

Australian/New Zealand Standard™

**Approval and test specification—Plugs,
socket-outlets and couplers for general
industrial application**



AS/NZS 3123:2005

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-004, Electrical Accessories. It was approved on behalf of the Council of Standards Australia on 10 December 2004 and by the New Zealand Standards Approval Board on 17 December 2004.
This Standard was published on 23 February 2005.

The following are represented on Committee EL-004:

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Australian Chamber of Commerce and Industry
Australian Electrical and Electronic Manufacturers Association
Canterbury Manufacturers Association, New Zealand
Consumer Electronic Suppliers Association
Consumers' Federation of Australia
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This Standard was issued in draft form for comment as DR 04378.

Australian/New Zealand Standard™

Approval and test specification—Plugs, socket-outlets and couplers for general industrial application

Originated as AS C317—1958.
Previous edition AS/NZS 3123:2000.
Fourth edition AS/NZS 3123:2005.
Reissued incorporating Amendment No. 1 (July 2020).

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ISBN 0 7337 6488 6

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-004, Electrical Accessories, to supersede AS/NZS 3123:2000.

This Standard incorporates Amendment No. 1 (July 2020). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

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

A1 | AS/NZS 3123:2005 will remain current for 24 months from the date of publication of this document. After this time, it will be superseded by AS/NZS 3123:2005 incorporating Amendment No. 1. Regulatory authorities that reference this Standard in regulation may apply these requirements at a different time. Users of this Standard should consult with these authorities to confirm their requirements.

This Standard is based on the principles, but not the format, of the IEC 60309, *Plugs, socket-outlets and couplers for industrial purposes* series. In this Standard, only standardized Australian and New Zealand configurations for operation at 50 Hz are included. In this respect, the Standard differs significantly from the IEC 60309 series in that the configurations of IEC 60309-2 *Plugs, socket-outlets and couplers for industrial purposes Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories* are omitted.

While this Standard depicts only standardized Australian and New Zealand configurations, it can be applied to configurations and contact types other than those depicted herein, providing all appropriate requirements of this Standard are complied with.

The essential safety requirements in AS/NZS 3820 that could be applicable to plugs, socket-outlets and couplers for general industrial application are covered by this Standard taken in conjunction with any other relevant requirements affecting safety.

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

- (a) changes to fire test requirements; and
- (b) updating of cross-references to referred Standards and other minor editorial changes.

In this Standard, the requirements proper appear in ‘roman’ type and the test requirements appear in ‘*italic*’ type. Explanatory matters are contained in notes to the clauses, in smaller size ‘roman’ type.

This Standard does not contain all the necessary conditions of a contract.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Approval and test specification—Plugs, socket-outlets and couplers for general industrial application****1 SCOPE AND REFERENCED DOCUMENTS****1.1 Scope**

This Standard sets out the requirements for plugs and socket-outlets, cable couplers and appliance couplers for operation at 50 Hz, with a rated voltage not exceeding 660 V and a rated current not exceeding 315 A, primarily intended for general industrial use, either indoors or outdoors.

NOTES:

- 1 This Standard applies to plugs and socket-outlets, cable couplers and appliance couplers (referred to in this Standard as 'accessories') for use when the ambient temperature does not normally exceed 40°C.
- 2 The use of accessories (see Note 1) in building sites and in agricultural, commercial and domestic situations is not precluded.
- 3 Appliance inlets incorporated in, or fixed to, electrical equipment are within the scope of this Standard.
- 4 This Standard does not apply to accessories that comply with AS/NZS 60320.1 and AS/NZS 3112 and which are primarily intended for domestic and similar general purposes, nor to accessories that comply with AS 2380.1 and are intended for explosive atmospheres.
- 5 The configurations shown in this Standard depict standardized Australian and New Zealand industrial plugs, socket-outlets, cable couplers and appliance couplers for operation at 50 Hz.
- 6 This Standard may be applied to configurations and contact types other than those depicted herein, providing all appropriate (to that type) requirements of this Standard are complied with.
- 7 Devices that comply with IEC 60309-1 are deemed to comply with the appropriate requirements of this Standard.

