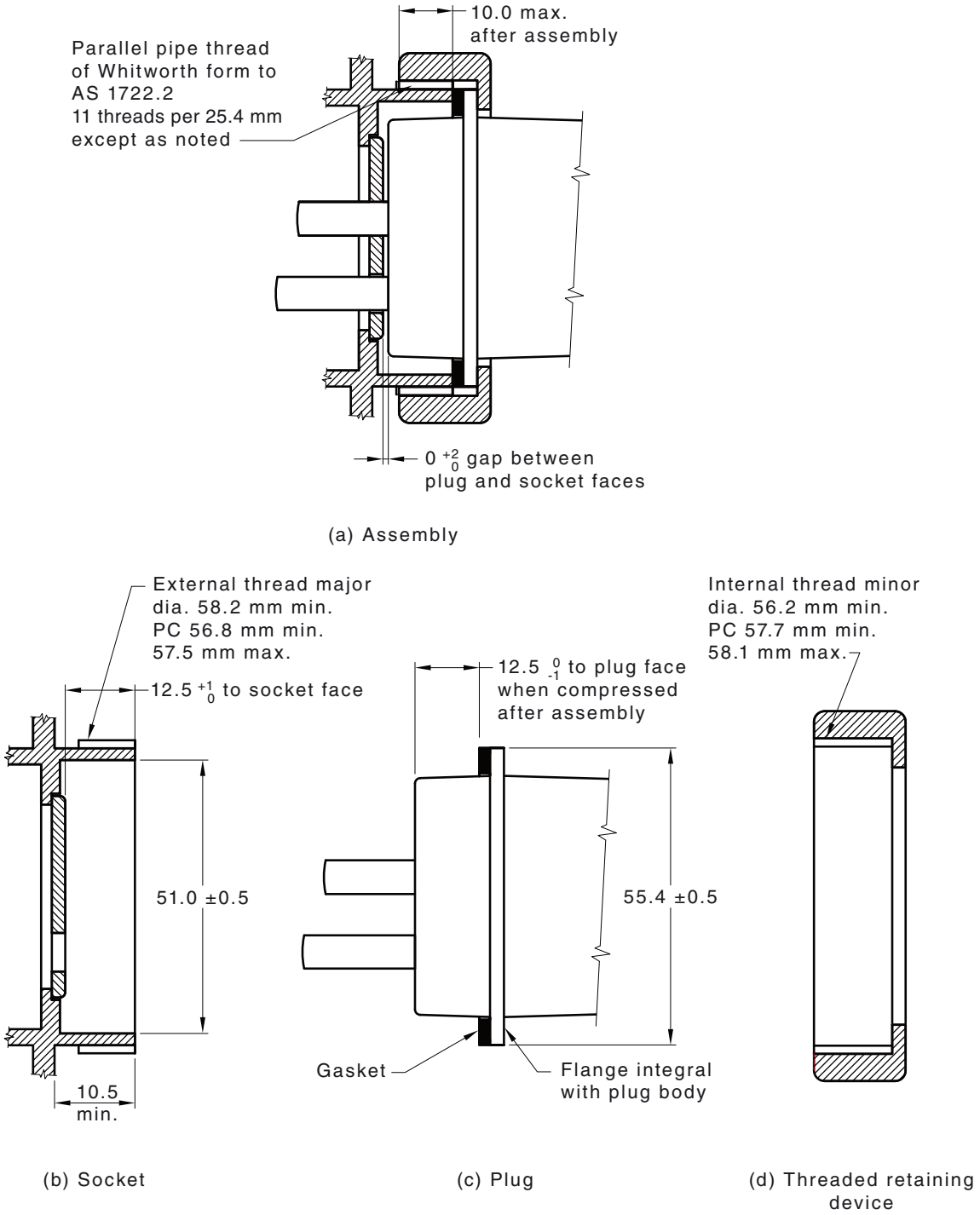
DIMENSIONS IN MILLIMETRES

FIGURE G1 THREE-PIN TEST PLUG WITH FLAT AND ROUND PINS FOR TESTS TO CLAUSES 3.3.4 AND 3.8.1

APPENDIX H

DIMENSIONS FOR PLUGS AND SOCKET-OUTLETS, IP-RATED, WITH THREADED RETAINING DEVICES

(Normative)



DIMENSIONS IN MILLIMETRES

FIGURE H1 DIMENSIONS FOR IP-RATED PLUGS AND IP-RATED SOCKETS WITH THREADED RETAINING DEVICE

APPENDIX I

PROTECTIVE DUMMY PLUGS

(Normative)

I1 SCOPE

This Appendix sets out the dimensional and constructional requirements for the essential safety of protective dummy plugs intended to be inserted into socket-outlets in accordance with Section 3 of this Standard.

