

Australian/New Zealand Standard™

**Electrical equipment for mines and
quarries—Bolted explosion-protected
three-phase cable coupling devices**



AS/NZS 1300:2009

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-023, Electrical Equipment in Mines and Quarries. It was approved on behalf of the Council of Standards Australia on 26 November 2009 and on behalf of the Council of Standards New Zealand on 13 November 2009. This Standard was published on 9 December 2009.

The following are represented on Committee EL-023:

Australian Chamber of Commerce and Industry
Australian Coal Association
Australian Industry Group
Aviation and Marine Engineers Association, New Zealand
Department of Mines and Energy, Qld
Department of Mines and Petroleum, WA
Department of Primary Industries, Mine Safety NSW
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Australian/New Zealand Standard™

Electrical equipment for mines and quarries—Bolted explosion-protected three-phase cable coupling devices

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-023 Electrical Equipment in Mines and Quarries to supersede AS 1300—1989, *Electrical equipment for coal mines—Bolted flame-proof cable coupling devices*.

This Standard incorporates Amendment No. 1 (March 2012). 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.

The objective of this Standard is to provide requirements and guidance for bolted explosion-protected three-phase cable coupling devices and adaptors of the pin and socket type to manufacturers, users, regulatory authorities and associated interests and for use with Australian/New Zealand Standards and relevant mining regulations. It also is to allow for the use of existing compatible cable coupling systems and for the introduction of new non-compatible cable coupling systems.

This Standard differs from the previous edition in the following significant ways:

- (a) Recognizes the AS/NZS 60079 series of Standards.
- (b) Introduces provisions for alternative designs. Couplers and adaptors that are dimensionally compatible with this Standard are called Type A. Alternative designs are called Type B.
- (c) Updated Figures showing critical compatibility dimensions and flamepaths ensure compatibility between different makes of Type A components.
- (d) Provides for transition devices between Type A and B components.
- (e) Increased emphasis on integrity of earth paths.
- (f) Clarifies test criteria.
- (g) Allows for higher current ratings.
- (h) Removes reference to coal mines and includes mines and quarries.
- (i) Withdrawal of AS 1147.1, *Electrical equipment for coal mines—Insulating materials*, Part 1: *Materials for insulating power conducting components* and incorporation of test requirements into Appendix B of this Standard. Materials tested by authorities to Standards listed in Appendix B may be accepted without verification.
- (j) Outlines additional marking requirements in Clause 1.6.
- (k) Introduces the term ‘explosion-protected’ throughout the Standard.
- (l) Allows for non-metallic materials to be used in the construction of the components (refer to Clause 2.3).
- (m) Details requirements of earthing through the couplers and adaptors.
- (n) Increases phase barrier earth connection to at least 6 mm².
- (o) Provides template drawings to allow manufacturers of explosion-protected enclosures to design outlets that do not compromise the integrity of adaptors.
- (p) Adds Section 4 with Figures and dimensions.
- (q) Adds partial discharge and impulse withstand tests.

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

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Electrical equipment for mines and quarries—Bolted explosion-protected three-phase cable coupling devices**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the design and test requirements for bolted explosion-protected three-phase cable coupling devices and adaptors of the pin and socket type, referred to in this Standard as ‘cable coupling devices’, for use with restricted earth-fault systems in mines and quarries. The devices are designed to couple cables together, or to couple a cable to equipment.

Cable coupling devices and adaptors constructed to this Standard are not intended to be coupled or uncoupled while the circuit is energized.

The Standard covers two types of coupling devices:

(a) Type A

Designed according to Figures in this Standard that prescribe the dimensions necessary to interconnect cable coupling devices from different manufacturers.

(b) Type B

Designed to dimensions that are not compatible with Type A coupling devices. Type B couplers cannot be directly coupled to Type A coupling devices under normal operation.

Type B plugs and receptacles do not comply with Figures 4.1 to 4.5 but comply with all other requirements of this Standard. Where there is a variation to a particular clause for Type B plugs and receptacles it is specifically stated. The use of transition devices between Type A and Type B systems is permitted.

This Standard also deals with some electrical and mechanical requirements, including the provision of earthed phase barriers to protect against interphase faults. It does not specify fully detailed designs.