1.2 Referenced documents

The following documents are referred to in this Standard:

AS

- | | |
|--------|--|
| 2380 | Electrical equipment for explosive atmospheres—Explosion-protection techniques |
| 2380.1 | Part 1: General requirements |
| 60529 | Degrees of protection provided by enclosures (IP Code) |

AS/NZS

- | | |
|--------|--|
| 3100 | Approval and test specification—General requirements for electrical equipment |
| 3112 | Approval and test specification—Plugs and socket-outlets |
| 3133 | Approval and test specification— Air break switches |
| 3191 | Electric flexible cords |
| 3947 | Low-voltage switchgear and controlgear |
| 3947.3 | Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units |

AS/NZS

5000	Electric cables—Polymeric insulated
5000.1	Part 1: For working voltages up to and including 0.6/1 (1.2) kV
5000.2	Part 2: For working voltages up to and including 450/750 V
5000.3	Part 3: Multicore control cables
60112	Method for the determination of the proof and the comparative tracking indices of solid insulating materials
60320	Appliance couplers for household and similar general purposes
60320.1	Part 1: General requirements
60335	Household and similar electrical appliances—Safety
60335.1	Part 1: General requirements
IEC	
60309	Plugs, socket-outlets and couplers for industrial purposes
60309-1	Part 1: General requirements

2 DEFINITIONS

2.1 General

Where the terms ‘voltage’ and ‘current’ are used in this Standard, they imply the r.m.s. values.

2.2 Specific definitions

For the purpose of this Standard, the definitions below apply.

NOTE: The use of the accessories is shown in Figure 1.

2.2.1 Accessories

Plugs and socket-outlets, cable couplers and appliance couplers.

2.2.2 Appliance coupler

A means enabling the connection at will of a flexible cable to the equipment. It consists of the following two parts:

- (a) *Appliance connector* The part integral with, or intended to be attached to, the flexible cable connected to the supply.

NOTE: This may also be a connector in accordance with the appropriate figures in this Standard.

- (b) *Appliance inlet* The part incorporated in, or fixed to, the equipment or intended to be fixed to it.

2.2.3 Basic insulation

The insulation applied to live parts to provide basic protection against electric shock.

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

2.2.4 Cable coupler

A means of enabling the connection, at will, of two flexible cables. It consists of the following two parts:

- (a) *Connector* The part integral with, or intended to be attached to, the flexible cable connected to the supply. In general, a connector has the same contact arrangement as a socket-outlet.

- (b) *Plug* See Clause 2.2.10(b).

2.2.5 *Double insulation*

Insulation comprising both basic insulation and supplementary insulation.

2.2.6 *Integral switching device*

A mechanical switching device constructed as a part of an accessory within the scope of this Standard.

2.2.7 *Interlock*

A device, either electrical or mechanical, that prevents the contacts of a plug from becoming live before it is in proper engagement with a socket-outlet or connector, and which either prevents the plug from being withdrawn while its contacts are live or makes the contacts dead before separation.

2.2.8 *Mechanical switching device*

A switching device designed to close and open one or more electric circuits by means of separable contacts.

2.2.9 *Non-rewireable plug or connector*

An accessory so constructed that the flexible cable cannot be separated from the accessory without making it permanently useless.

2.2.10 *Plug and socket-outlet*

A means enabling the connection at will of a flexible cable to fixed wiring. It consists of the following two parts:

- (a) *Socket-outlet* The part intended to be installed with the fixed wiring.
- (b) *Plug* The part integral with, or intended to be attached to, the flexible cable connected to the equipment or to a connector.

2.2.11 *Rated current*

The current assigned to the accessory by the maker in accordance with Clause 5.2.

2.2.12 *Rated voltage*

The voltage assigned to the accessory by the maker in accordance with Clause 5 and to which dielectric tests, clearances and creepage distances are referred.

2.2.13 *Reinforced insulation*

A single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in this Standard.

NOTE: The term 'insulation system' does not imply that the insulation is to be one homogeneous piece. It may comprise several layers which cannot be tested singly as supplementary or basic insulation.

2.2.14 *Retaining device*

A mechanical arrangement that holds a plug or connector in position when it is in proper engagement and prevents its unintentional withdrawal.

2.2.15 *Rewireable plug or connector*

An accessory so constructed that the flexible cable can be replaced.

2.2.16 *Supplementary insulation*

An independent insulation applied in addition to the basic insulation, in order to ensure protection against electric shock in the event of a failure of the basic insulation.

2.2.17 *Switched socket-outlet*

A socket-outlet with an associated switching device to disconnect the supply from the socket-outlet contacts.

2.2.18 *Terminal*

A conductive part provided for the connection of one or more conductors to an accessory.

2.2.19 *Type test*

A test of one or more devices made to a certain design to show that the design meets certain specifications.

3 GENERAL REQUIREMENTS

Accessories shall be designed and constructed so that in normal use their performance is reliable and there is no danger to the user or surroundings.

In general, compliance is checked by carrying out all the specified tests.

4 GENERAL NOTES ON TESTS

4.1 *Type of tests*

Tests according to this Standard are type tests.