I2 PROTECTIVE DUMMY PLUG

A protective dummy plug is a stand-alone accessory (not integral with or part of a socket-outlet), that is intended to prevent the insertion of foreign objects into live contact apertures of a socket-outlet.

I3 REQUIREMENTS FOR THE PROTECTIVE DUMMY PLUGS

I3.1 Construction

I3.1.1 *Mechanical strength*

Protective dummy plug pins shall have sufficient mechanical strength to allow repeated insertion and removal of the accessory, without pin breakage or other damage.

Conformance is checked by inspection following the insertion/withdrawal test of Paragraph I3.2.

I3.1.2 *Material*

The protective dummy plug accessory shall consist wholly of non-hygroscopic insulating material with properties not inferior to those specified in AS/NZS 3121 for insulating mouldings having a temperature class of 60°C.

Determination of ignitability and combustion propagation shall comply with the requirements for resistance to fire in accordance with AS/NZS 3100 for equipment not designated as ‘attended’ or ‘unattended’. The glow-wire test temperature ‘T’ shall be 650°C.

I3.2 Insertion and withdrawal

A protective dummy plug shall permit safe ‘insertion into, or withdrawal from’ its corresponding sockets and it may be provided with an accessory to achieve this.

A protective plug accessory complying with Figure 2.1(a1), Figure 2.1(c), Figure 2.1(d), Figure 2.1(f) or Figure 2.1(g) shall permit easy insertion, or withdrawal from, a socket-outlet complying with Figure 3.5 of this Standard.

Conformance is checked by inspection and the following test.

Manually insert the plug fully into and withdraw the plug from a new socket-outlet 20 times.

Manually align the plug in the socket-outlet to minimize the effects of misalignment between mating components and any other friction-increasing factors, in order to attain the best practical position for minimum resistance to withdrawal.

The plug is then fully reinserted and a withdrawal force gradually applied by any suitable means until the plug is fully withdrawn.

The withdrawal force, during the three subsequent and consecutive disengagements, shall then be measured.

The withdrawal forces measured shall be a minimum of 5 N.

I3.3 Dimensions

I3.3.1 *Pin dimensions*

For protective dummy plugs intended to be inserted into socket-outlets that accept low voltage flat-pin plugs and low voltage plugs and having one round earth pin and two flat live pins or two round live pins and one flat earth pin, with ratings up to and including 20 A, the pins of the protective dummy plugs shall not exceed the appropriate maximum dimensions shown in Figure 2.1.

Conformance is checked by measurement.

I3.3.2 *Maximum plug radius*

The protective dummy plug body shall have a maximum radius of 21.9 mm.

Conformance is checked by measurement.

I3.3.3 *High voltage test*

Prior to starting the tests on sample A, the protective dummy plug shall be conditioned in an atmosphere of 93 ±2% relative humidity at room temperature for a period of 48 h.

While the dummy plug is in 93 ±2% relative humidity it is inserted into an appropriate socket outlet and a high voltage test of 3500 V a.c. for 1 min is applied between live parts of the socket outlet and foil placed over all accessible parts of the dummy plug. There shall be no failure in accordance with the AS/NZS 3100 high voltage test.

I3.4 Pin bending test

The protective dummy plug shall be in accordance with Test 7b of Table 2.2.

APPENDIX J

INTEGRAL OR DETACHABLE PLUG PORTIONS OF EQUIPMENT FOR INSERTION INTO SOCKET-OUTLETS

(Normative)

NOTE: See Preface and Clause 1.2.3, Transitional arrangements, for information relating to the pre-existing and new requirements in this Appendix.

J1 SCOPE

This Appendix sets out the dimensional and constructional requirements of plug portions of equipment and any detachable connection between the plug portion and the equipment. It applies to only the plug portion of equipment and shall be read in conjunction with Section 2 contained in the body of this Standard. Where the term ‘plug’ is used in Section 2 in accordance with this Appendix, it shall be taken to mean the plug portion of equipment.