NOTES:

- 1 Appendix A lists the information a user should provide with any enquiry or order.
- 2 Appendix C lists the information that should be supplied by the designer or manufacturer.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard.

AS

1856	Electroplated coatings—Silver
1931	High-voltage test techniques
1931.1	Part 1: General definitions and test requirements
2700	Colour standards for general purposes
60270	High-voltage test techniques—Partial discharge measurements
60529	Degrees of protection provided by enclosures (IP Code)

AS/NZS

- 1802 Electric cables—Reeling and trailing—For underground coal mining purposes
- 1972 Electric cables—Underground coal mines—Other than reeling and trailing
- 2802 Electrical cables—Reeling and trailing for mining and general use (other than underground coal mining)
- 3008 Electrical installations—Selection of cables
- 3008.1 Part 1: Cables for alternating voltages up to and including 0.6/1 kV (Series)
- 60079 Explosive atmospheres
- 60079.0 Part 0: Equipment—General requirements
- 60079.1 Part 1: Equipment—Protection by flameproof enclosures ‘d’
- 60079.7 Part 7: Equipment—Protection by increased safety ‘e’

IEC

- 60093 Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials
- 60112 Method for the determination of the proof and the comparative tracking indices of solid insulating materials
- 60167 Methods of test for the determination of the insulation resistance of solid insulating materials
- 60216 Electrical insulating materials—Properties of thermal endurance
- 60216-1 Part 1: Ageing procedures and evaluation of test results
- 60243 Electric strength of insulating materials—Test methods (Series)
- 61180 High-voltage test techniques for low-voltage equipment
- 61180-2 Part 2: Test equipment

ISO

- 62 Plastics—Determination of water absorption

ASTM

- D-570 Standard Test Method for Water Absorption of Plastics

DIN/IEC

- 93/167 This refers to the DIN equivalents of IEC 60093 and IEC 60167

1.3 DEFINITIONS

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

1.3.1 Adaptor

A device to connect a cable coupling device to equipment that maintains the explosion-protected properties of the enclosure.

NOTE: This could be used as a transition device.

1.3.2 Auxiliary contact pin

A rigid conducting member for other than electrical power circuits and pilot circuits intended to be inserted into an auxiliary contact socket of suitable form so as to make electrical contact.

1.3.3 Auxiliary contact socket

A resilient conducting member for other than electrical power circuits and pilot circuits intended to receive a suitable auxiliary contact pin.

1.3.4 Cable coupling device (Sometimes referred to as a 'flit plug')

A device consisting of a housing, together with means for connecting cable conductors to insulated contact pins or sockets and forming an explosion-protected coupling.

NOTE: The housing is designed to receive a cable, provide room to spread and connect cores, protect the cores, allow for the attachment of a cable gland or to seal conductors and the insulating material of the cable.

1.3.5 End cover

A cover which, when bolted to the coupling face of a cable coupling device or adaptor, completes the explosion-protected enclosure of the cable coupling device or adaptor and enables full working voltages to be applied. The device may include components for controlling and monitoring.

1.3.6 Main contact pin

A rigid conducting member for electrical power circuits intended to be inserted into a main contact socket of suitable form so as to make electrical contact.

1.3.7 Main contact socket

A resilient conducting member for electrical power circuits intended to receive a suitable main contact pin so as to make electrical contact.

1.3.8 Phase barrier

An electrically conductive barrier that is earthed and is positioned to prevent an interphase fault.

1.3.9 Pilot contact pin

A rigid conducting member for other than electrical power circuits intended to be inserted into a pilot contact socket of suitable form so as to make electrical contact.

1.3.10 Pilot contact socket

A resilient conducting member for other than electrical power circuits intended to receive a suitable pilot contact pin so as to make electrical contact.

1.3.11 Transition device

A device that allows Type A or Type B devices to be interconnected. The transition device need not have a consistent end to end current rating

1.4 SERVICE CONDITIONS

Cable coupling devices in accordance with this Standard shall be suitable to operate at ambient temperatures between -20°C and $+40^{\circ}\text{C}$. The average temperature over 24 h is not to exceed 35°C .