If a part of an accessory has previously passed tests for a given degree of severity, the relevant test shall not be repeated if the severity is not greater.

4.2 *Sampling*

Unless otherwise specified, the samples are tested as delivered and under normal conditions of use, at an ambient temperature of $20 \pm 5^\circ\text{C}$; the tests are made at rated frequency.

4.3 *Order of tests*

Unless otherwise specified, the tests are carried out in the order of the clauses of this Standard.

4.4 *Number of samples*

One sample is subjected to all the tests; however, separate samples may be used for the tests of Clauses 18, 24, 25, 27 and 28.

NOTES:

- 1 Attention is drawn to the additional 'new' plug required by Clause 15.
- 2 A sample of the matching accessory is required for test purposes.

4.5 *Pass criteria*

Accessories are deemed not to comply with this Standard if the sample fails any of the tests.

4.6 *Conductors*

When tests are carried out with conductors, they shall be copper and shall comply with either the AS/NZS 5000 series or AS/NZS 3191, as appropriate.

5 RATING

5.1 *Rated voltages*

The rated voltage shall be one of the following:

110 V, 250 V, 415 V, 440 V, 480 V, 500 V or 660 V.

NOTE: Configurations for 660 V types are not yet specified.

5.2 Rated currents

The rated current shall be one of the following:

10 A, 20 A, 32 A, 40 A, 50 A, 63 A, 80 A, 100 A, 160 A, 200 A, 250 A or 315 A.

NOTE: Configurations for 250 A and 315 A types are not yet specified.

6 CLASSIFICATION

Accessories are classified as follows:

(a) *According to purpose—*

- (i) plugs and socket-outlets;
- (ii) cable couplers, i.e. connector and plug; or
- (iii) appliance couplers, i.e. appliance connector and appliance inlet.

NOTE: See also Figure 1 for reference.

(b) According to the degree of protection provided by the enclosure in accordance with AS 60529, if applicable.

NOTE: The preferred degree of protection is IP56.

(c) *According to method of connecting the cable—*

- (i) rewirable plugs and connectors; or
- (ii) non-rewirable plugs and connectors.

(d) According to interlock facilities—

- (i) accessories without interlock;
- (ii) with or without integral switching device accessories with mechanical interlock; or
- (iii) accessories with electrical interlock.

7 MARKING

7.1 General

Accessories shall be marked with the following:

- (a) Rated current, in amperes, in accordance with the appropriate current rating specified in Table 1.
- (b) Rated voltage, or rated voltages range, in volts, in accordance with the appropriate voltage rating specified in Table 1.
- (c) Rated frequency (i.e. 50 Hz).
- (d) Manufacturer's name or trademark.
- (e) Manufacturer's type reference, or catalogue number.
- (f) Designation for degree of protection in accordance with AS 60529, if applicable.
- (g) On products referenced in Standard Sheets 9 and 10, a warning for keyway connection with the words 'ENSURE CORRECT INSERTION OF KEYWAYS' or the 'keyway warning symbol' (see Figure 7).

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

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7.2 Symbols

When symbols are used, they shall be as follows:

<i>Name</i>	<i>Symbol</i>
Ampere	A
Volt	V
Hertz	Hz
Degree of protection	IPXX
Earth	E or, 
Keyway warning symbol (if used)	

Until 12 months after publication of this Standard the symbol  may be used as the earth symbol.

IP classifications are defined in AS 60529.

7.3 Socket-outlets and appliance inlets

For socket-outlets and appliance inlets, the marking for rated current, rated frequency and maker's name or trademark shall be on—

- (a) the main part;
- (b) the outside of the enclosure; or
- (c) the lid, if the lid cannot be removed without the aid of a tool.

Except for flush-type socket-outlets and appliance inlets, these markings shall be easily discernible when the accessory is mounted and wired as in normal use, if necessary after removal of the enclosure.

The marking for rated voltage, type reference, the symbol for degree of protection and keyway warning shall be visible after installation of the accessory, either on the outside of the enclosure or on the lid if the lid cannot be removed without the aid of a tool.

The marking for the keyway warning for Standard Sheets 9 and 10 products shall be marked in the 12 o'clock position in relation to the socket outlets and connectors shown in the Standard Sheets.

NOTE: The term 'main part' of a socket-outlet or an appliance inlet means the part carrying the contacts.