This Appendix does not, however, include requirements which are covered by the relevant product standard for the equipment.

J2 DEFINITIONS

For the purpose of this Appendix the definitions below apply.

J2.1 Detachable plug portion

A plug portion that is detachable from the equipment and with connections including the following standardized outputs and other contacts:

(a) Type A (see Figure J1):

A detachable plug portion with a connection intended for plugging directly into equipment. The connection being via the equipment group 1 appliance inlet within the scope of AS/NZS 60320.1.

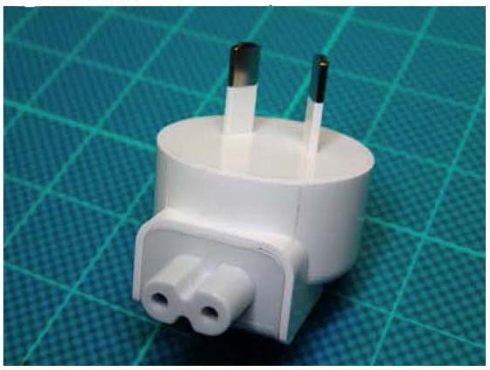
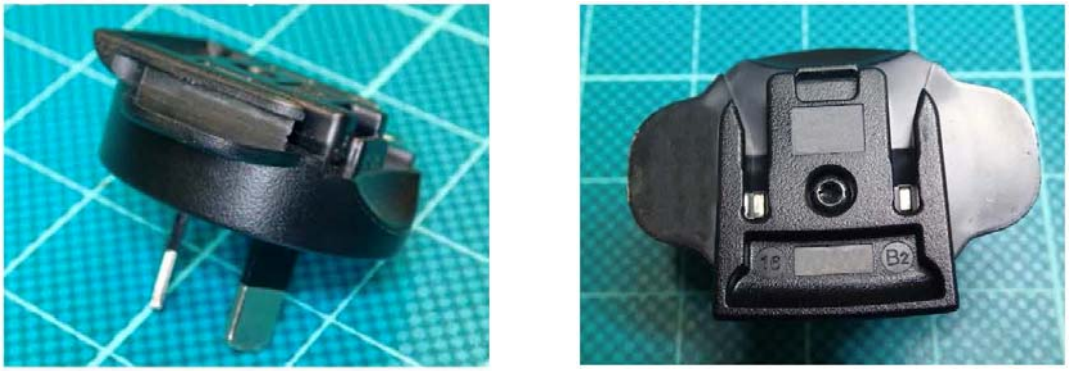


FIGURE J1 EXAMPLE DETACHABLE PLUG PORTION WITH A CONNECTION—TYPE A

(b) Type B (see Figure J2):

A detachable plug portion with a non-standardized connection intended for plugging directly into equipment.



(a) (b)

FIGURE J2 EXAMPLE DETACHABLE PLUG PORTION WITH A NON-STANDARDIZED CONNECTION—TYPE B

(c) Type C (see Figure J3):

A detachable plug portion with a connection intended for use with an adaptor connected to a flexible cord so as to replicate a supply plug and flexible cord configuration. The connection being via a group 1 appliance outlet within scope of AS/NZS 60320.2.2, which is integral with the plug portion.