NOTE: The design of such devices should take into consideration conditions peculiar to mining such as chemical fumes, wetting agents, stone dusting and other corrosive agents in mine water.

1.5 RATINGS, DIMENSIONS AND COLOUR CODING

1.5.1 Type A

The ratings and dimensions of Type A cable coupling devices shall comply with Table 1.

Housings of cable coupling devices shall be colour coded in accordance with Table 1.

1.5.2 Type B

Type B cable coupling devices shall be colour coded in accordance with Table 1 for their voltage rating.

Type B cable coupling devices need not comply with the current ratings listed in Table 1.

A Type B cable coupling device shall be of such dimensions that it cannot be connected to a Type A cable coupling device without a transition device.

TABLE 1
RATINGS, DIMENSIONS AND COLOUR CODING

1	2	3	4
Voltage	Maximum current A	Colour code to AS 2700	For dimensions refer to Figures in Section 4
660 V	55	X15 (Orange)	4.1
	150	X15 (Orange)	4.2
	300	X15 (Orange)	4.2
	425	X15/N24 (Orange/Silver Grey)	4.2
1.1 kV	55	B24 (Harbour Blue)	4.1
	150	B24 (Harbour Blue)	4.2
	300	B24 (Harbour Blue)	4.2
	425	B24/N24 (Harbour Blue/Silver Grey)	4.2
3.3 kV and 6.6 kV	150	R13 (Signal Red)	4.3
	300	R13 (Signal Red)	4.3
	425	R13/N24 (Signal Red/Silver Grey)	4.3
11 kV	150	R13 (Signal Red)	4.4
	300	R13 (Signal Red)	4.4
	425	R13/N24 (Signal Red/Silver Grey)	4.4
	800	R13/N14 (Signal Red/White)	4.5

NOTE: 425 A and 800 A plugs shall be colour coded to show a distinct band of Silver Grey or White at least 25 mm wide.

1.6 MARKING

Cable coupling devices, adaptors and end covers shall be legibly and durably marked with the following information:

- Manufacturer's name or trademark.
- Manufacturer's component identification.
- Voltage and current rating.
- The symbol 'Ex'.
- Type of protection used, e.g. 'd' explosion-protected. Where more than one type of protection is used, the symbol for the main type of protection shall appear first.
- The symbol of the apparatus group, in accordance with AS/NZS 60079.0.
- Certification number.
- Serial number.
- Construction type identification, i.e. Type A or Type B.
- The warning 'Do not separate when energized'.

S E C T I O N 2 D E S I G N

2.1 ENCLOSURE

2.1.1 Explosion protection

Coupling devices, adaptors and end covers shall, when coupled together, comply with the requirements of AS/NZS 60079.0 and AS/NZS 60079.1 for Group I apparatus.

To reduce the possibility of sparking in the cable connection chamber it is recommended that explosion protection principles such as Ex 'e' and Ex 'm' be considered for this area.

NOTE: Refer to electrical connections in AS/NZS 60079.7.

2.1.2 Ingress protection

A sealing method shall be provided between the joint faces of the cable coupling device, adaptor or end cover, so that when coupled together, they shall achieve a minimum degree of protection against dust and water ingress of IP 55 in accordance with AS 60529.

The sealing method shall not interfere with the flamepath provided.

2.1.3 Adaptor mounting

For the mounting of Type A adaptors Figures 4.6 to 4.8 shall be adhered to in order to maintain the explosion-protected properties of the adaptor and enclosure.

Where a Type B adaptor is designed to be mounted on a Type A template, Figures 4.6 to 4.8 shall be adhered to in order to maintain the explosion-protected properties of the adaptor and enclosure.

2.2 CLEARANCE AND CREEPAGE DISTANCES

The clearance and creepage distance through casting compounds, distances between contact sockets, contact pins, phase barriers, cable conductors, end covers and metal housings of cable coupling devices, adaptors and adaptor compounding chambers, shall comply with the relevant requirements of AS/NZS 60079.7.

2.3 MATERIALS

The mating flange and body of the device that protects the contacts, shall be of metal having a tensile strength of not less than 450 MPa and an elongation at failure of not less than 10%.