TABLE 1
RATING, CONFIGURATIONS AND RELEVANT DIMENSIONS
OF ACCESSORIES

1	2	3	4	5	6	7	8
Rating at 50 Hz		Standard Sheet number					
		Socket-outlets and connectors	Plugs and appliance inlets	Matching appliance coupler combinations			
				Type 1 (see Note 1)		Type 2 (see Note 2)	
Amperes	Volts			Appliance connector	Appliance inlet	Appliance connector	Appliance inlet
10, 20	250	1	2	16	15	1	2
10, 20	415 to 500	3	4	18	17	3	3
32	110	5	6	-	-	5	6
32	250	7	8	-	-	7	8
32, 40, 50	250†	-	-	20	19	-	-
32, 40, 50*	415 to 500†	9	10	20	19	9	10
50*, 63, 80	415 to 500	11	12	22	21	11	12
100, 160, 200	415 to 500	13	14	24	23	13	14
250	415 to 500	‡	‡	-	-	‡	‡
315	415 to 500	‡	‡	-	-	‡	‡

* See Note 3.

† Applies to Standard Sheets 19 and 20 only.

‡ Not yet specified.

NOTES:

- 1 Type 1 combinations use a dedicated appliance connector in combination with a dedicated appliance inlet in accordance with this Standard. The dedicated appliance connector will not accommodate a 'standard' plug.
- 2 Type 2 combinations use a 'common' connector which can accommodate an appliance inlet or standard plug in accordance with this Standard.
- 3 This Standard recognizes two '50 A, 415 to 500 V' systems. One system is the end of the 32 A/40 A/50 A, 415 to 500 V configuration range; the other is the commencement of the 50 A/63 A/80 A, 415-500 V configuration range, as detailed in the Standard Sheets.

7.4 Plugs and connectors

For plugs and connectors, the marking specified in this Clause 7 shall be easily discernible when the accessory is wired ready for use.

- A1 | The marking for the keyway warning for Standard Sheets 9 and 10 products shall be marked in the 12 o'clock position in relation to the socket outlets and connectors shown in the Standard Sheets.

NOTE: The term 'ready for use' does not imply that the plug or connector is in engagement with its complementary accessory.

7.5 Rewireable accessories

For rewireable accessories, the terminals of contacts and pins shall be indicated as follows:

Terminal of contact or pin

Indicator

Single-phase active.....L or A (L is the preferred letter)

Multiphase active.....L1, L2 and L3

Neutral.....N

Earthing.....E or  (preferably both in conjunction)

Ancillary.....C or C1, C2, etc.

Until 12 months after publication of this Standard the symbol  may be used as the earth symbol.

The symbols shall be placed on the insulating blocks, close to the relevant terminals. They shall not be placed on—

- (a) screws;
- (b) removable washers; or
- (c) other removable parts.

7.6 Legibility and durability

Marking shall be legible and durable.

Compliance with the requirements of Clauses 7 to 7.6 is checked by inspection.

In addition, the marking is rubbed vigorously by hand for 15 s with a piece of cloth soaked in water and again for 15 s with a piece of cloth soaked in petroleum spirit.

NOTE: The petroleum spirit used should consist of a solvent hexane with a content of aromatics of maximum 0.1 volume percentage, a kauri-butanol value of 29, an initial boiling point of approximately 65°C, a dry-point of approximately 69EC and a specific gravity of approximately 0.68.

7.7 Literature available from the manufacturer

The manufacturer shall make available information detailing the range of cable sizes intended to be accommodated by the terminals of the accessory. In addition, for plugs and connectors, the manufacturer shall make available the size and type of flexible cord(s)/cable(s) intended to be accommodated and the stripping dimensions of sheathing and conductor insulation.

8 DIMENSIONS

8.1 General

Accessories shall comply with the Standard Sheets as specified in Table 1.

NOTES:

- 1 Attention is drawn to Notes 5 and 6 of Clause 1.
- 2 Pins of plugs and appliance inlets may incorporate a narrow slit and, if so, may exceed the specified dimension in the direction across the slit.

In any plug or appliance inlet, the length of the earth pin shall not be shorter than adjacent live pins by more than 1 mm.

Compliance is checked by measurement in accordance with the appropriate Standard Sheet.

8.2 Protection against improper connections

It shall not be possible to engage plugs with socket-outlets or connectors having lower ratings, or having fewer contact combinations. In addition, it shall not be possible to engage appliance connectors with appliance inlets having higher ratings, or having a larger number of contact combinations.

NOTE: Keyways may be used for this purpose.

In addition, the design shall be such that improper connections shall not be possible between—

- (a) the earth and/or ancillary plug-pins and a live socket-contact, or a live plug-pin and the earth and/or ancillary socket-contact;
- (b) the phase plug-pin and the neutral socket-contact, if any; or
- (c) a neutral plug-pin and phase socket-contact.

NOTE: The requirements of Items (a), (b) and (c) also apply to appliance inlets and appliance connectors.

Compliance is checked by inspection and, if necessary, by test.