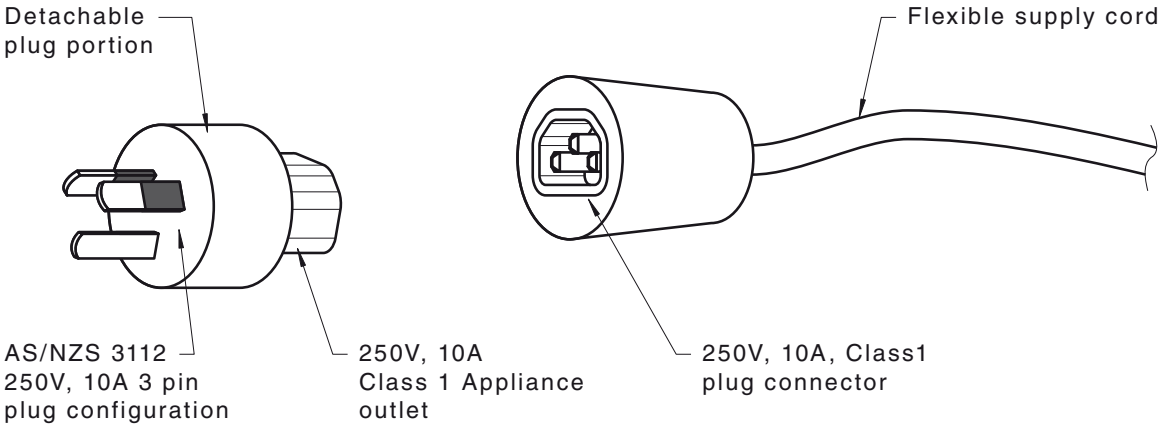


FIGURE J3 EXAMPLE DETACHABLE PLUG PORTION WITH A CONNECTION—TYPE C

J2.2 Integral plug portion

A plug portion that is integral to the equipment enclosure and is not detachable.

J2.3 Plug portion

New DOA 24/02/2019

A plug portion is that portion of equipment with pins for insertion into a socket-outlet, including the plug pins, terminals of the plug pins, external dimensions of the ‘maximum projection’ and any connections of a detachable plug portion.

Pre-existing DOW 24/02/2019

A plug portion is that portion of equipment with integral pins shown in Figure 2.1, including the plug pins, terminals of the plug pins and external dimensions of the ‘maximum projection’.

J3 REQUIREMENTS FOR THE PLUG PORTION

J3.1 General

The following provisions apply to the dimensional and constructional requirements of plug portions of equipment and any detachable connection between the plug portion and the equipment:

(a) For detachable plug portions intended for connection to the equipment in multiple orientations, the relevant tests are performed in the most onerous orientation.

(b) For Type A detachable plug portion, the relevant requirements of AS/NZS 3105 are applicable, in addition to conformance with relevant clauses of this Appendix.

(c) For Type B detachable plug portions, the conformance is shown by the relevant clauses of this Appendix.

(d) For Type C detachable plug portions, conformance is shown by assessment to Section 2 of this Standard (plugs) and relevant clauses of this Appendix.

J3.2 Plug pins of plug portions

The requirements of Clause 2.2 are applicable for plug pins.

J3.3 Ratings and dimensions for low-voltage plug portions

The requirements of Clauses 2.8.1 and 2.8.4 are applicable for ratings and dimensions.

J3.4 Internal connections for plug portions

The requirements of Clause 2.9 are applicable for internal connections unless requirements are contained in the relevant product standard.

J3.5 Arrangement of earthing connections for plug portions

The requirements of Clause 2.10 are applicable for the arrangement of earthing connections.

J3.6 Configuration of plug portions

The requirements of Clause 2.12.6 are applicable to the configuration of the plug portion.

J4 TESTS

J4.1 General

Plug portions of equipment shall be subjected to the following tests and unless stated otherwise, shall comply with the requirements specified in Section 2 for each test. The number of test samples shall be in accordance with Table 2.2.

Conformance for detachable plug portions shall be established by assessment with the plug portion fully assembled with the equipment.

J4.2 High voltage test

The requirements of Clause 2.13.3 are applicable unless requirements are contained in the relevant product standard.

J4.3 Mechanical strength of pin tests

J4.3.1 *Tumbling barrel test*

The tumbling barrel test is applied to determine the mechanical strength of the plug pins.

Three samples that have not been subjected to any previous test are tested to the requirements of Clause 2.13.7.1, however the test is modified as follows:

A sample is dropped—

(a) 500 times if the mass of the specimen does not exceed 250 g. The pins being straightened after each 100 drops and at the completion of the test to pass through the appropriate gauge of Figure A1, Figure B1 or Figure F1; and

(b) 250 times if the mass of the specimen exceeds 250 g. The pins being straightened after each 25 drops and at the completion of the test to pass through the appropriate gauge of Figures A1, Figure B1 or Figure F1.

New DOA 24/02/ 2019

Following each test the samples shall comply with Clause 2.13.7.1.

Pre-existing DOW 24/02/ 2019

Following each test the samples shall comply with Item (e) of Clause 2.13.7.1.

J4.3.2 *Pin bending test*

The pins of the plug portion of three samples not subjected to any previous tests shall be tested for conformance with the pin bending test of Clause 2.13.7.2.