The mating portion of a Type B device may be non-metallic provided that it has equivalent earth paths, mechanical strength and explosion protection to a Type A system.

If made of ferrous metal, the case shall be rustproof or, alternatively, its surface shall be so treated that it will resist corrosion without reducing the conductance of the earthing circuit.

The remaining portion of the case shall either be a suitable metal having a tensile strength of not less than 220 MPa and an elongation at failure of not less than 10% or a non-metallic material complying with the requirements of AS/NZS 60079.0 and AS/NZS 60079.1.

2.4 FASTENERS

All bolts, screws, set-screws, studs and nuts shall comply with AS/NZS 60079.0 and AS/NZS 60079.1, as appropriate.

2.5 CABLE GLANDS

Cable glands forming part of a cable coupling device shall be designed so that cables specified in AS/NZS 1802, AS/NZS 2802 and AS/NZS 1972 can be accommodated. They shall comply with the requirements of AS/NZS 60079 series.

2.6 TERMINALS

2.6.1 General

Terminals of cable coupling devices and adaptors shall provide for crimped, soldered, or clamped connections.

All connections shall be designed to resist loosening due to vibration or temperature variation.

NOTES:

- 1 The use of slotted head grub screws is not recommended, due to potential burring of the head and the limitation of the tightening torque.
- 2 Consideration should be given to providing electrical stress relief in the cable termination for plug ratings above 3.3 kV.

2.6.2 Conductor insertion depth

Terminals shall provide a conductor insertion depth of not less than that shown in Table 2.

TABLE 2
CONDUCTOR INSERTION DEPTH

Rating A	Insertion depth mm	
	Power core	Pilot core
55	15	10
150	20	10
300	25	10
425	25	10
800	25	10

NOTE: For Type B devices the minimum insertion depths will be taken from the closest current rating specified above.

2.7 CONTACT SOCKETS AND PINS

2.7.1 Materials

Contact sockets and pins shall be of any suitable metal having—

- (a) a Brinell hardness of not less than 70 HB or a Vickers hardness of not less than 87 HV;
- (b) a volume resistivity of not more than 1.1 mΩ.m at 20°C; and
- (c) copper or brass contacts that are silver-plated with a thickness of at least 8 μm in accordance with AS 1856 and comply with any of the test requirements of Section 3, or equivalent plating based on manufacturer's specification.

2.7.2 Construction of sockets

When two cable coupling devices, or one device and an adaptor, are bolted together, contact sockets shall—

- (a) make good electrical contact with the pins;
- (b) be self-adjusting to the extent necessary to accommodate the permitted tolerance on pitch; and
- (c) be provided with a facility to prevent overexpansion.

2.7.3 Location of sockets and pins

Contact sockets and pins for Type A devices shall be positioned as shown in Figures 4.1 to 4.5, as appropriate.

2.7.4 Pins

The entry radius on a pin shall be not less than 3 mm or the entry taper shall be not less than 3 mm long and at an angle of not greater than 30°.

2.8 EARTHING

2.8.1 General

The through-earth integrity shall be of a size determined by the earth size of the maximum size cable nominated by the manufacturer as capable of being connected to the coupler and shall be tested in accordance with Clause 3.3.10.

All metallic external parts of couplers and adaptors shall make good electrical contact to prevent touch potential across those parts.

Where non-metallic external parts are used, effective earth screening shall be provided to prevent touch potential on any external surface due to component failure.

Provision shall be made for external earth-jumper straps to be attached to the housings and to the cable glands, where the latter are used.

2.8.2 Phase barrier

The conductor forming the earth circuit from the phase barrier shall have a nominal cross-sectional area of at least 6 mm². The earth connection to the phase barrier shall be terminated in a manner to prevent self-loosening and to maintain contact pressure.

2.8.3 Terminals

One or more earthing terminals shall be provided to receive cable earthing conductors (including metallic screens). The terminal or terminals shall accept all of the earthing conductors for the maximum size cable nominated by the manufacturer. Terminals shall be designed to accommodate at least the earthing conductors of cables listed in AS/NZS 1802.

2.9 PHASE BARRIER

The phase barrier shall extend the full length of the solid interior.

The phase barrier shall be exposed at each end of the interior but not interfere with the connection of the mating device.