8.3 Protection against single-pin or unintended connections

It shall not be possible to make single-pin or unintended connections between plugs and socket-outlets or connectors, or between appliance inlets and appliance connectors or socket-outlets.

Improper connections include single-pin, unintended connections or other connections that do not comply with the requirements for protection against electric shock.

Compliance is checked by inspection and, if necessary, by test.

9 PROTECTION AGAINST ELECTRIC SHOCK

9.1 Design

Accessories shall be designed so that live parts of—

- (a) socket-outlets and connectors (when wired as in normal use); and
- (b) plugs and appliance inlets (when in partial or complete engagement with the complementary accessories);

are not accessible to the standard test finger of AS/NZS 3100.

It shall not be possible to make contact between a pin of a plug or appliance inlet and a contact of a socket-outlet or connector while any live part is accessible to the standard test finger of AS/NZS 3100.

Compliance is checked by inspection and, if necessary, by a test on the sample(s) wired as in normal use.

The standard test finger of AS/NZS 3100 is applied in every possible position. An electrical indicator, with a voltage not less than 40 V, is used to show contact with the relevant part.

NOTE: Neutral contacts and ancillary contacts of socket-outlets and connectors are deemed to be live parts.

9.2 Earthing connection

Accessories shall be designed so that—

- (a) when inserting the plug or connector, the earth connection is made before the phase connections and the neutral and ancillary connections, if any, are made; and
- (b) when withdrawing the plug or connector, the phase connections and the neutral and ancillary connections, if any, are broken before the earth connection is broken.

Compliance is checked by inspection and, if necessary, by test.

10 PROVISION FOR EARTHING

10.1 Earthing connection

Accessories shall be provided with an earthing pin or contact which shall provide facility for direct connection of the earthing conductor.

10.2 Accessible metal parts

Accessible metal parts of accessories shall be directly and reliably earthed unless they are separated from live parts by double or reinforced insulation.

Compliance with the requirements of Clauses 10 and 10.2 is checked by inspection and by conformance with the test of Clause 27.5 of AS/NZS 60335.1.

10.3 Prevention of overheating

Earthing contacts shall be capable of carrying a current equal to that specified for the phase contacts, without overheating.

Compliance is checked by the test of Clause 22.

10.4 Protection against mechanical damage

Earthing contacts shall be so shrouded or guarded that they are protected against mechanical damage.

NOTE: The use of side-earthing contacts is only permitted as a supplementary earthing means for the body of a metal-clad plug of rating ≥ 100 A.

11 TERMINALS

11.1 Types of fixings

Rewireable accessories shall be provided with terminals in which connection is made by means of screws, nuts or equally effective devices.

11.2 Construction

Parts of terminals, other than screws, nuts, washers, stirrups, clamping plates and the like, shall be of—

- (a) copper; or
- (b) an alloy containing at least 58% copper for parts that are worked cold or at least 50% copper for other parts; or
- (c) other metal no less resistant to corrosion than copper and having mechanical and electrical properties suitable for the application.

Steel screws shall be adequately protected against corrosion.

Compliance is checked by the test of Clause 28.

11.3 Earthing terminal

If the body of an earthing terminal is not part of the metal frame or housing of the accessory, the body shall be of material as prescribed in Clause 11.2 for parts of terminals. If the body is part of the metal frame or housing, the clamping screw or nut shall be of such material.

If the body of the earthing terminal is part of a frame or housing of aluminium or aluminium alloy, precautions shall be taken to avoid the risk of corrosion resulting from contact between copper and aluminium or its alloys.

Compliance with the requirements of Clauses 11 to 11.3 is checked by inspection and, if necessary, by chemical analysis.

NOTE: The requirements regarding the avoidance of the risk of corrosion does not preclude the use of adequately coated metal screws or nuts.

11.4 Connection of conductor

Terminals shall allow the connection of conductors appropriate to the rating of the accessory and in accordance with the manufacturer's stated range of conductor sizes and types that can be accommodated.

Compliance is checked by inspection and by fitting conductors of the smallest and largest cross-sectional areas and types nominated by the manufacturer in accordance with Clause 7.7.

11.5 Mechanical strength

Terminals shall have adequate mechanical strength.

Screws and nuts for clamping the conductors shall have a metric ISO thread or a thread comparable in pitch and mechanical strength, and shall comply with the appropriate tests of Clause 25.

11.6 Fixing to accessory

Terminals shall be securely fixed to the accessory and shall not work loose when the conductor clamping screws or nuts are tightened or loosened.

Screws and nuts for clamping the conductors shall not serve to fix any other component.