J4.4 Temperature rise test

The relevant requirements of Clause 2.13.8 are applicable for the temperature rise test, except that the test current shall be that specified in the relevant product standard.

The temperature rise of the pins shall not exceed 45 K irrespective of the temperature rise of parts specified in end-product standards.

For detachable plug portions the temperature rise of terminals and contacts shall not exceed 45 K.

J4.5 Securement of pins of the plug portion

The requirements of Clause 2.13.9 are applicable for the securement of pins.

J4.6 Tests on the insulation material of insulated pin-plug portions

The requirements of Clause 2.13.13 are applicable for insulating material of insulated plug pins.

J4.7 Equipment with a plug portion intended to be supported by the contacts of a socket-outlet

Equipment with a plug portion intended to be supported by the contacts of socket-outlets shall not impose undue strain on those socket-outlets.

Unless requirements are contained in the relevant product standard, conformance is checked by inserting the equipment with a plug portion, as in normal use, into a flush-mounting combination switch socket-outlet complying with this Standard. The socket-outlet being pivoted about a horizontal axis through the centre-lines of the contact apertures at a distance of 8 mm behind the engagement face of the socket-outlet (see Figure J4). The additional torque, which has to be applied to the socket-outlet to maintain the engagement face in the vertical plane, shall not exceed 0.25 Nm.

For equipment with a plug portion having an outlet in the form of a flexible cord, the test is conducted with the centre-line of the axis of pivot of the socket-outlet located at a point 500 mm above a horizontal surface. The flexible cord is allowed to hang freely from the equipment with that flexible cord in excess of 500 mm resting on the horizontal surface during the test.

J4.8 Additional requirements for detachable plug portions

J4.8.1 *Access to live parts*

The design and construction of the detachable plug portion shall be such that it is not possible to contact live parts with the small test finger of Figure 13 of IEC 61032.

NOTE: This provision is intended to ensure live parts cannot be accessed if the detachable plug portion is inserted in a socket outlet without being connected to the equipment.

It shall not be possible to incorrectly assemble the plug portion to the equipment allowing access to live parts.

Conformance is checked by inspection and applying small test finger of Figure 13 of IEC 61032:1997 to the plug portion. If an opening does not allow entry of the test finger, a force on the test finger in the straight position is increased to 20 N.

New DOA 24/02/ 2019

J4.8.2 *Construction of detachable contacts where the input current of the equipment exceeds 0.2 A*

Contacts of the equipment shall be such that they make and maintain, under normal service conditions, satisfactory electrical and mechanical contact with the corresponding contact of the detachable plug portion.

For connections intended to accommodate flat pins, contact shall be made with both sides of each pin, except that it shall be permissible to use spring-assisted single-sided contacts. These contacts shall not rely exclusively on the resilience of the contact material and shall have an opposite face of material other than thermoplastic or resilient insulating material. The alignment and contact making properties of contacts shall be independent of terminal screws. The effectiveness of the contacts shall be independent of pressure from any thermoplastic or resilient moulding.

Conformance with the effectiveness of the contacts is checked by inspection and by the plug portion detachment requirements of Paragraph J4.8.3.

A visual inspection is conducted to determine the existence of interference between the metal contacts and the thermoplastic or resilient moulding to provide supplementary contact pressure to the metal contacts.

J4.8.3 *Plug portion detachment requirements*

For all Type B or C devices and for Type A devices where the outlet of the detachable plug portion is parallel to the plug supply pins, disengagement of the detachable plug portion from the equipment shall require at least two simultaneous independent actions or the use of a tool.

Conformance is verified by inspection and the following test.

The plug portion and the equipment/adaptor shall be connected and disconnected 50 times (100 strokes).

The plug portion shall be securely held in position. A force which, over a period of 10 s, shall be increased steadily to 60 ±0.6 N and held at this value for a further 10 s, shall be applied evenly at the connecting equipment in a direction parallel to the pins. This procedure shall be conducted three times on the same plug portion, at intervals of 5 min, without disturbing the plug portions between tests.

During the test period, the plug portion shall not separate from the equipment.

NOTE: This test is intended to ensure the design of the connection of the detachable plug portion to prevent poor electrical connections caused by accidental full or partial detachment.

The test of AS/NZS 3112 ‘temperature rise test’ for plugs shall be conducted immediately after the above test without disturbing the sample.