Compliance with the requirements of Clauses 11.5 and 11.6 is checked by inspection, by measurement, and by the test of Clause 25.1.

NOTES:

- 1 The clamping means for the conductor may be used to stop rotation or displacement of the plugs or socket contacts.
- 2 These requirements do not preclude terminals that are floating or terminals designed so that rotation or displacement of the terminal is prevented by the clamping screw or nut, provided that their movement is appropriately limited and does not impair the correct operation of the accessory.
- 3 Covering with sealing compound without other means of locking is deemed to be insufficient. Self-hardening resins may, however, be used to lock terminals that are not subject to torsion in normal use.

11.7 Clamping of conductor

Terminals shall be designed so that they clamp the conductor between metal surfaces with sufficient contact pressure and without significant damage to the conductor.

NOTE: Conductors are considered to be significantly damaged if they show deep or sharp indentations.

11.8 Loosening of clamping screws or nuts

Clamping screws or nuts of terminals shall be adequately secured against accidental loosening. It shall not be possible to loosen clamping screws or nuts without the aid of a tool.

11.9 Protection and segregation of terminals

Terminals shall be located or shielded so that—

- (a) screws becoming loose from terminals cannot establish any electrical connection between live parts and metal parts connected to the earthing terminal or ancillary terminals;
- (b) conductors becoming detached from live terminals of plugs and connectors cannot touch metal parts connected to the earthing terminal or ancillary terminals; and
- (c) conductors becoming detached from the earthing terminal or ancillary terminals cannot touch live parts.

NOTE: Examples of ancillary terminals are those used for control or indicating purposes.

Compliance with the requirements of Clauses 11.8 and 11.9 is checked by inspection and by manual test.

11.10 Prevention of improper contact

When the conductors have been correctly fitted, there shall be no risk of accidental contact between live parts of different polarity or between such parts and accessible metal parts, and, should a conductor strand escape from a terminal, there shall be no risk that the strand emerges from the enclosure.

The requirement with regard to the risk of accidental contact between live parts and accessible metal parts does not apply to accessories having rated voltages not exceeding 32 V.

Compliance is checked by inspection and, where the risk of accidental contact between live parts and other metal parts is concerned, by the following test:

An 8 mm length of insulation is removed from the end of a conductor having a cross-sectional area in the middle of the range specified in Clause 11.4. One conductor strand is left free and the other strands are fully inserted into and clamped in the terminal. The free strand is bent, without tearing the insulation back, in every possible direction, but without making sharp bends round barriers.

The free conductor strand connected to a live terminal shall neither touch any metal part that is not a live part nor emerge from the enclosure; and the strand of a conductor connected to the earthing terminal shall not touch any live part.

NOTE: If necessary, the test is repeated with the free strand in another position.

12 INTERLOCKS, RETAINING DEVICES AND SWITCHES

12.1 Interlocks

An interlock shall be incorporated in socket-outlets and connectors not designed to comply with the appropriate tests for breaking capacity.

Interlocks shall be linked with the operation of a switching device, so that the plug cannot be withdrawn from the socket-outlet or connector while the contacts are alive or inserted while the switching device is in the 'ON' position.

Socket-outlets and connectors shall be designed so that, after engagement with any complementary accessory, the interlock operates correctly.

The operation of an interlock shall not be impaired by normal wear of the portion of the plug used for interlocking.

The mechanical switching device for a mechanical interlock may be incorporated in the socket-outlet or connector.

12.2 Retaining devices

Accessories shall be provided with a retaining device as indicated in Standard Sheets 25, 26 or 27, as appropriate.

12.3 Switches

Switches incorporated in accessories shall be in a utilization category of at least AC-22 in accordance with AS/NZS 3947.3, or shall comply with AS/NZS 3133.

Compliance with the requirements of Clauses 12.1, 12.2 and 12.3 is checked by inspection and by measurement and tests.

13 RESISTANCE TO ULTRAVIOLET RADIATION

NOTE: Attention is drawn to the need to take account of the detrimental effects of ultraviolet radiation.

14 GENERAL CONSTRUCTION

14.1 General

Any part or sub-assembly of an accessory, which is removed, or is removable without further use of a tool when the accessory is dismantled to the extent necessary to attach conductors, shall be keyed or otherwise located so that an unsafe or incorrect assembly is prevented.

14.2 Accessible surfaces

Accessible surfaces of accessories shall be free from burrs, flashes and similar sharp edges.

Compliance is checked by inspection.

14.3 Screws

Any screw used to make an earth connection shall not be used for any other purpose except in the case whereby an internal earthing connection is established automatically and in a reliable way.

Compliance is checked by inspection and if necessary in accordance with Clause 10.3.

14.4 Position of earthing or neutral contact or pin

It shall not be possible for the user to alter the position of any earth or neutral contact, or pin.

Compliance is checked by manual means to ensure that only the correct mounting position is maintained.

14.5 Material suitability for conditions of use

Accessories shall be suitable for the conditions of use as required by AS/NZS 3100.

15 CONSTRUCTION OF SOCKET-OUTLETS

15.1 Socket-outlet and plug contact

15.1.1 General

The force exerted between the socket-outlet contacts and plug pins shall not be so great as to prevent easy insertion and withdrawal of the plug.

Compliance is checked by conducting the test of either Clause 15.1.2 or Clause 15.1.3, to determine the force necessary to withdraw an appropriate 'new' plug, complying with the dimensional requirements of this Standard, from a socket-outlet.

15.1.2 Withdrawal force test

By manual means, the plug shall be fully inserted into and withdrawn 10 times from a socket-outlet complying with the appropriate Standard Sheet of this Standard. The plug shall be reinserted into the socket-outlet and shall be mounted so that the axes of the contact tubes are vertical with the contact openings, downwards. A typical test apparatus is shown in Figure 2.

The principal weight, together with the supplementary weight (the latter being such that it exerts a force equal to one-tenth of the force exerted by the principal weight) and the 'test plug', exert a force equal to the maximum withdrawal force shown in Table 2.

The principal weight and the supplementary weight are hung without jolting on the test plug. If the test plug is not completely withdrawn, the supplementary weight is raised 50 mm and then allowed to fall onto the principal weight.

The plug shall not remain in the sample.

NOTE: During this test any retaining device shall be disengaged.

TABLE 2
MAXIMUM WITHDRAWAL FORCE

Rated current of the accessory A	Maximum withdrawal force N
≤20	125
>20, ≤50	150
>50, ≤80	275
>80, ≤315	400

15.1.3 *Alternative withdrawal force test*

By manual means, the plug shall be fully inserted into and withdrawn 10 times from a socket-outlet complying with the appropriate Standard Sheet of this Standard. Manually align the plug in the socket-outlet to minimize the effects of misalignment between mating components and any other friction-increasing factors, so as 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 requires to be considered in all measurements.

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

The withdrawal forces so measured shall not exceed the maximum withdrawal force specified in Table 2.

NOTE: During this test any retaining device shall be disengaged.

15.1.4 *Contact pressure*

Contacts shall be designed so as to provide and maintain adequate contact pressure when completely engaged with the corresponding plug pin.

Compliance is checked by the temperature-rise test of Clause 22.

Socket-outlet contacts shall be floating and shall be self-adjusting so as to ensure and maintain adequate contact pressure.

Compliance is checked by inspection and by the following test:

The sample is mounted so that the axes of the contact tubes are vertical with the contact openings, downwards.

A gauge of hardened steel with a finish of 1.6 µm (N7) and free from grease, having the dimensions shown in Table 3, is inserted into each contact tube, also free from grease, and the force necessary to withdraw the gauge is measured.

The sum of the force and the weight of the gauge shall be not less than the minimum total force shown in Table 3.

TABLE 3
MINIMUM TOTAL FORCE

Nominal pin diameter mm	Gauge	
	Diameter of gauge* mm	Minimum total force N
4.0	3.9	2.5
5.6	5.5	5
6.4	6.3	5
8.0	7.9	10
9.5	9.4	15
12.7	12.6	20

* The tolerance on all gauges is $\begin{smallmatrix} 0 \\ -0.01 \end{smallmatrix}$ mm.

15.2 Construction

Socket-outlets shall be constructed so as to permit—

- (a) the conductors to be easily introduced into the terminals and secured therein;
- (b) the correct positioning of the conductors, without their insulation coming into contact with live parts of a polarity different from that of the conductor; and
- (c) the covers of enclosures to be fixed easily after connection of the conductors.

15.3 Parts providing protection

Parts providing protection against electric shock shall have adequate mechanical strength. They shall be securely fixed in such a way that they will not work loose in normal use. It shall not be possible to remove these parts without the aid of a tool.

15.4 Cable entries

Cable entries shall allow the introduction of the conduit or the protective covering of the cable so as to afford complete mechanical protection.

Compliance with the requirements of Clauses 15.2 to 15.4 is checked by inspection and by an installation test with conductors of the largest cross-sectional area specified in Clause 11.4.

15.5 Insulating linings, barriers and the like

Insulating linings, barriers and the like shall have adequate mechanical strength. They shall be fixed to the metal casing, or the body, in such a way that they cannot be removed without being seriously damaged, or shall be designed so that they cannot be replaced in an incorrect position.