New, *continued* DOA 24/02/ 2019

J4.8.4 *Resistance of insulating material to heat and fire*

J4.8.4.1 *Resistance to heat*

For Type B detachable plug portions parts of non-metallic material, parts of insulating material supporting live parts including connections, and parts of thermoplastic material providing supplementary insulation or reinforced insulation, shall be sufficiently resistant to heat if their deterioration could cause the appliance to fail to comply with this Standard.

This requirement does not apply to the insulation or sheath of flexible cords or internal wiring.

Conformance is checked by subjecting the relevant part to the ball pressure test of IEC 60695-10-2.

The test is carried out at a temperature of 40 ±2°C plus the maximum temperature rise determined during the temperature test of Paragraph J4.4, but it shall be at least—

(a) 75 ±2°C, for external parts;

(b) 125 ±2°C, for parts supporting live parts.

NOTE: The test is not carried out on parts of ceramic material.

J4.8.4.2 *Resistance to fire*

Plug portions shall comply with the requirements for resistance to fire in accordance with AS/NZS 3100. The glow-wire test temperature ‘T’ shall be 750°C.

Pre-existing DOW 24/02/ 2019

J4.8 Additional requirements for detachable plug portions

Where a plug portion is detachable, conformance shall be established by assessment with the plug portion fully assembled with the equipment.

Access to live parts shall be assessed for incorrect assembly of the plug portion.

It shall not be possible to assemble the plug portion to the equipment resulting in a dangerous situation allowing access to live parts.

The plug portion shall not expose live parts prior to assembly.

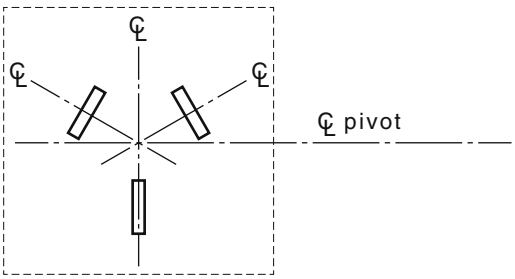


FIGURE J4 ARRANGEMENT FOR DETERMINATION OF PIVOT

APPENDIX K

NON-DETACHABLE PARTS TEST

(Normative)

K1 SCOPE

This Appendix sets out the method for determining non-detachable parts that protect against access to live parts, moisture or contact with moving parts.

K2 GENERAL

Non-detachable parts shall be fixed in a reliable manner and withstand the mechanical stress occurring during normal use. Snap-in devices used for the fixing of non-detachable parts shall have an obvious locked position. The fixing properties of snap-in devices used in parts that are likely to be removed during installation or servicing shall be reliable.

Conformance is checked by the following test.

K3 TEST

Parts that are likely to be removed during installation or servicing shall be disassembled and assembled 10 times before the test is carried out.

The test shall be carried out at room temperature. If conformance may be affected by the temperature of the equipment, the test is also carried out immediately after the equipment has been operated under the conditions specified in Clause 3.14.5.

The test is applied to all parts that are likely to be detachable whether or not they are fixed by screws, rivets or similar parts.

A force shall be applied without jerks for 10 s in the most unfavourable direction to parts likely to be weak as follows:

(a) Push force, 50 N.

(b) Pull force:

  (i) If the shape of the part is such that the fingertips cannot easily slip off, 50 N.

  (ii) If the projection of the part that is gripped is less than 10 mm in the direction of removal, 30 N.

The push force shall be applied by test probe 11 of IEC 61032.

The pull force shall be applied by a suitable means, such as a suction cup, so that the test results are not affected. While the force is being applied, the test fingernail of Figure K1 is inserted in any aperture or joint with a force of 10 N. The fingernail is then slid sideways with a force of 10 N but is not twisted or used as a lever.

If the shape of the part is such that an axial pull is unlikely, the pull force shall not be applied but the test fingernail is inserted in any aperture or joint with a force of 10 N and is then pulled for 10 s by means of the loop with a force of 30 N in the direction of removal.