Compliance is checked by inspection and by the tests of Clause 24.

15.6 Protected socket-outlets

Protected socket-outlets with an IP classification shall maintain that classification without a plug in position. In addition, they shall incorporate means for maintaining the degree of protection when a plug is completely engaged.

The means for achieving the required degree of protection shall be securely fixed to the socket-outlet.

In addition, when a plug or appliance inlet is fully engaged with the socket-outlet or connector, the lower degree of protection of the two accessories shall be ensured.

Lid springs, if any, shall be of corrosion-resistant material, such as bronze or stainless steel.

Compliance is checked by inspection, by measurement, and by the tests of Clauses 18, 19 and 21.

16 CONSTRUCTION OF PLUGS AND CONNECTORS

16.1 General

Means shall be provided to enable accessories to be withdrawn manually and in a safe manner.

The pin assembly of a plug shall be protected by a surrounding shroud.

The construction of rewirable plugs and connectors shall be such that the conductors can be properly connected and the cores kept in place so that there is no risk of contact between them from the point of separation of the cores to the terminals.

Accessories shall be designed so that they can only be reassembled so as to ensure the correct angular relationship between key(s), keyway(s), the earthing pin and the earthing contact tube, as originally assembled.

Compliance is checked by inspection and, for connectors, by the tests of Clause 15.

16.2 Loosening of plug or connector

The various parts of a plug or connector shall be reliably fixed to one another in such a way that they will not work loose in normal use. It shall not be possible to dismantle plugs or connectors without the aid of a tool.

Compliance is checked by manual test and by the tests of Clause 24.3.

16.3 Insulating lining

If an insulating lining is provided, it shall have adequate mechanical strength and shall either be secured to the enclosure in such a way that it cannot be removed without being seriously damaged, or shall be designed so that it cannot be replaced in an incorrect position.

Compliance is checked by inspection and by the tests of Clause 24.3.

16.4 Prevention of rotation

Plug pins shall be locked against rotation and shall not be removable without dismantling the plug.

Compliance is checked by inspection and by manual test.

NOTE: Plug pins may be either floating or fixed.

16.5 Contacts

Contacts of connectors shall be self-adjusting so as to ensure adequate contact pressure.

Compliance is checked by inspection and by the test and requirements of Clause 15.1.4.

16.6 Contact force

The force exerted by the contacts of connectors on the plug or appliance-inlet pins shall not be so great as to prevent easy insertion and withdrawal of the plug, but sufficient to prevent it from working out of the connector in normal use, even with the retaining device disengaged.

Compliance is checked by the test and requirements of Clause 15.1.1.

16.7 Protected plugs

Protected plugs with an IP classification, when fitted with a flexible cable as in normal use, shall incorporate means for maintaining the degree of protection when in complete engagement with the complementary accessory.

The means of ensuring the required degree of protection shall be securely fixed to the plug.

Compliance is checked by inspection and by the tests of Clauses 18 and 19.

16.8 Protected connectors

Protected connectors with an IP classification shall maintain that classification when fitted with a flexible cable as in normal use and when not in engagement with the complementary accessory. In addition, they shall incorporate means for maintaining the degree of protection when in complete engagement with the complementary accessory.

The required degree of protection when the complementary accessory is not in position shall be achieved by means of a lid, flap or cover.

The means of ensuring the required degree of protection shall be securely fixed to the connector.

Flap or lid springs shall be of corrosion-resistant material, such as bronze or stainless steel.

Compliance is checked by inspection and by the tests of Clauses 18, 19 and 21.

17 CONSTRUCTION OF APPLIANCE INLETS

17.1 Prevention of rotation

Pins shall be secured against rotation and shall not be removable without the aid of a tool.

Compliance is checked by inspection and by manual test.

NOTE: Pins may be either floating or fixed.

17.2 Protected appliance inlets

Protected appliance inlets with an IP classification shall incorporate means for maintaining the degree of protection when an appropriate connector is completely engaged.

The means of ensuring the required degree of protection shall be securely fixed to the appliance inlet.

Compliance is checked by inspection and by the tests of Clauses 18 and 19.

17.3 Pins

The pin assembly shall be protected by a surrounding shroud.

18 IP DESIGNATION

Accessories marked with an IP designation shall be tested in accordance with the relevant requirements of AS 60529.

NOTE: This test may be deferred and conducted as specified after the tests (and on the separate sample used for the test) of Clause 24.

Socket-outlets, connectors and appliance connectors are tested both with and without the complementary accessory in engagement, the means for ensuring the required degree of protection being positioned as in normal use.

Plugs and appliance inlets are tested only when in engagement with the complementary accessory.

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