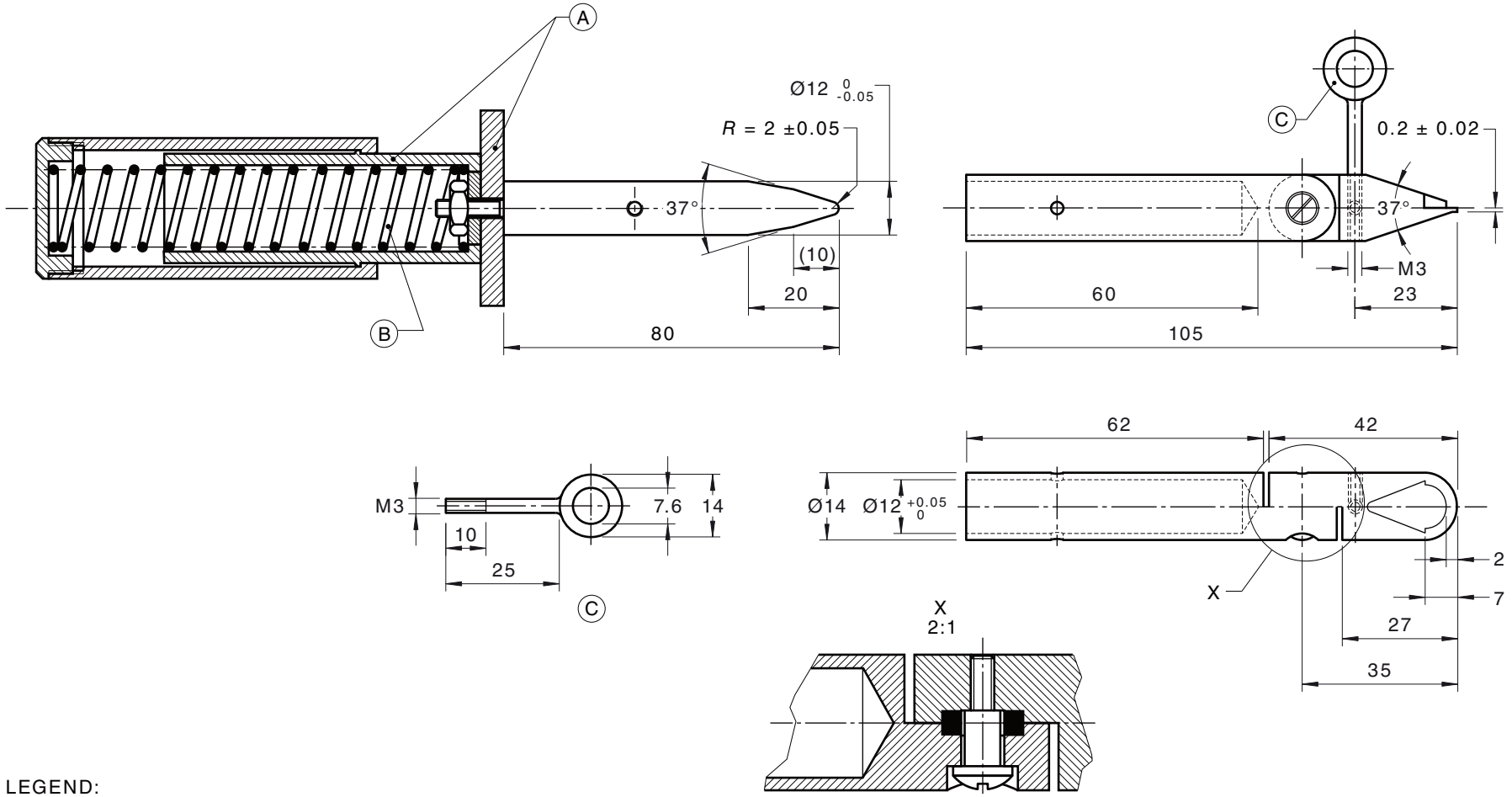
If the part is likely to be twisted, the following torque shall be applied at the same time as the pull or push force:

(A) 2 Nm, for major dimensions up to 50 mm.

(B) 4 Nm, for major dimensions over 50 mm.

This torque is also applied when the test fingernail is pulled by means of the loop. If the projection of the part which is gripped is less than 10 mm, the torque is reduced by 50%.

Parts shall remain in the locked position and not become detached.



LEGEND:
A Insulating material
B Spring with a constant suitable for providing a push force as specified in Appendix K on the test fingernail
C Loop

DIMENSIONS IN MILLIMETERS

FIGURE K1 TEST FINGERNAIL

NOTES

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Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. These standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth government, Standards Australia is recognized as Australia's peak national standards body.

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